Building Information Modeling with Autodesk Revit Building

Student Workbook

Autodesk®

Contents

Introduction 4
Unit 1 7
Theory: CAD Versus BIM 7
Autodesk Revit Building: Introduction, Interface, and Sketching 7
Unit 2 22
Theory: Objects 22
Autodesk Revit Building: Walls, Floors, and Ceilings 22
Unit 3 36
Theory: Families and Nested Families 36
Autodesk Revit Building: Editing Types 36
Unit 4 44
Theory: Parameters 44
Autodesk Revit Building: Dimensions, Doors, and Windows 44
Unit 5 52
Theory: Representations 52
Autodesk Revit Building: Views, Visibility, and Sheets 52
Importing an Autodesk Revit Building Model into Autodesk 3ds Max 85
Set up Your Model for Export 85
Units 6 91
Theory: Design Constraints 91
Autodesk Revit Building: Levels, Reference Planes, and Grids 91
Unit 7 109
Theory: Design Information Organization 109
Autodesk Revit Building: Components, Categories, and Subcategories 109
Unit 8 122
Theory: Domain-Specific Knowledge 122
Autodesk Revit Building: Roofs 122
Unit 9 132
Theory: Delaying Specificity 132
Autodesk Revit Building: Massing 132
Unit 10 151
Theory: Component Design 151
Autodesk Revit Building: Family Editor 151
Unit 11 174
Theory: Propagation of Constraints. 174
Autodesk Revit Building: Alignment, Locking, and Constraints 174
Unit 12 219
Theory: Interdependencies 219
Autodesk Revit Building: Site 219
Unit 14 238
Theory: Detail 238
Autodesk Revit Building: Drafting and Linework 238
Unit 16 244
Theory: Is Architecture Engineering? 244
Autodesk Revit Building: Formulas 244
Unit 18 255

Theory: Things You Won't Have to Do in School 255
Autodesk Revit Building: Tags and Schedules 255
Unit 19 288
Theory: Time 288
Autodesk Revit Building: Phasing 288
Unit 20 294
Theory: Variation 294
Autodesk Revit Building: Options 294

Introduction

This student workbook contains a set of exercises that clarify in a practical way the concepts explained in the *Building Information Modeling with Autodesk® Revit® Building Lecture Notes* by Simon Greenwold.

The exercises cover the basic principles of the Autodesk Revit Building technology and the building information modeling (BIM) approach. For more training information, see the official Autodesk Revit Building training manuals, and the tutorials available from the Help menu. This workbook explains the different functionalities through various exercises, but the emphasis is on the workflow rather than on the tools themselves.

The difficulty of the exercises increases as you proceed through the units, so it is recommended that you do them in sequence. Most units are independent and can be done starting with the provided file, named Unit (#) – Start. Files with the completed exercises are included in the data set folder and can be used to check your work.

The workbook is structured in a three-column format (see below):

The first column contains an explanation of all steps necessary to complete an exercise.

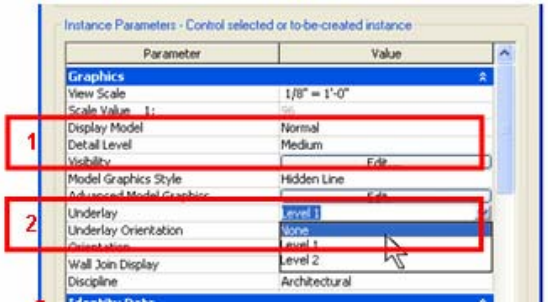
The middle column contains the images that clarify visually the tasks to accomplish.

The third column contains notes on the features and tools that are being used and a few helpful tips.

Add a Floor slab on the newly created Level

10. Open **Floor Plan Level 2**.

11. RMC on the Floor plan **Level 2** in the Project Browser and open the **Properties** window. Change the **Detail Level** from **Coarse** to **Medium**.



12. Change the **Underlay** field to **None**

Views have many different properties that filter the information of the underlying data model and define how it will be displayed.

We have prepared the following data for you:

- Workbook (this document)
- Workbook data sets (placed in a folder that contains all necessary files, families, and the template prepared for your use)

Before starting the exercises, change the following settings to simplify use of this workbook and provide faster access to the data sets:

Data Sets and the Autodesk Revit Building Library

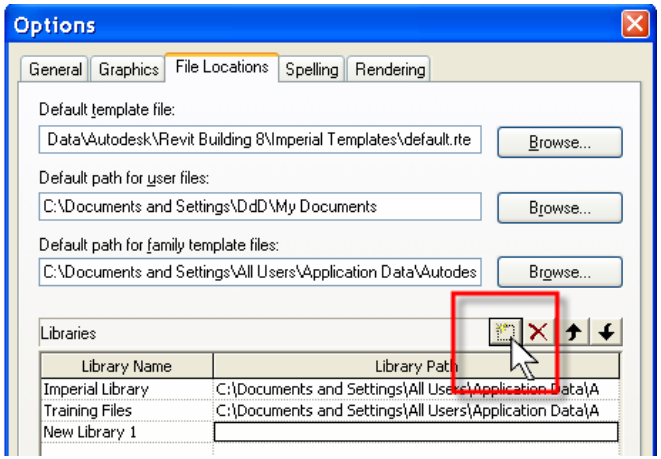
1. Copy the provided *Workbook Data Sets* folder onto your desktop.

2. Open Autodesk Revit Building.

3. From the Settings menu, choose Options.

4. Click the File Locations tab.

5. Click the Add Library button.

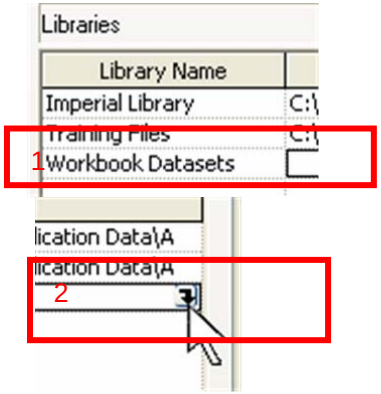


You can copy the data sets from the provided CD or download to any location you choose.

A library is a shortcut that appears in any Revit Building dialog box that asks you to browse for a file. This includes the Open and Saveas commands as well as others.

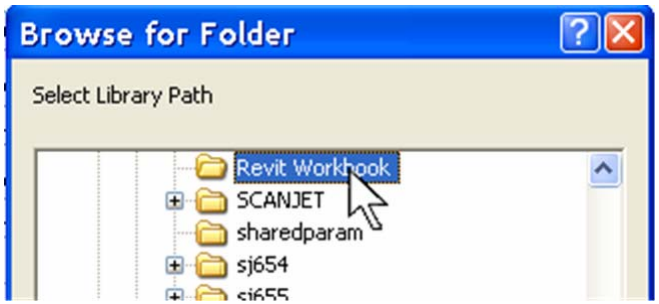
6. Rename the newly created New Library 1 to Workbook Data Sets.

7. Click in the blank Library Path field next to it, and then click the Flash icon at the far right of the row.

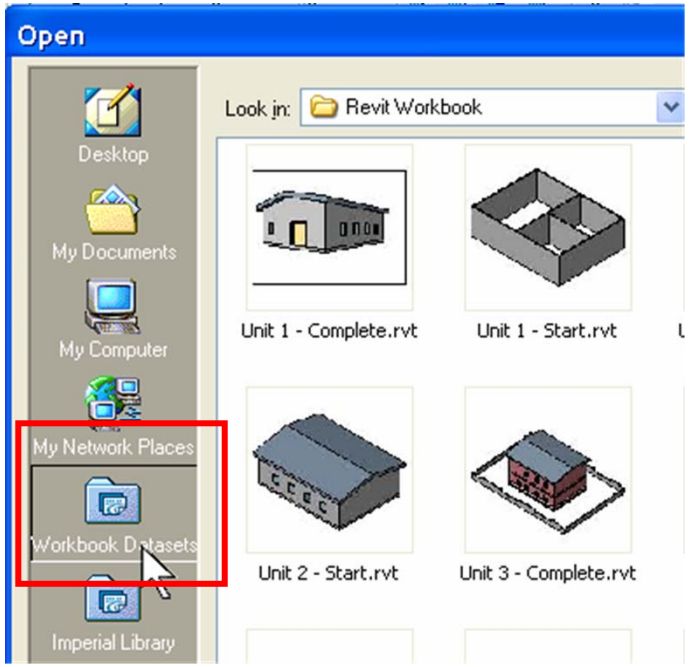


8. Browse to the path where you saved the data sets and click OK.

9. Click the Workbook Data Sets field and, using the upper flash sign , move it up to the first row.



10. Now each time you go to the File menu to Open or Save, you see the folder in the browse window on the left so you can access it quickly.



Note:
Exercises for some lectures note units are not available here, and in some cases they have been grouped into a single exercise. The reason lies in the workflow approach that does not meet specific feature training requirements. For more information, see the Autodesk Official Training Courseware and the help file.

We hope you enjoy learning the principles of Autodesk Revit Building and the BIM approach.

Have fun!

Unit 1

Theory: CAD Versus BIM

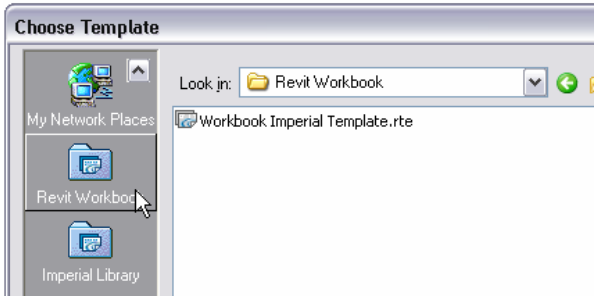
Autodesk Revit Building: Introduction, Interface, and Sketching

In this first unit you start a new project, using the Default Imperial template.

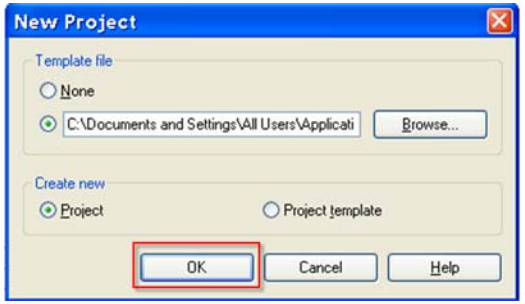
1. From the File menu, choose New>Project.

Templates are prepared drawing files that contain data according to office or project standards, helping to ensure that all team members who are working on the same project are using the same objects and standards. You can create these templates on your own, according to your office or project requirements.

2. Click the Browse button, and select the Revit Workbook library shortcut icon.

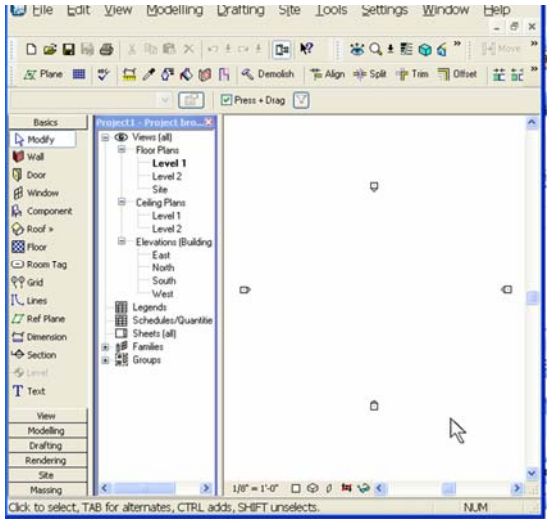


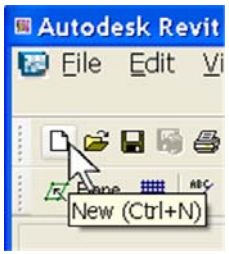
3. Select Workbook Imperial Template.rte. Click Open, and then click OK.



In the default folder are templates for commercial and residential, as well as other specialized templates you can choose to start from. Each of these templates has unique families, views, and possibly sheets already loaded for you to work with.

4. A new project file is created.



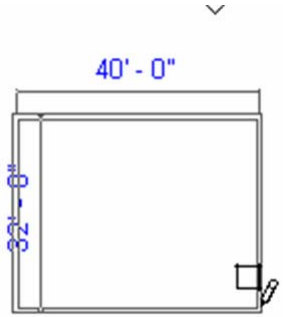


You can set path to the default template used for all projects on the Settings menu: Options>File Locations>Default template file. This setting determines which template is used when you click the new project icon on the toolbar.

Add Walls

5. From the Basics Design Bar on the left of your screen, select the Wall tool.

6. Draw four walls. Accept all the default values. The rectangle should be about 40’ x 30’.

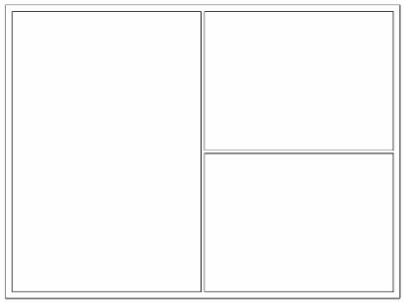


After selecting the Wall tool, the Options Bar displays the different options for drawing the wall segments. Select the rectangular shape to draw the external walls.

Switch to the linear option to draw the interior walls.

7. Without exiting the Wall command, change the wall type from the Options Bar to Generic- 5”.

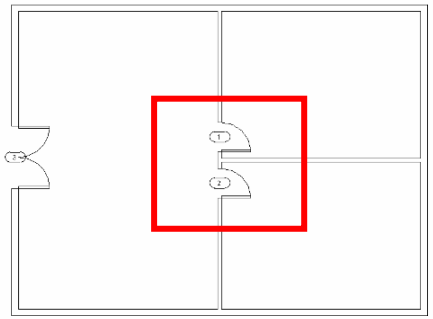
8. Draw two interior walls, as shown in the image at right.



Zooming: Use the mouse wheel to zoom in and out of the drawing window.

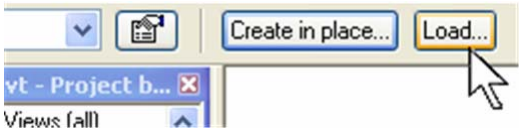
Add Doors and Windows

9. On the Basics Design Bar select Door and place two doors Single-Flush: 36” x 84”, as shown in the image.



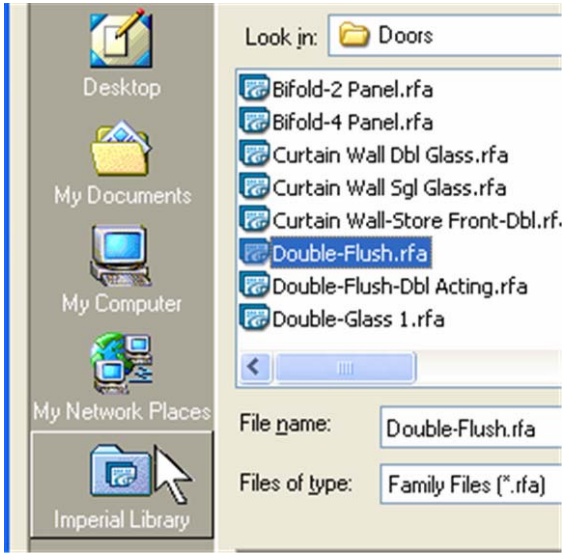
As you add these two doors, press the spacebar before you select a point to flip the swing before the door is placed.

10. With the door tool still active, click the Load button on the Options Bar.

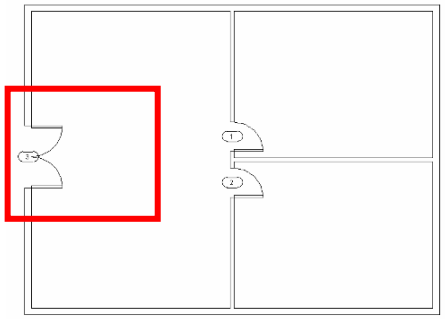


Many other door types are installed with the software but not available within the general template you started with. When you load from library, you are bringing in a family of doors and all its types.

11. Browse to the *Doors* folder and select the Double Flush door type and click Open.



12. Change the door type on the Options Bar to Double-Flush: 72” x 84” and position a door on the left wall, as shown in the image.

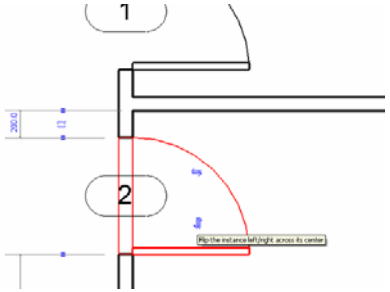


The horizontal arrows mirror the door along the wall it is positioned on. Both vertical and horizontal arrow symbols appear in doors, windows, furniture components, and in all families that can be mirrored or reversed without changing their geometry or their function.

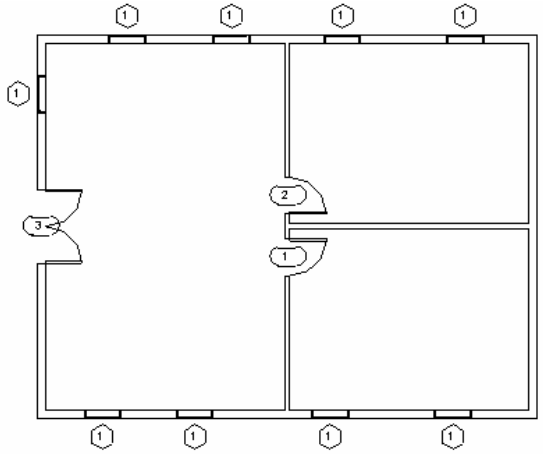
13. Press the Esc key twice to exit the command.

To end a command in Autodesk Revit Building, either press the Esc key two times, or right-click and choose Cancel two times.

14. To change the swing direction, select the Single Flush door on the bottom vertical wall and click the vertical arrows that appear next to it.



15. On the Basics Design Bar click Windows and select Fixed: 36” x 48” and position some windows on the exterior walls.



Windows and doors are tagged automatically if Tag on Placement is selected on the Options Bar. To avoid automatic tagging, clear the option.

The tags that appear when placing the components are set on the Settings menu: Annotations>Loaded Tags.

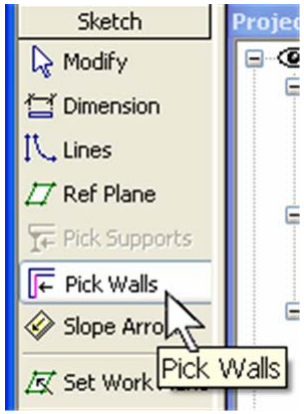
16. Right-click and choose Cancel twice to exit the command.

Alternatively, you can select the next tool you want to use. Select the Modify tool from the top of the design bar. Type MD on the keyboard to end most commands and return to the basic cursor state.

Add a Floor

Sketch mode is activated when designing specific sketch-based components or geometry. The available options vary depending on the component you are designing.

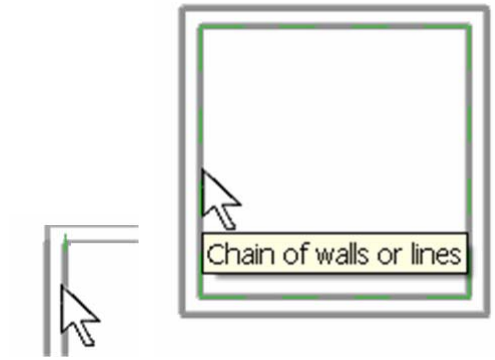
17. On the Basics Design Bar click Floor. You are now in sketch mode, and the Design Bar has changed. The default method for creating floors is by selecting existing walls (Pick Walls).



You can draw the desired shape of your object (floor in this case) using the Lines tool, but often it is much faster and easier to accept the default proposed mode. The Pick Walls function automatically recognizes the boundary of the connected walls and generates a closed loop of lines that represent the shape of the floor.

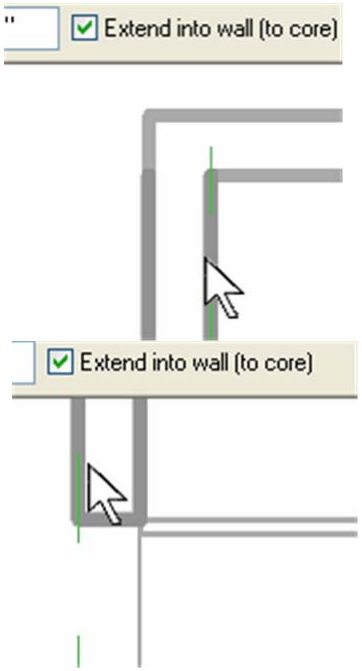
18. Select all connected walls at once:

   a. Place the cursor over one of the exterior walls (without clicking).
   b. Press the Tab key to highlight all four walls.



This method is used frequently in Autodesk Revit Building. By holding your cursor over the object, pressing the Tab key, and then clicking, you can select connected chains of walls or lines.

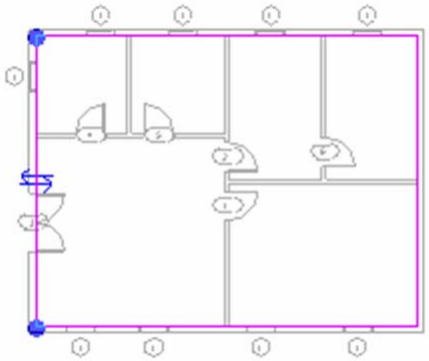
This screen capture is not from the project but illustrates the nature of the highlights on the screen.



The side of the wall your cursor is on when you select a wall determines which side of the wall the sketch line is placed on.

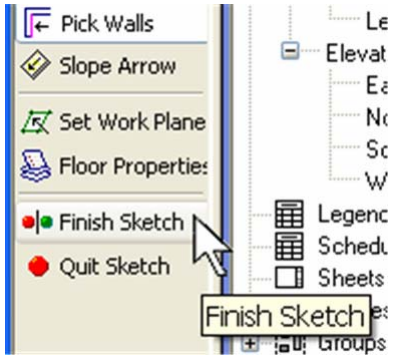
When you use Pick Walls to define your sketch, Revit Building snaps either to the exterior/interior faces of the wall or to its structural core layer, as set in the Options Bar.

19. Click with the left mouse button to select the highlighted walls as the floor boundary. Make sure you click the interior side of the walls.



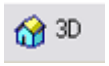
When you click with the mouse, the software reads the geometry into the command and creates a magenta sketch line at each wall.

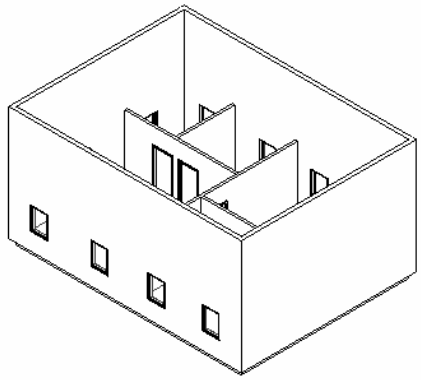
20. Click Finish Sketch on the Design Bar to accept the floor sketch.



You can reenter sketch mode any time after designing the component by selecting the component and clicking the Edit button on the Options Bar.

21. Open a 3D view by clicking the 3D view icon on the toolbar.





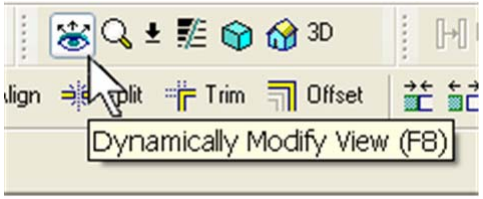
3D View Navigation

22. Rotate the model by:

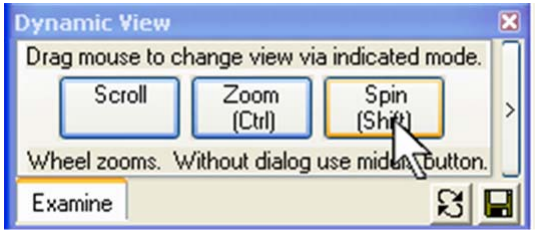
- Pressing the Shift key and the middle button of the mouse at the same time.

The cursor changes to the 3D rotate cursor.

- Or clicking the icon on the View toolbar to open the Dynamic View dialog box.



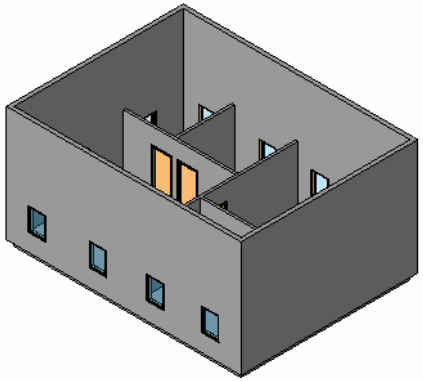
23. Select Spin mode.



Model Graphic Style

Model graphic style by keyboard shortcut:

24. Press the letters “SD” (in sequence) to activate a shaded view.



You can use several different methods to change from shade mode to wireframe to hidden mode.

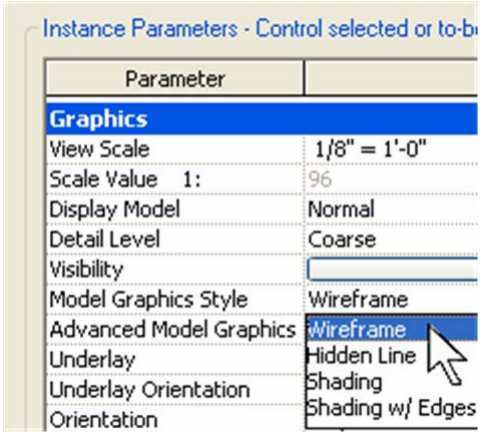
The other keyboard shortcuts for graphic style are as follows:

- WF = Wireframe
- HL = Hidden line
- AG = Advanced Model Graphics

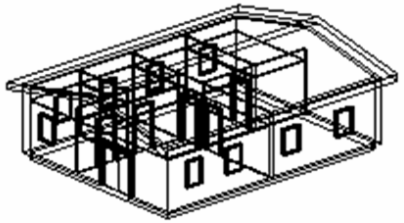
You can customize keyboard shortcuts by editing the *keyboardshortcuts.txt* file in the program folder.

Model graphic style by view properties:

25. Right-click the view and choose View Properties. In the Properties dialog box, change the Model Graphics Style to Wireframe.

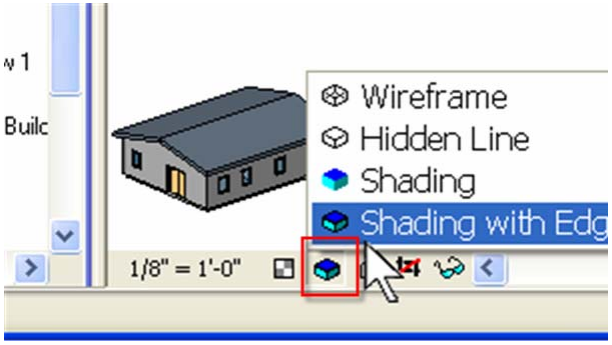


Like any wall or door, the view itself has properties. The properties page of a view controls many aspects of how the model is represented.



Model graphic style by Workspace View toolbar:

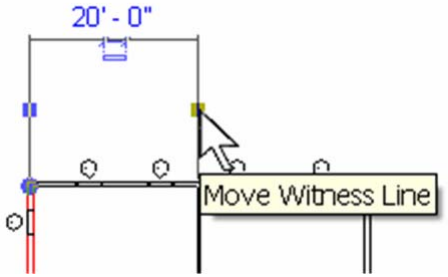
26. Click the model graphics tool at the bottom left of the workspace and choose Shaded with Edges from the context-sensitive menu.



Modify the Position of the Components

Temporary Dimensions

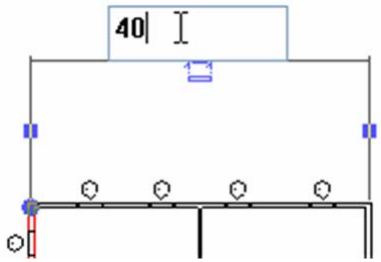
27. From the Project Browser, open Floor Plans Level 1 again by double-clicking Floor Plans>Level 1. Select the left exterior wall. A temporary dimension appears.



The temporary dimension may not have the witness lines in the location you want. Drag the middle square grip on a temporary dimension line to a new location.

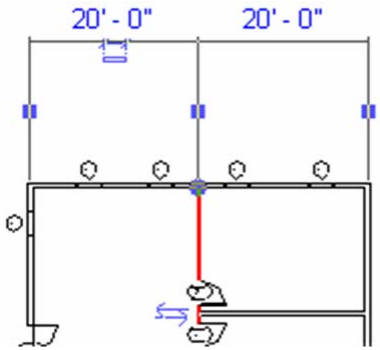
28. Drag the square middle grip to the outside right exterior wall.

29. Click the dimension text, and type 40 to change the building width to 40 feet.



The units in Autodesk Revit Building are real-world units: you can set them to be metric or imperial. The dialog box for setting units is on the Settings menu under Units. You can also work in millimeters, centimeters, or meters, set in the same menu.

30. Select the interior wall, and use the temporary dimensions to set the interior vertical wall to 20’ from one of the end walls.

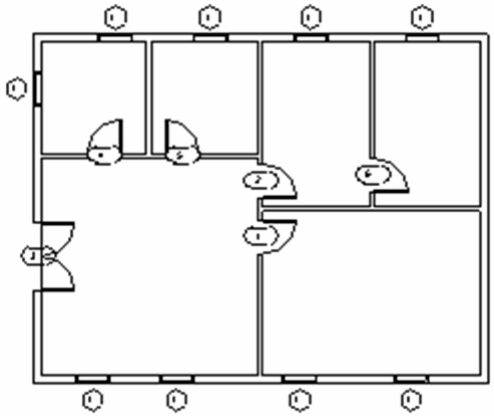


Notice that you have just defined a new position for the wall, but all other components adjusted accordingly.

Temporary dimensions appear whenever you select a component. Edit these dimensions on the fly by clicking the text and typing the desired value.

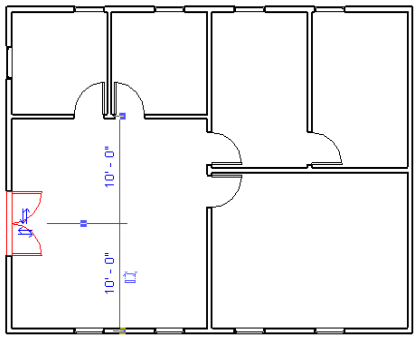
You can transform these dimensions into permanent dimensions by clicking the icon that appears below the dimension line.

31. Add walls and doors to create a few more rooms, always using the image as a guide.



By right-clicking a component, you can use the Place function, which activates insertion mode for the desired component. This command automatically inserts an object of the same type as the one selected.

32. Select the double entrance door and change its position by changing the value of the lower temporary dimension: Type 10 in the dimension text for 10’ – 0”.

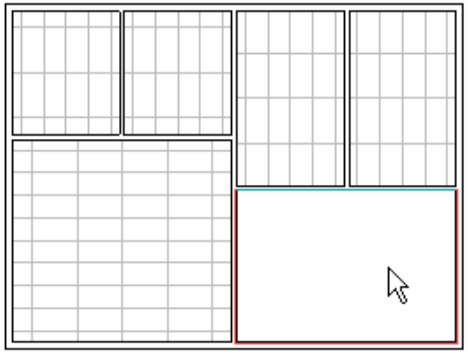


Add Ceilings

33. Double-click Project Browser>Ceiling Plans>Level 1.

34. On the Modeling Design Bar select Ceiling.

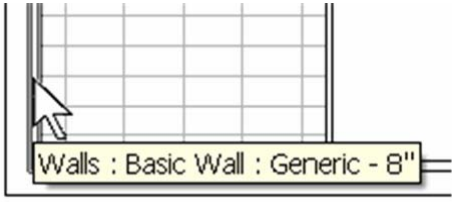
35. On the Options Bar select Compound Ceiling: 2’ x 4’ ACT System. Click once inside each room to automatically generate the ceilings.

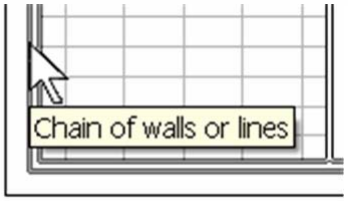


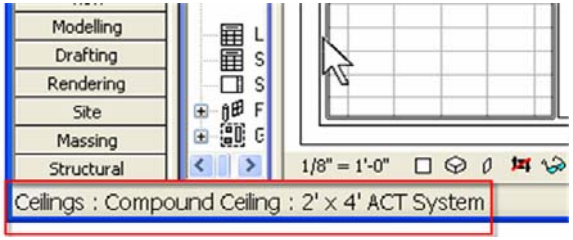
Ceilings are also sketch based. The auto-generate tool is helpful, but if you need to change the shape, you must select the ceiling and select Edit on the Options Bar.

36. Hold your cursor over the object, and press the Tab key:

- Sometimes selecting objects that are colinear with other objects can be difficult.
- Hold your cursor over the edge of a ceiling (which is also the same location as a wall).
- Press the Tab key a couple times to cycle through the objects that are at the cursor location.





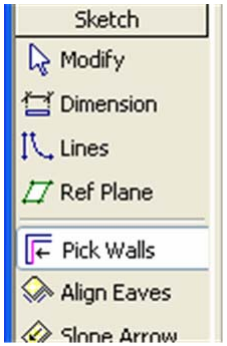


Anything that you select with a left mouse-click is available as a tooltip and at the lower-left corner of the window at the status bar.

Add a Roof

Roofs can be created by footprint or by extrusion. This exercise walks you through creating a roof by extrusion.

37. Open view Floor Plans>Level 2.
38. On the Modeling Design Bar select Roof>By Footprint.

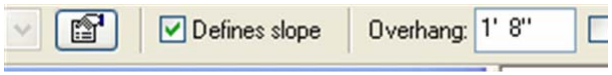


If the Pick Walls option is selected, the roof boundary follows the walls position and any further changes to the wall location are automatically propagated on the roof shape.

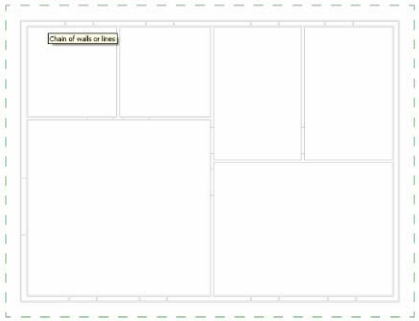
39. You are in sketch mode. The default sketch mode is Pick walls.

Pick Walls is equivalent to assigning a constraint to maintain design intent or structural sense.

40. On the Options Bar type 1’ 8” in the Overhang box and make sure that Defines Slope is selected.

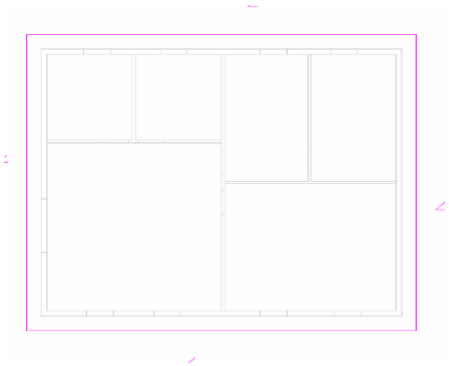


41. Highlight any exterior wall and press Tab to highlight all four. Click to create the roof footprint.



When clicking, make sure your cursor is positioned on the exterior side of the walls or the overhang is on the wrong side.

42. Click Finish Roof on the Design Bar.

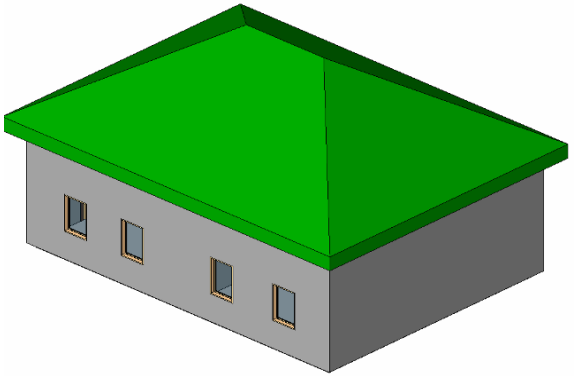


Tab selecting is a convenient way to select chains of components with a single click. It is widely used in sketch mode.

43. A dialog box asks if you want to attach the highlighted walls to the roof. Click Yes.

By clicking Yes, you are attaching the walls to the roof and thus defining an explicit relationship: if the roof changes height, the attached walls follow accordingly.

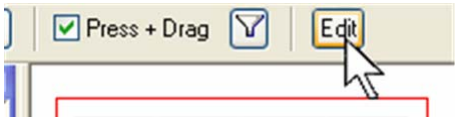
44. Open the 3D View by clicking the 3D Icon to see the roof.



The 3D view category is automatically created once a 3D view is opened. You can customize view grouping so the Project Browser can display the view groups in many different ways.

45. Go back to floor plan Level 2.

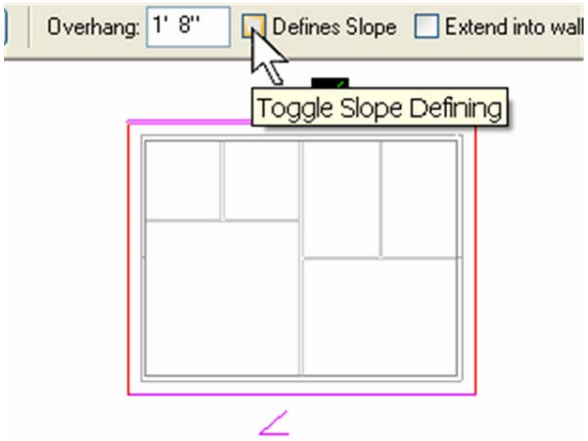
46. Select the roof.



47. On the Options Bar, click Edit.

48. Select the left and right roof footprint lines.

49. On the Options Bar, clear Defines Slope.



Autodesk Revit Building manages the slopes by automatically adjusting most geometrical data. If the eaves are not correct, use the Align Eaves tool to correct the problem.

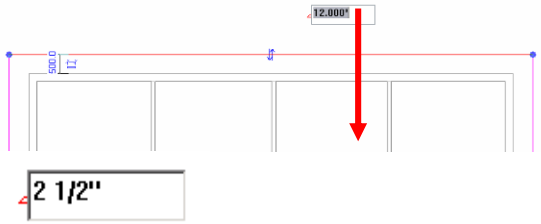
To select more than a single item, hold down the Ctrl key as you select the objects.

Hold down the Shift key to remove objects from an existing selection set.

50. Select the top magenta line. Text displaying an angle value appears.

51. Click the blue text and change the value to 2 1/2". Repeat for the bottom line.

52. Click Finish Roof.



Sketch lines are displayed in magenta, which you can change to any other color (Settings>Line Styles>Lines(Sketch)).

Change the value of the roof slope by selecting the slope-defining line and opening its Properties dialog box, where you find the angle parameter.

Add a Camera (Perspective View)

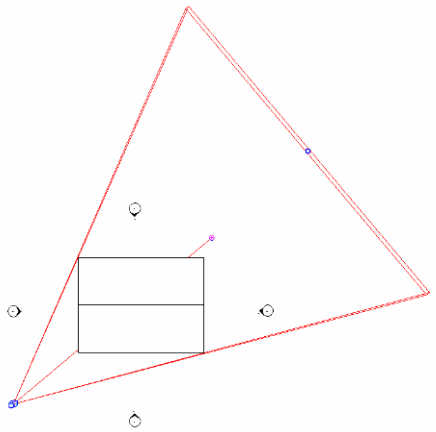
53. Open Floor Plan: Site.

54. Go to View Design Bar.

55. Select the Camera tool.

56. Select a point at the lower left to place the camera.

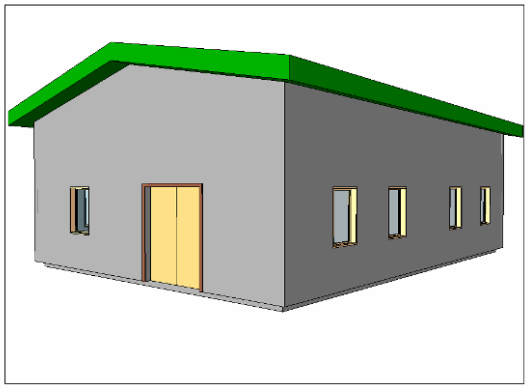
57. Select a point at the upper right to establish the direction the camera is pointing.



The camera creates a perspective view that is automatically placed under the 3D group in the Project Browser.

Once the camera view is generated, the camera itself is no longer displayed in plan views or sections/elevations. To display it, right-click the 3D perspective view in the Project Browser and choose Show Camera from the context-sensitive menu.

58. Once you have placed a camera, the building displays in a 3D view. (Press SD to shade the view.)



An easy way to reposition your camera directly in perspective view is by opening the Dynamically Modify View dialog box and applying the different options available for navigating in the 3D workspace.

Note that you can change or modify elements directly in 3D perspective views only by selecting the component and opening its Properties dialog box.

Unit 2

Theory: Objects

Autodesk Revit Building: Walls, Floors, and Ceilings

This unit covers wall, floor, and roof basics.

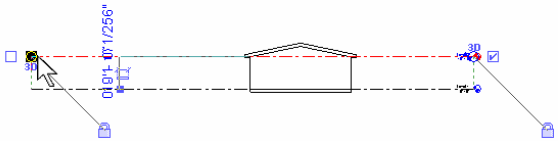
Add a New Level

1. Open file Unit 2 – Start. Open to the 3D view.

2. Open Elevation East.

3. Select the open blue circle at the end of one gridline.

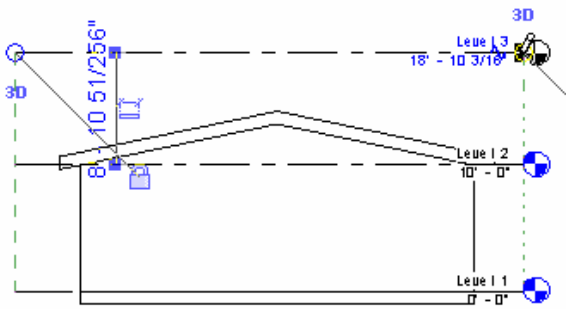
4. Left-click and drag toward the building. Repeat with the right side.



Autodesk Revit Building allows editing and creation of most components in all available views.

5. On the Basics Design Bar select Level.

6. Draw a level above Level 2 by drawing a horizontal line from left to right.



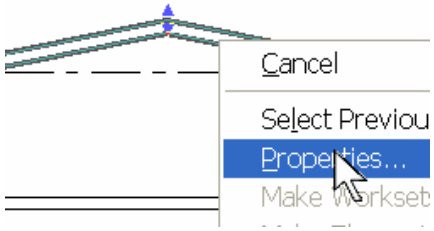
Note how Autodesk Revit Building helps you snap to the beginning and end of the other level lines.

7. Click the elevation text of the level mark, and type 24’.

Some annotations allow direct editing of their properties (in this case: level height). Revit Building automatically recognizes the different units used for editing if the unit suffix is added after the value.

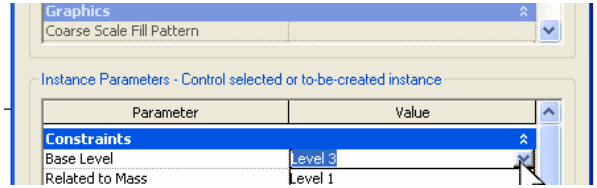
8. Modify the roof position.

9. Select the roof. Right-click and choose Properties.



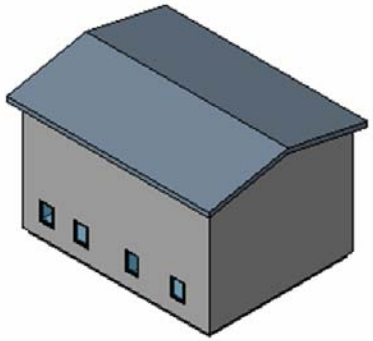
Levels are managed as any other entity. Levels are a data element in Revit Building. Although they look like a standard annotation, they are the basis for vertical control for most components in the building model.

10. Change the Roof Base Level to Level 3.



Change component constraints at any time during the design process.

11. Open the 3D view.



The roof is constrained to the level. As the level moves, the roof moves with it. In addition, because you attached the walls to the roof, the inherent constraint is applied, and they then follow the roof up to the third level as well.

Change Wall Type

The template contains many different wall types. Walls, roofs, floors, ceilings, stairs, and railings are system families and cannot be loaded from an external file except by using the Transfer Project standards command on the File menu.

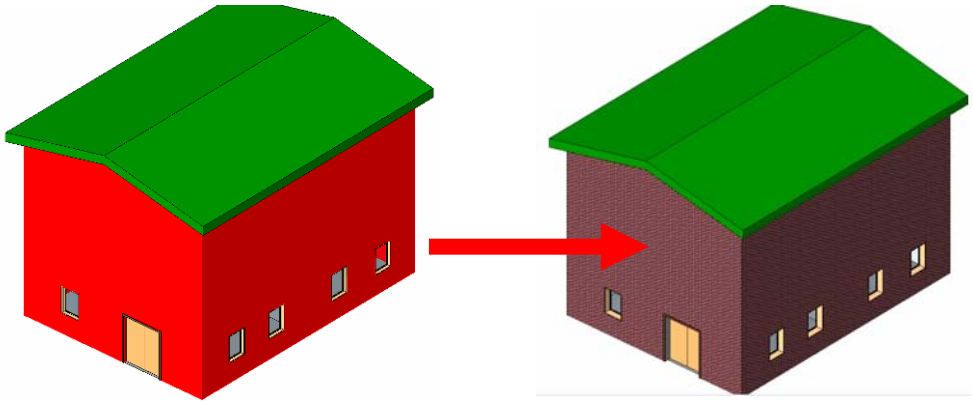
Note that you must have at least two projects open in the same session for the tool to be available.

To transfer system families from one project to another, it is generally easier to copy an instance of that object from one project to another. The system family of the instance is then also copied into the target project. Just use Ctrl+C to copy and Ctrl+V to paste.

12. Select the four exterior walls at once (hold your cursor over one wall and press the Tab key).

13. On the Options Bar, change the wall type to Exterior – Brick on Mtl. Stud.

14. Zoom in the 3D view to see the different finish and material of the wall type.

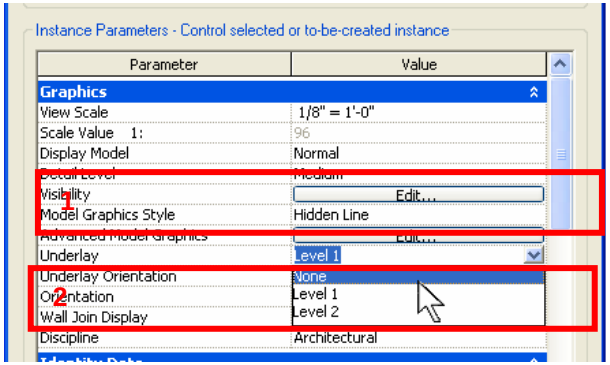


Add a Floor Slab on Level 2

15. Open Floor Plan Level 2.

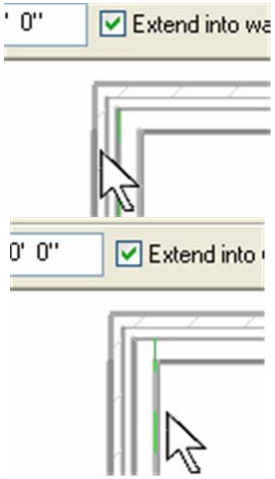
16. Right-click the Floor Plan Level 2 in the Project Browser. Right-click in the drawing area, and choose View Properties to open the View Properties window. Change the Detail Level from Coarse to Medium.

17. Change the Underlay field to None.



Views have many different properties that filter the information of the underlying data model and define how it is displayed.

18. On the Basics Design Bar, select Floor. You are in sketch mode.



When clicking the wall-defining line for the floor slab, make sure that

- The option Extend to Core is flagged on the Options Bar.
- The green lines that appear while highlighting the walls are in the middle of the wall (or slightly off center). This is the exterior face of the core of the wall - or if the cursor is inside the building, to the location between the gypsum finish and the stud.

19. Hold your cursor over one exterior wall, and press Tab. Click to select the four exterior walls.

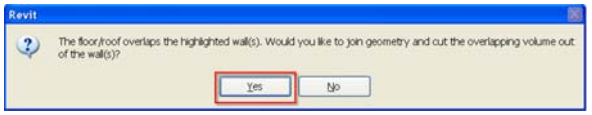
20. Click Finish Sketch on the Design Bar.

When you created the first floor, Pick Walls created a sketch line either inside or outside the wall. Now that the wall is of a different type (Brick on Stud), the definition has changed. Part of the definition is a core (or structural core). For this wall type the stud has been defined in the core and the brick defined as a finish on the core.

21. In the two dialog boxes that appear when you finish the sketch, click Yes to both prompts.

This prompt is asking if you want to establish a relationship between the interior walls and the new floor. Click Yes.

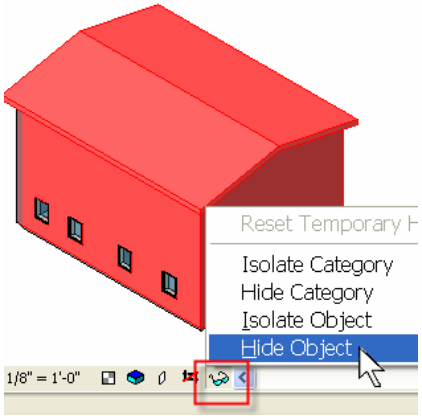
This option cleans up the intersections among walls and the floor.



This prompt is asking if you want to cut the geometry of the floor from the geometry of the wall. Click Yes.

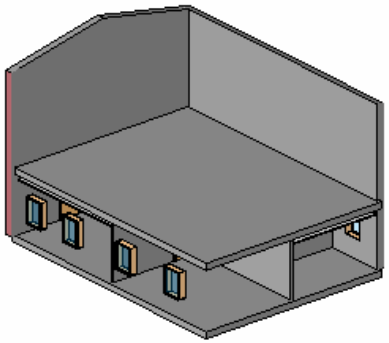
This option extends the floor into the wall to create a bearing condition that you see when you start working with the sections.

22. Constrain walls to a different height.



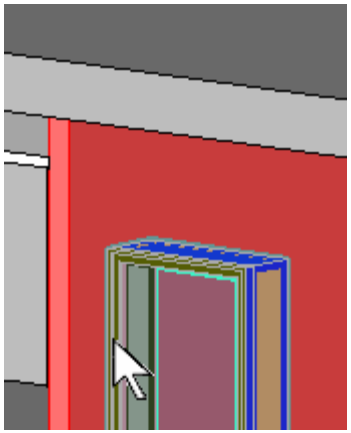
The interior walls were set to the second-level height when they were drawn. When you finished the floor, the interior walls were extended to the underside of the floor. As the floor level changes, wall height remains attached.

23. Open the 3D view. Select the two visible exterior walls and the roof, and then click the Hide/Isolate icon on the View toolbar.



Hide/Isolate is a view-specific tool that is useful when working in a 3D view displaying a lot of data.

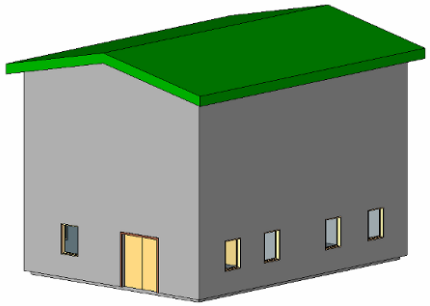
When the tool is active and a component is hidden or isolated, the icon on the View toolbar changes color to indicate that the view contains hidden data.



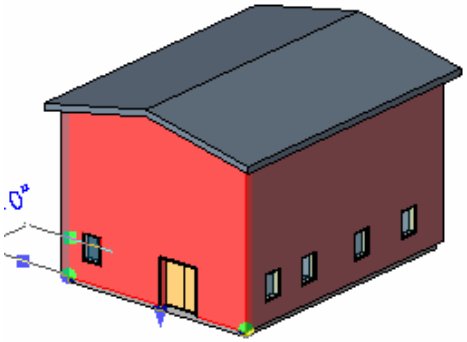
The interior walls no longer extend all the way to Level 2 but are attached to the underside of the floor.

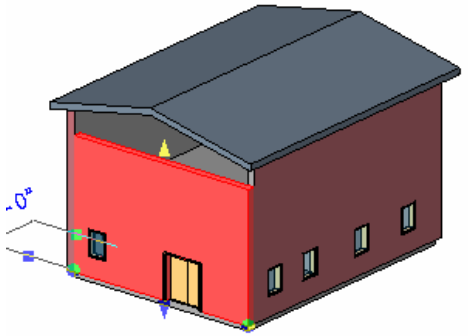
24. Click the Hide/Isolate icon, and on the View toolbar click Reset. Close the dialog box.

25. Rotate the 3D view, as shown in image.



26. Select the front wall (containing the double door). On the Options Bar click Detach, and then select the roof.

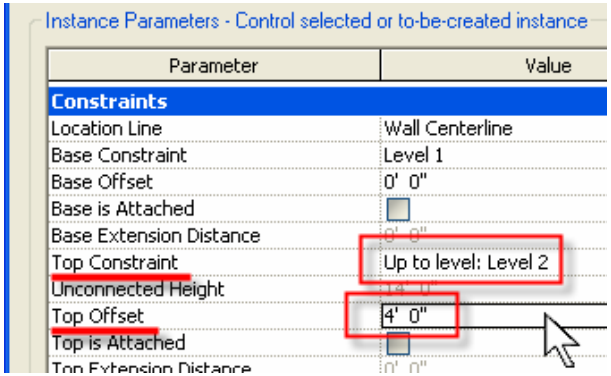




You can remove explicit relationships at any time.

27. Right-click the wall and choose Properties.

28. Change the Top Constraint value from Explicit to Level 2 and the Top Offset field to 4’.



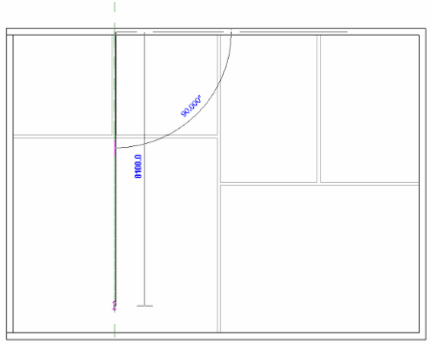
Add a Curtain Wall and Modify Its Properties

Curtain walls are considered as wall families. Most of the Instance parameters are the same as for the basic wall families, but the Type parameters are completely different.

29. Open Floor Plan Level 2. On the Basics Design Bar click Wall, and change the wall type from the Options Bar to Curtain Wall: Exterior Glazing.

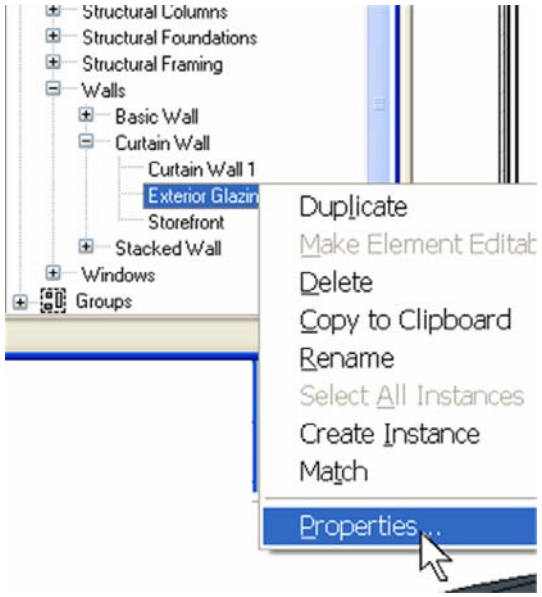
30. Before you start drawing, set the height to Level 3 on the Options Bar.

31. Draw a vertical wall, as shown in the image.

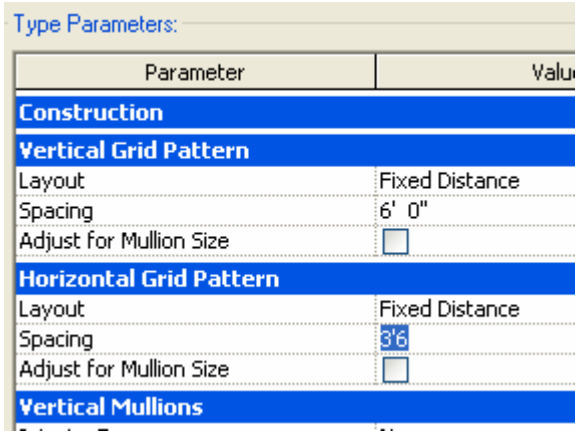


32. Open the 3D view.

33. Go to Project Browser>Families>Walls>Curtain Wall and right-click Exterior Glazing. Choose Properties.



34. Change the pattern to the spacing as shown. Click OK to close the dialog box and see the changes in the model.

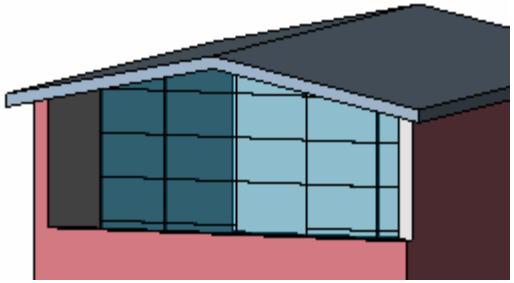


There are many different ways to access a family's Properties dialog box.

The pattern layout properties refer to the curtain gridlines.

The available options allow for flexible editing.

35. Select the curtain wall, and on the Options Bar, click Attach, and then select the roof.

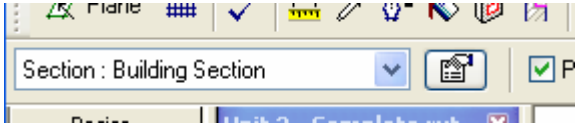


This curtain wall type contains only the grid divisions. Mullions must be placed after positioning the curtain wall.

To add mullions, on the Modeling Design Bar, click Mullion and click any curtain grid.

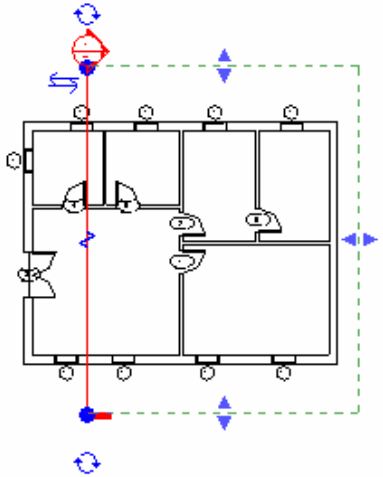
Add a Section

36. Open the view Floor Plan>Level 1, and on the Design Bar click Section and draw a building section, as shown in image.



Like a level, creating a building section also creates a view that represents the section.

37. Open the section by double-clicking the Building Section view that was automatically created in the Project Browser.

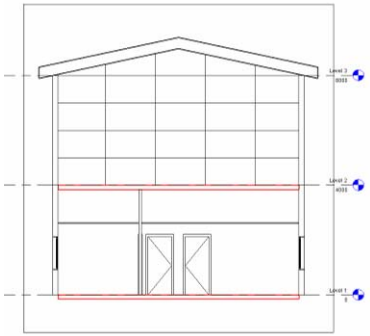


Reverse section views by clicking the arrow symbols that appear next to the section head.

Section heads and tails can be turned on or off and toggled among the available loaded ones by clicking the circular arrow symbols next to the section head and tail.

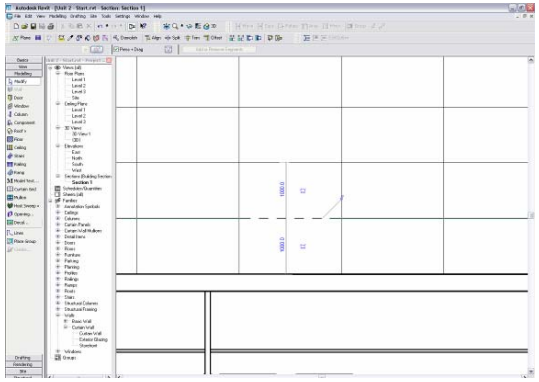
Switch to the section view by double-clicking the section marker in plan view. This method works only if the section mark is deselected, showing a blue section bubble.

38. Select the floor slabs on Level 1 and Level 2 (use the Ctrl key), and verify that their type is Generic - 12” on the Options Bar.

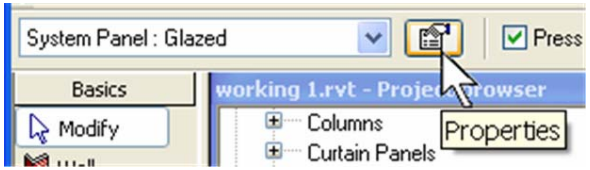


Modify the Curtain Wall Division, and Change a Curtain Panel into a Door Panel

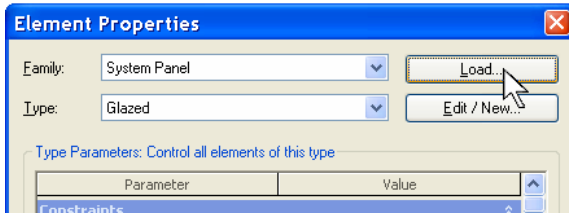
39. Select the first gridline from the bottom on the curtain wall, and on the Options Bar click Add or Remove Segments. Click the middle segment to remove it.



40. Using the Tab key, select the newly created curtain panel that is twice as big as the other ones (position the cursor next to the side of the panel and press Tab until it is highlighted). Open the Properties dialog box by clicking the icon on the Options Bar.



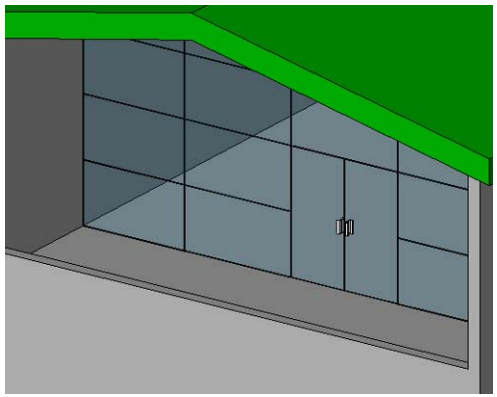
41. Click Load and navigate to Imperial Library>Doors>Curtain Wall Dbl Glass.rfa.



Load family components as needed during the design process.

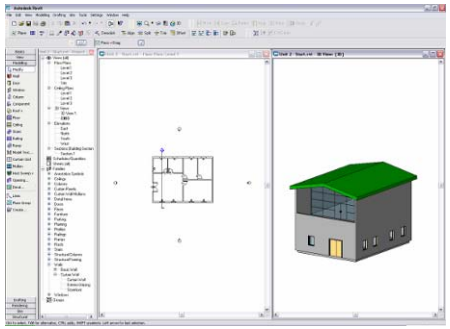
42. Click OK to accept and close the Properties dialog box. Open the 3D view to see the change.

43. On the Window menu, choose Close Hidden Windows.



As you work with the different views, they remain open until you close them. Close Hidden Windows enables you to free computer memory by closing those windows that you are not using.

44. Open the view Floor Plan>Level 1, and then from the Window menu, choose Tile.



Alternatively, you can press WT on your keyboard to tile the windows.

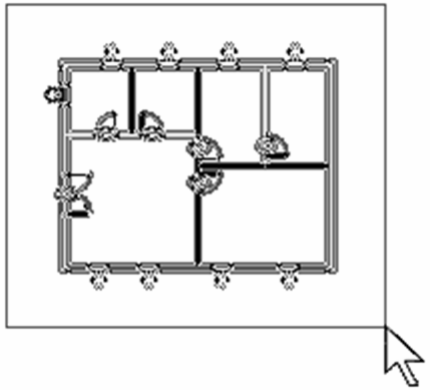
Tiling windows enables you to work in more than one view at a time.

This tool is particularly useful for selecting objects that may not be available from any one view.

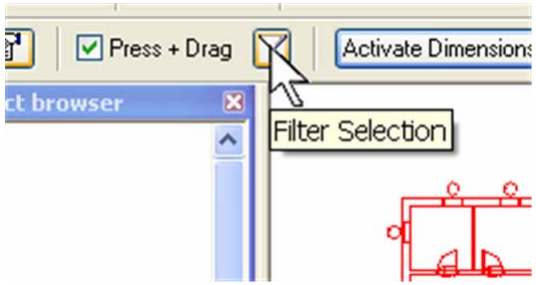
Copy Components from One Level to the Other

45. Open Floor Plan Level 1.

46. In plan view, draw a selection window around the building.

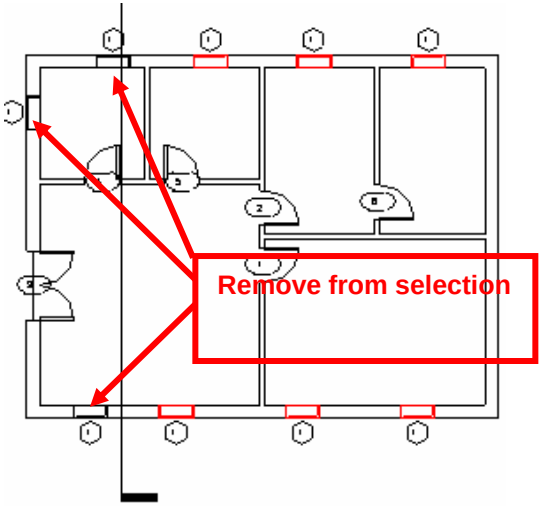


47. Use the Filter Selection button to filter only the windows in the selection set.



48. Check only the windows category.

49. Press the Shift key, and remove the windows on the left side (on the vertical wall and the first ones from the left on the horizontal walls) from the selection set.



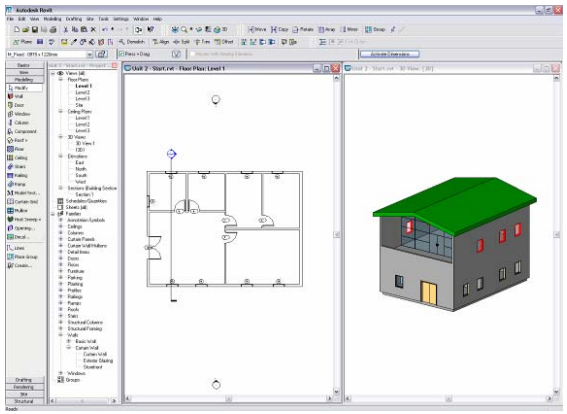
The default section with the cursor movement is as follows:

- Left to right: Include only those objects entirely within selection box.
- Right to left: Include any element that lies within or is crossed by the bounds of the selection box.

When selecting individual components:

- Ctrl+click adds to the selection set.
- Shift+click removes from selection set.

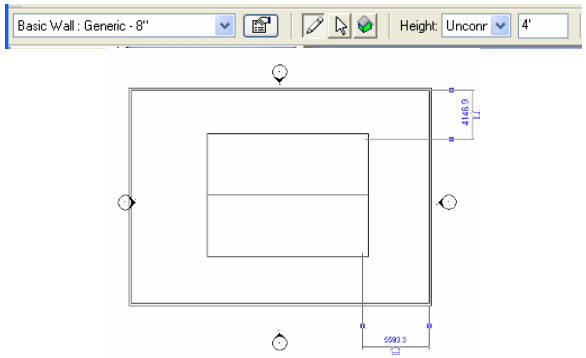
50. From the Edit menu, choose Copy to Clipboard. Then from the Edit menu, choose Paste Aligned>Select Levels by Name>Level 2.



You can use Paste Aligned on multiple levels at the same time by pressing Ctrl and clicking the level names in the dialog box.

Modify a Wall Profile

51. Open Floor Plan: Site.

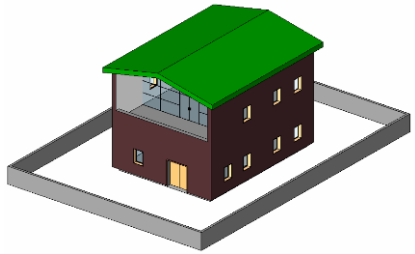


Change wall height as well as any other wall property after it has been positioned by opening the Wall Properties dialog box.

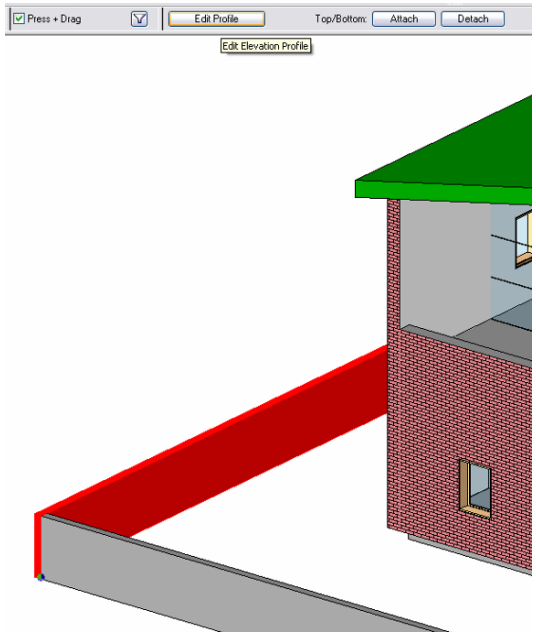
52. From the Basics Design Bar click Wall and select wall type (from the Options Bar): Generic 8” Height: Unconnected 4’.

53. Draw four walls using the rectangle template from the Options Bar to create the wall around the building, as shown in image.

54. Open the 3D view.



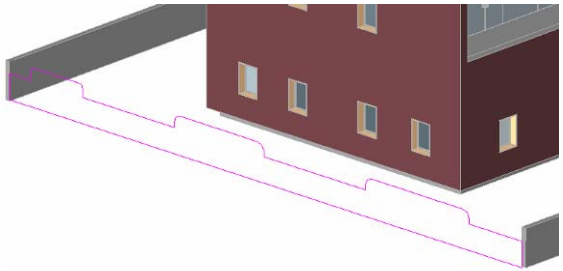
55. Select the north wall, and click Edit Profile from the Options Bar. You are in sketch mode.



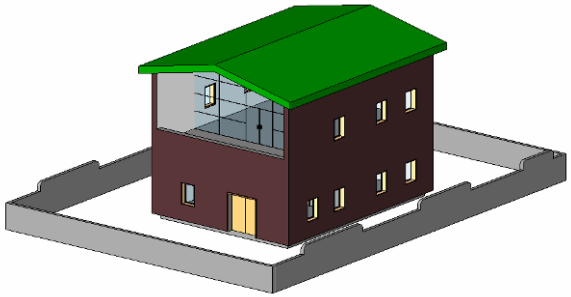
When editing the wall profile, you are in sketch mode and some specific rules are applied:

- All wall constraints are removed while sketching.
- The line that is constrained (usually the bottom and top lines) displays a lock if you select it.

56. Select the top line of the wall and erase it. Create a new top profile for the wall using lines. Rotate the model for better visibility; use image as a guideline.



57. Repeat the process with the south wall.



You can create rectangular openings in curved walls but not edit the profile. To achieve a different profile, you must cut the wall with an in-place family.

Unit 3

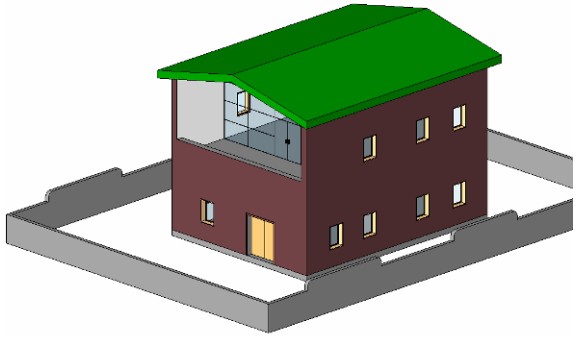
Theory: Families and Nested Families

Autodesk Revit Building: Editing Types

In this lesson you work with families and types. You create a new wall type and window type from existing types in the project. For the wall you create a type with a sweep for a base and a reveal (cutout) at the top. You also split the brick, adding a new component to the wall base. Wall types are system families. They do not exist outside the project environment.

Window families can be defined outside the project as RFA files or family files. For the window you duplicate an existing window type to create a new size window. **Nested families and the Family Editor are explained in Units 10 and 11. This unit explains how to duplicate, edit, and manage a *system family* such as a wall.**

1. Open file Unit 3 – Start. Open to the 3D view and orient the view as shown.

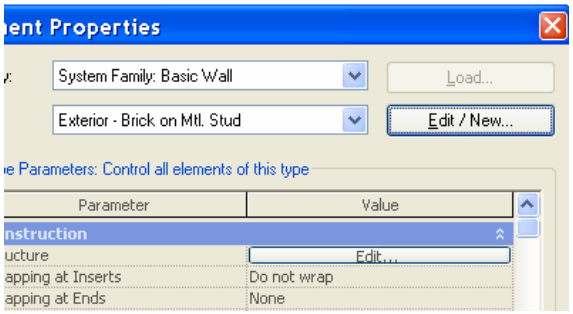


2. Right-click one of the exterior walls, and choose Properties.

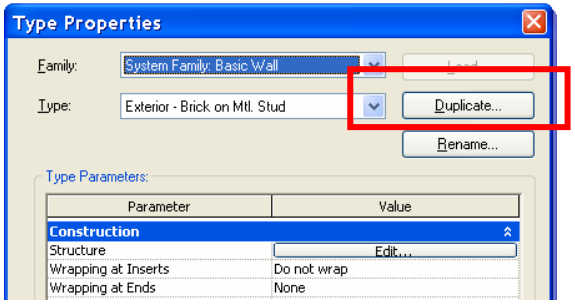
To access a component Properties window, select the component and do one of the following:

- Right-click, and choose Properties
- Click the Properties icon on the Options Bar

3. Click the Edit/New button.

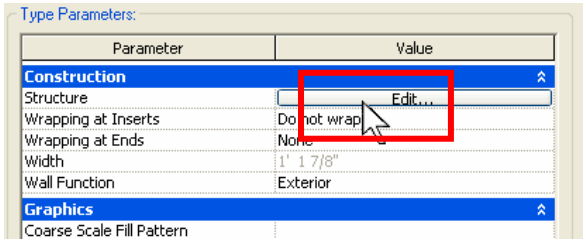


4. Click Duplicate and enter Exterior - Brick on Mtl. Stud with Base as the new name for the wall type.

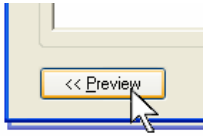


It's essential to always duplicate an existing type instead of editing it directly, which would mean that you were actually changing the standard Autodesk Revit Building library. You can easily purge excess types later.

5. Click the Edit button under the Structure field.



6. Click the Preview button in the bottom left of the dialog box.

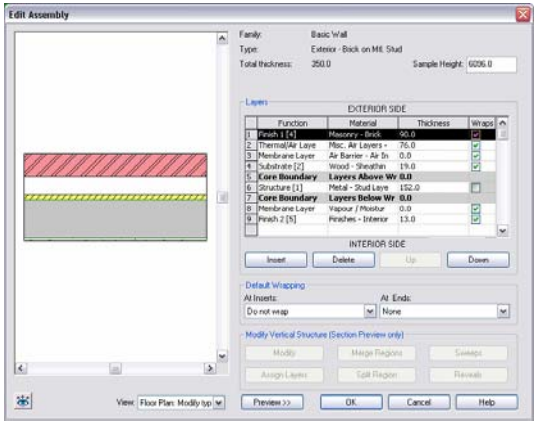


Every wall component has the following properties: layer, function, material, and thickness. Wall components can "wrap" around the wall end or at inserts.

7. Default preview is plan structure. Change the view from floor plan to section at the lower portion of the preview pane.

8. Add a sweep:

9. Click the Sweeps button in the right pane. The Wall Sweeps dialog box opens.



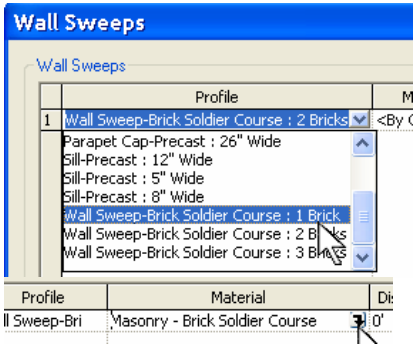
The layer determines how wall components clean up with each other.

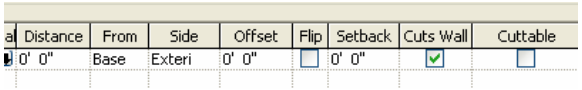
The material determines what hatch is shown when the wall is cut in section or plan or viewed in elevation along with the shading and rendering textures. Materials also affect how walls clean up.

Note that the lower part of the structure window becomes active only if you switch the preview to Section.

10. Click the Add button in the Wall Sweeps dialog box. After the sweep is added, the list sets the properties as shown at the right:

- Wall Sweep - Brick Soldier Course 1 Brick
- Material = Brick Soldier Course
- The other values should default to the values shown.

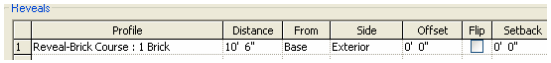




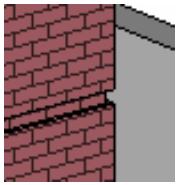
There are two ways you can create sweeps: either internally to an object type definition (wall, railing) as in these steps, or a singular instance applied directly to an object (wall sweep/reveal, roof/slab edge) using the Sweep tools on the Design Bar.

11. Use the Reveal button to add a reveal.

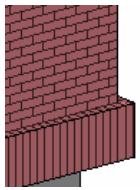
- Reveal - Brick Course 1 Brick
- Distance = 10’ 6”
- From = Base
- Exterior



12. Click OK until you are back at the drawing window.



Reveal



Sweep

You should see that a reveal notches out of a wall, and a sweep adds to the wall.

Sweeps and reveals are profile based. The Sweep and Reveal dialog boxes allow for direct profile loading.

A profile is an external family that consists of linear geometry. You define a closed line shape (similar to sketch mode) and save it as a family. Then you load the profile into the project as you would a door or window. However, unlike a door or window family, profiles cannot be used directly in the project but must be assigned to a sweep type definition (applied sweeps, roof slab edges), or directly to the object (wall and railing type definitions).

- More on sweeps:

  Walls cannot have vertical sweeps set in the type, but they can be added manually from Modeling Design Bar>Host Sweep>Wall Reveal/Wall Sweep. You can also use this tool to create a horizontal instance of sweeps or reveals.

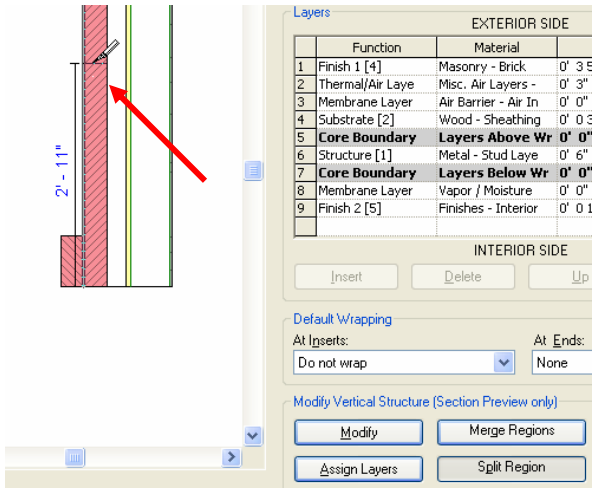
Sweeps and reveals clean up correctly at angles and at inserts unless the inserted family contains specific solid elements in the family itself (that is, an exterior or interior door frame) that may interfere with the sweep/reveal.

It is possible to grip-edit sweeps at inserts and corners to redefine them. It is also possible to modify the sweep return around the corner. Select any sweep and check the available options on the Options Bar.

Split a Component to Add a New Material

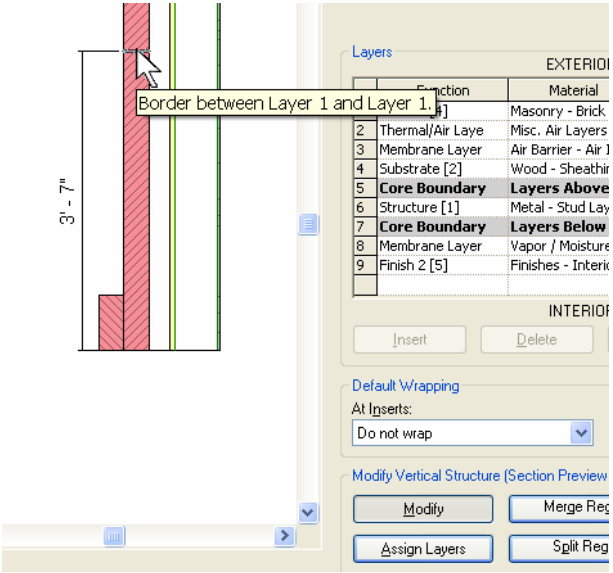
13. Select the wall you were working with, and return to the Structure Edit dialog box. Right-click the wall, and choose Properties>Type [edit/new]>Structure [edit].

14. Click the Split Regions button. Hold your cursor over the masonry brick exterior layer on the preview, and click near the bottom of the wall to divide the brick structure into two parts.



15. Click the Modify button, and click the line dividing the two brick regions.

16. With the edge selected, use the temporary dimension to move the line to 3’ above the bottom of the wall. Click the text of the temporary dimension and type 3 for 3’-0”.



To select this edge, you probably need to use the hover and tab process:

Hold your cursor over the split you made in the brick component. Do not select with the left mouse button yet. Use the Tab key to cycle through the various faces that you can select. Watch the edges highlight with each press of the Tab key. As you do this, watch the status bar at the lower-left corner of the application window. The status bar displays a description of what will be selected if you click at that time.

17. Add a new layer for the split component.

18. Click the Insert button to add a new component with these settings:

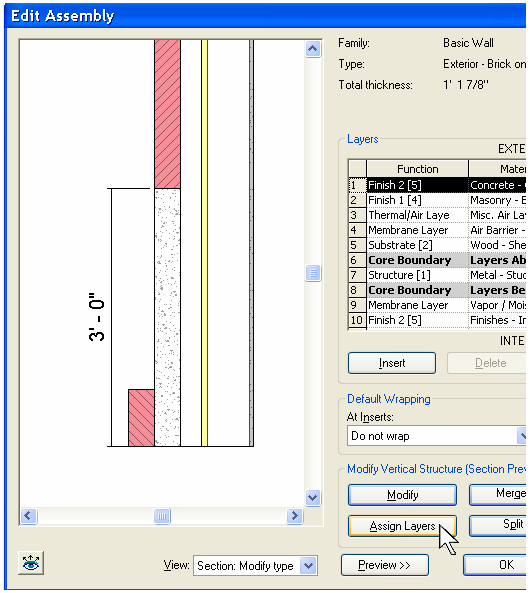
- Function: Finish 2 [5]
- Material: Concrete cast in place
- Width: unchanged

  Make sure the layer row with the new component is selected.

19. Click the Assign Layer button.

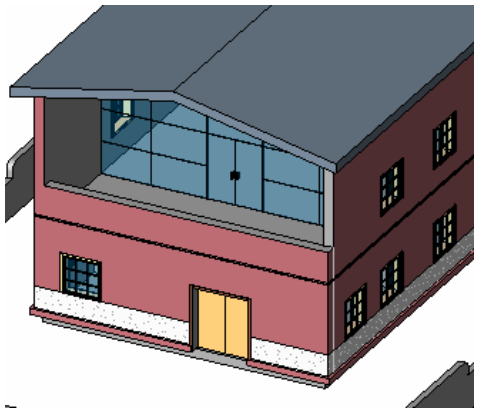
20. Click the lower part of the exterior brick component in the preview pane to assign the new wall component to it.

21. Click OK twice to close the dialog boxes.



Once the regions have been divided, it’s not possible to edit the width of the component, as the system sets the default value to “variable thickness” according to how it is used within the wall type. That is, you could assign the same layer material to two different regions, laying on two different components, each with a different width.

22. Select the remaining three exterior walls, and change their type from the Options Bar to the newly created type Exterior - Brick on Mtl. Stud with Base.



You can split wall components into as many regions as you want, but creating complex walls should be done only when the design idea and the construction method are clear. Otherwise, editing the regions can become difficult when there are many of them.

The wall you just modified belongs to a system family. It cannot exist outside the project (*.rvt* file) as a file you can edit. You create new types by duplicating existing types.

External (Hosted) Families
When you load from library, you are loading a separate file—a family (*.rfa*) file. These files store the basic geometry and parameters for components such as doors and windows.

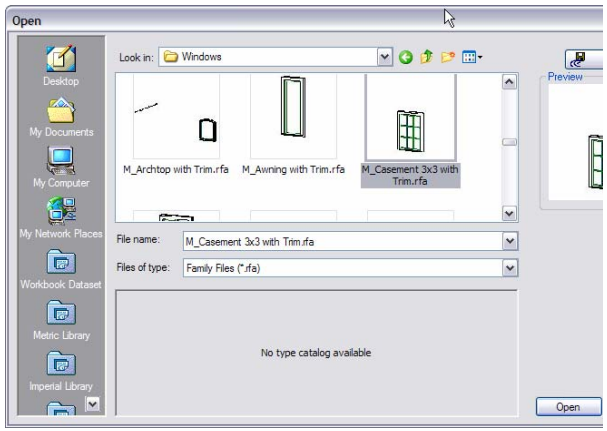
External families are also termed *hosted families.* Although this makes sense for doors and windows that are hosted by a wall, other components may be hosted by different components. For example, ceiling light fixtures must be placed on a ceiling. You cannot create an instance of a ceiling light unless there is a ceiling in the project. In general, all components that you load from the library are hosted at least by the level you place them on.

Load a Window Family

23. From the File menu, choose Load from Library>Load Family and navigate to the default Imperial Library>Windows folder.

24. Activate the preview in the browsing window to see previews of the window types.

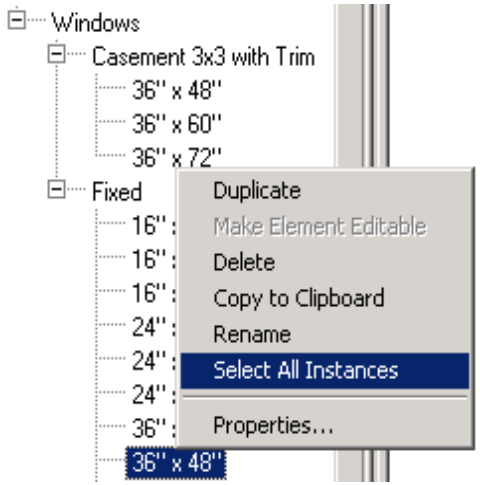
25. Select the window family called Casement 3x3 with Trim.rfa.



This is one of many ways to load families. In Unit 2 you loaded a family directly from the component's Properties dialog box. You see more ways to load families later.

26. Duplicate a window family to create a new window type.

27. Go to Project Browser>Families>Windows>Fixed, right-click 36” x 48”, and choose Select All Instances.



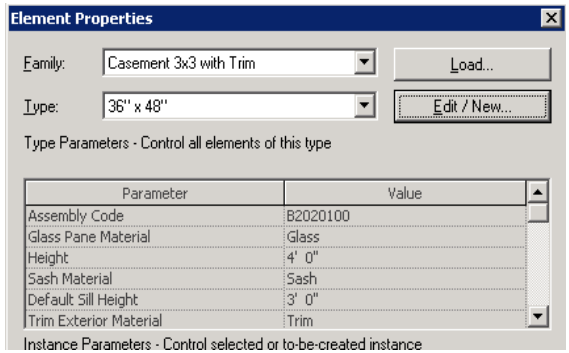
28. From the Options Bar change the window type to Casement 3x3 with Trim 36” x 48”.

Selecting families from the Project Browser is a convenient and easy way to create a selection set for a specific family type. Because it is not view specific, it selects all types contained in the model.

You can also select all instances by right-clicking one of the windows in any view and choosing Select All Instances from the context-sensitive menu.

29. Without deselecting the windows, right-click and choose Properties.

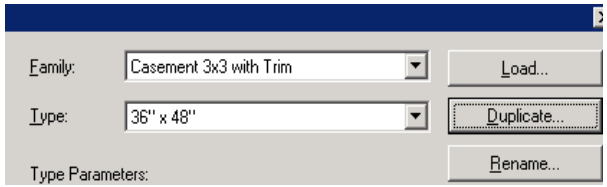
30. Click the Edit/New button.

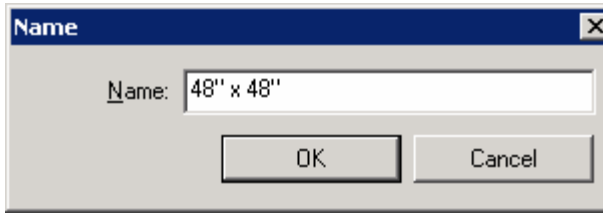


The Edit/New button opens the Type Properties dialog box. The parameters that appear in the first dialog box are the Instance properties. You can define Type parameters and Instance parameters during family creation.

31. Click the Duplicate button.

32. Create a new type named 48” x 48”.

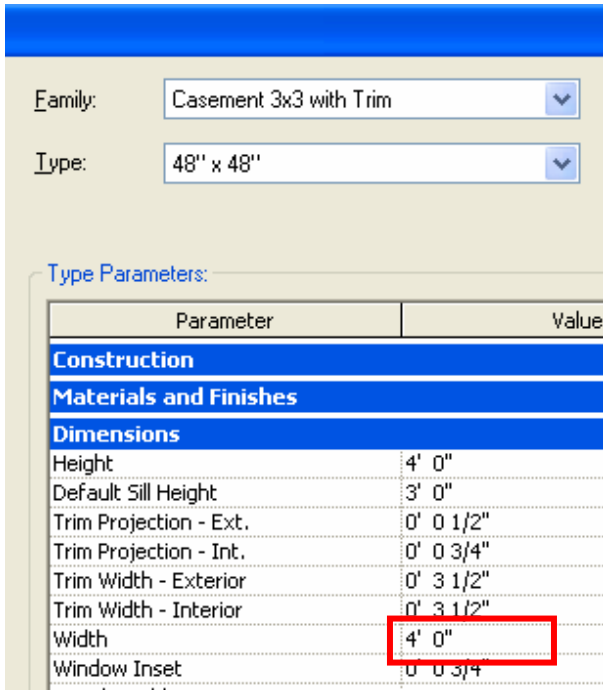




Duplicating the window type and modifying the window family does not automatically update the family file (RFA) stored outside the project file. You export the family to your library at the end of this exercise.

It’s a convention to name types using their size so that other people using families can easily trace and understand them. In a team, conventions are a fundamental part of the design process optimization, making it easier to share the data consistently.

33. Change Width value to 48”.
34. Click OK twice to close all dialog boxes.



There are many parameters in this dialog box that vary in type: length, material, text, and other component-specific properties. Try changing the materials to see what happens.

Export the Window Family

35. From the File menu, choose Save to Library.
36. From the Family to Save drop-down menu, select the family Casement 3x3 with Trim.

Remember to save in a location that makes sense: always keep your personal libraries separate from the default installed library.

If you save your libraries in the same folder as the Revit Building libraries, you might lose all of them if you forget to pull them out before upgrading to the next release. So, make it a habit to create your own library folder.

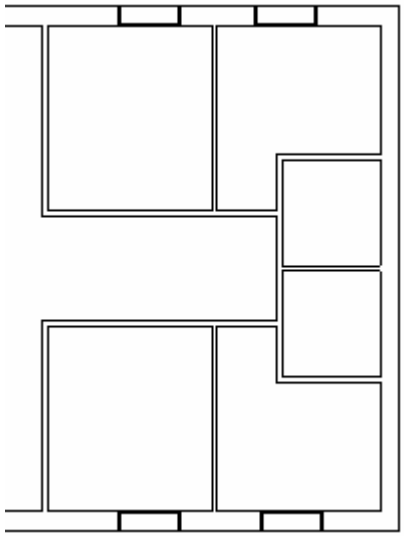
Unit 4

Theory: Parameters

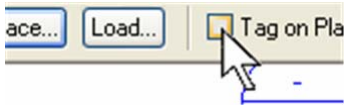
Autodesk Revit Building: Dimensions, Doors, and Windows

This unit explains how to use doors, windows, and dimensioning in Autodesk Revit Building.

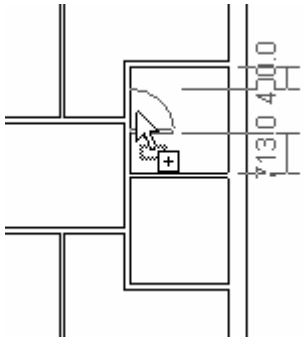
1. Open file Unit 4 – Start.
2. Open Floor Plan Level 2.
3. Zoom into the east area of the building.
4. Add the interior walls as shown in this image.



5. From the Basic Design Bar, select Door, and from the Options Bar, select door type: Single-Flush: 34” x 80”.
6. On the Options Bar, clear Tag on Placement.



7. Position the cursor over the vertical wall, as shown in the image.

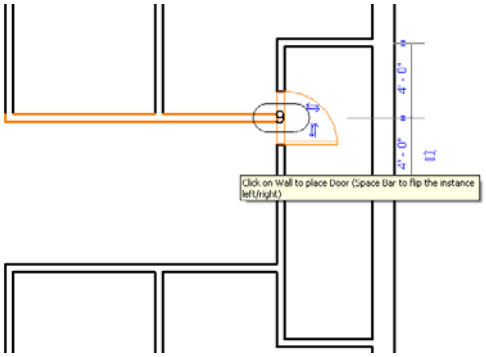


As you add these walls, verify that your walls heights are set to Level 3.

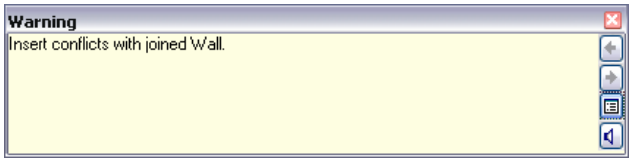
The door opening side is defined while positioning the door by moving the cursor from one side of the wall to the other.

Pressing the spacebar while positioning changes the swing direction.

8. Click to place the door. Try to place it so that the opening is in front of the perpendicular wall.



A Warning dialog box displays if there is a conflict between the door and the wall.



If you want, you can ignore this warning and resolve the problem later.

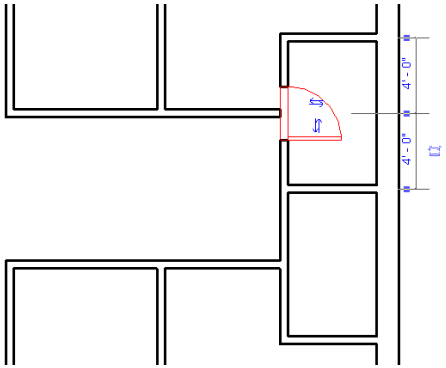
9. On the Basic Design Bar, click Modify, and select the door.

When you select a door, two symbols appear. Use them to invert opening side, swing direction, or both.

Invert swing.

Invert side.

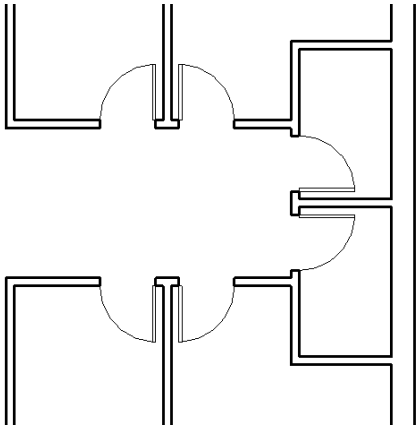
10. Click the text of the dimension that is attached to the horizontal wall in the middle. The value becomes editable. Type 2’ and press Enter.



11. On the Basic Design Bar, click Door, and from the Options Bar, click door type: Single-Flush: 34” x 80”.

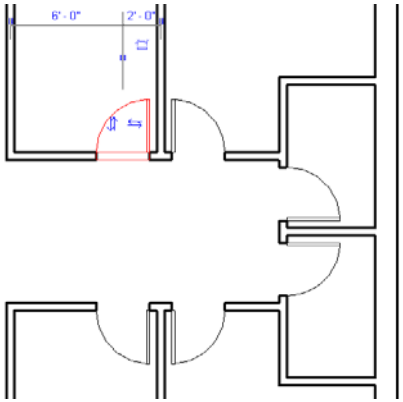
12. On the Options Bar, clear Tag on Placement.

13. Place doors, as shown in the image. Use temporary dimension to get an idea of location relative to walls.



You can edit temporary dimensions with the control boxes (blue squares) on each witness line. Just click a control box, and drag it to a new position.

14. Select door and adjust dimension from door center to wall centerline. Type 2’ to change location of door.

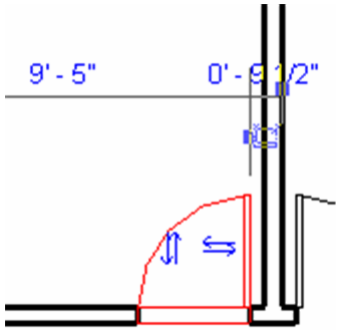


You can change what the temporary dimension is referencing by clicking or dragging the control box (blue square) on the witness line.

Click these control boxes to move the witness line to another reference point. There is a limited set of points the witness lines will find with this method.

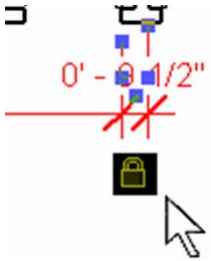
By dragging this control box, you can move to entirely different objects.

15. With the door still selected, change the dimension references so that they reference the face of wall and edge of door opening. Click the symbol ( ). The temporary dimension becomes a permanent dimension.



You can use permanent dimensions to annotate your design, and they can be useful to place a relationship between components.

16. Press Esc twice and select the permanent dimension that you just placed. Click the blue lock near the dimension line.



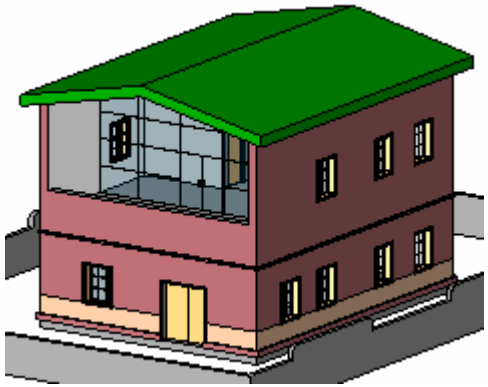
When you click to lock the dimension, you are creating an explicit relationship. If you move the wall, the door retains its position relative to the wall.

If you delete a dimension that establishes a relationship, Autodesk Revit Building displays a warning asking what you want to do. You can delete the dimension and keep the relationship or simply delete the dimension and the relationship.

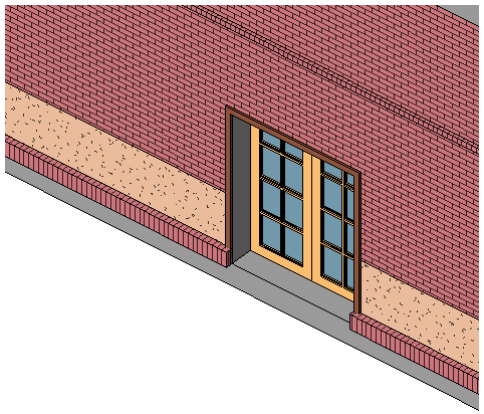
Load a Door Family and Change a Type

17. From the File menu, choose Load from Library>Load Family. Navigate to the *Doors* folder in the imperial library. Select Double-Glass 2.rfa, and click Open.

18. In the 3D view, rotate the model so that you can see the double door.



19. Select the door, and from the Options Bar choose Double-Glass 2 : 68” x 80” in the type selector.



20. Change Type and Instance parameters.

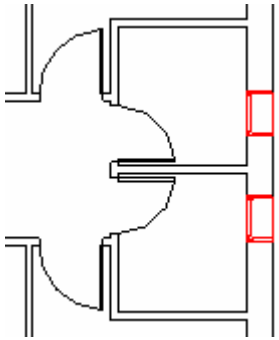
The easiest way to rotate the model is by pressing the Shift key and the middle button of the mouse at the same time.

21. Open Floor Plan Level 2.

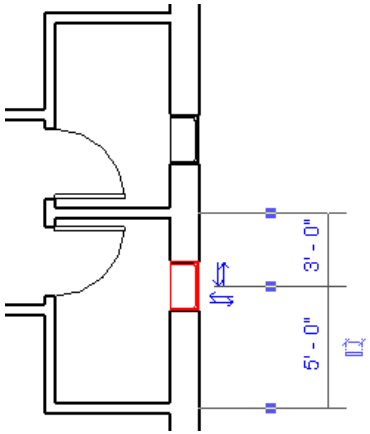
22. On the Basic Design Bar, click Window and click Load in the Options Bar.

23. Navigate to the Imperial library *Windows* folder, select Casement with Trim.rfa, and click Open.

24. On the Options Bar, click Casement with Trim: 24” x 24” and clear Tag on Placement. Add two windows on the vertical wall (east side) using the image as a guide.



25. Using Temporary dimensions, adjust the window’s position at 3’ from the horizontal wall.



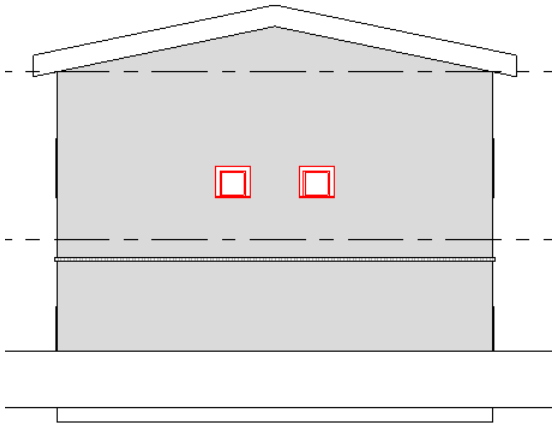
You can load a family in a project in many different ways:

- From the File menu, choose Load from Library>Load Family
- Select the corresponding button on the Design Bar, and click Load on the Options Bar
- Drag a family from Windows Explorer and drop it into Revit Building

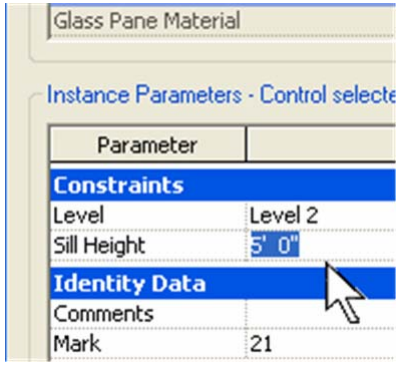
The casement window is like the casement 3x3 window but without the muntins. Different geometry, different family.

26. Go to Elevation East and select the two windows.

27. On the Options Bar, click Properties.

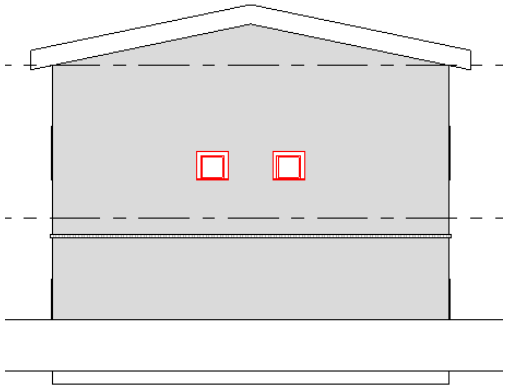


28. In the Element Properties dialog box, change the Sill Height parameter to 5’.



When you change an instance parameter, only the selected components are modified.

29. Click OK in the Element Properties dialog box.



Unit 5

Theory: Representations

Autodesk Revit Building: Views, Visibility, and Sheets

This unit covers the display features and capabilities of Autodesk Revit Building. It also covers some different presentation methods.
This unit includes five exercises:

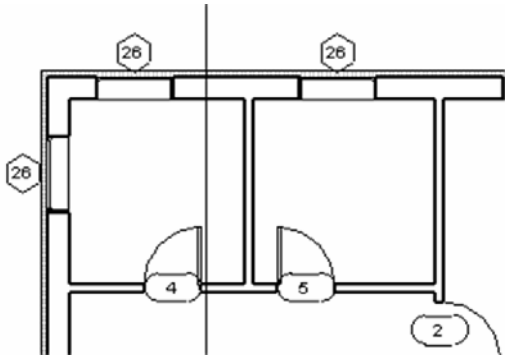
- Exercise 5a leads you through adding a section and detail callout. This exercise also covers adding views to sheets.
- Exercise 5b adds some material to the roof of the building.
- Exercise 5c illustrates some fine-tuning control over the visibility and cleanup of walls in plan view.
- Exercise 5d demonstrates how to create a sun and shadow study for your model.
- Exercise 5e show you how to import a model created in Autodesk Revit Building to Autodesk® 3ds Max® software for visualization.

Unit 5, Exercise A: Sections, Views, and Sheets

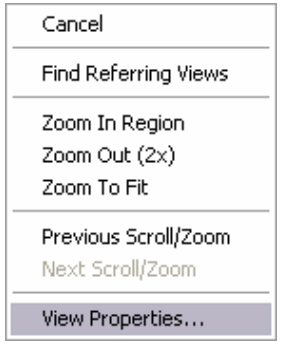
In this exercise you add a section to the building. You then adjust the view properties for the section and add a detail callout to the section view. At the end of the exercise you create a new sheet and composite the views on the sheet.

1. Open file Unit 5a – Start. Open Floor Plan Level 1.

2. Zoom into the two first rooms on the left side of the building.

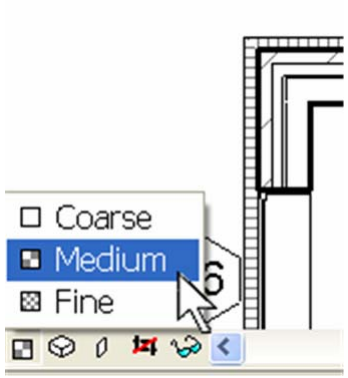


3. Right-click in the view, and choose View Properties.



You don't have to open a view to edit the properties. You can simply right-click a view in the Project Browser and then choose Properties in the context-sensitive menu.
Note that in coarse mode the wall structure is not displayed. When you set the detail level, the structure is displayed. This setting is also accessible from the View toolbar.
Autodesk Revit Building allows three different levels of detail (Fine, Medium, and Coarse). Objects in the project display correctly for each detail level.

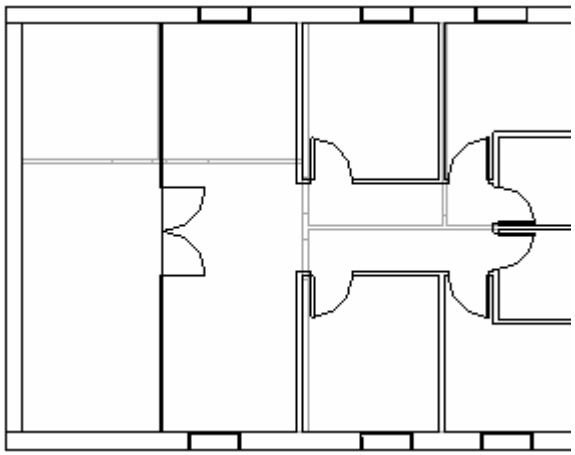
4. In the Element (view) Properties, change the detail level parameter to Medium and click OK.



5. Open Floor Plans Level 2.

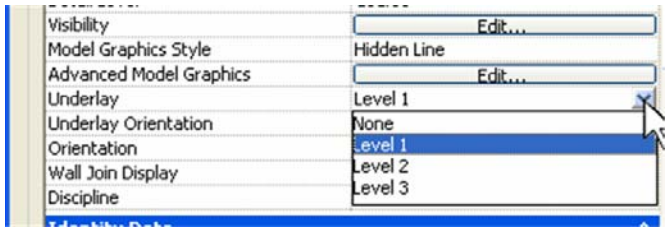
6. Right-click in the view and choose View Properties.

7. In the Element Properties dialog box change the Underlay parameter to Level 1.



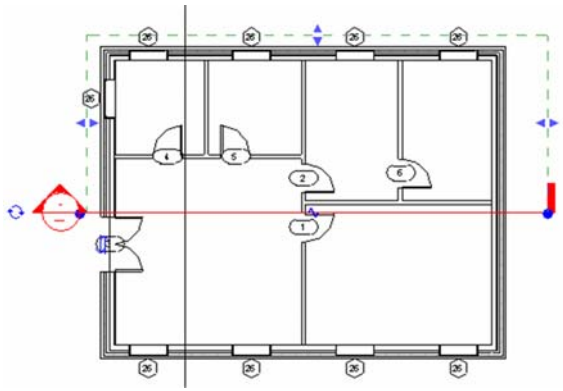
Autodesk Revit Building enables you to choose which view you want to use as an underlay. The view is displayed in gray, but you can use these elements for alignments or as a reference for new objects.

Use all the levels in the building, or simply choose level below or level above.



8. Open Floor Plans Level 1.

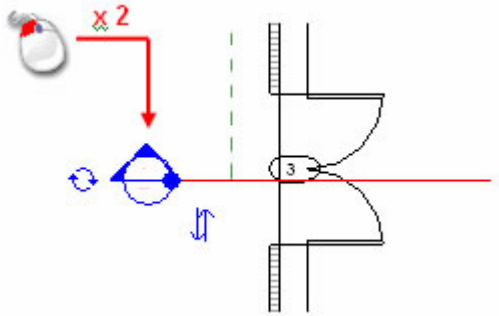
9. On the Basic Design Bar, click Section, and draw a line from left to right. Use the image as a guide.



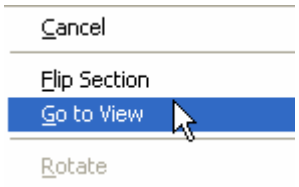
The direction used to draw the section line defines the direction of the section.

10. On the Basic Design Bar, click Modify.

11. Double-click in the middle of the circle of the section bubble in the project. (The section bubble should be blue when you do this. In other words, it should *not* be selected.)

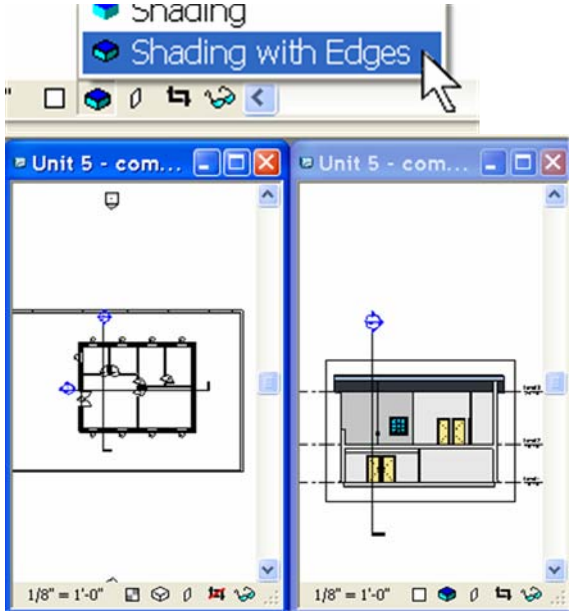


You can also right-click the section line, and then choose Go to View.



12. Change to the model graphics style Shading with Edges.

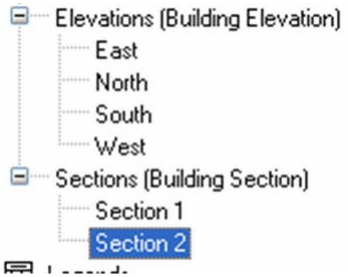
13. Press WT on the keyboard to tile the windows.



There are four Model Graphics Style modes:

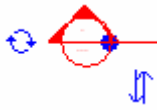
- Shading with edges
- Shading
- Hidden lines
- Wireframe

You have created a new view in the project. This view is automatically added to the Project Browser under Sections.



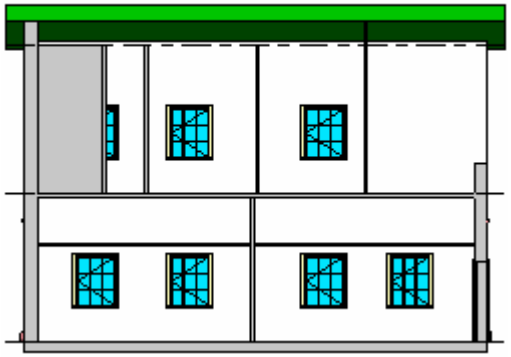
14. Go to Floor Plans – Level 1.

15. Select the section line. Some symbols are displayed next to the section line.



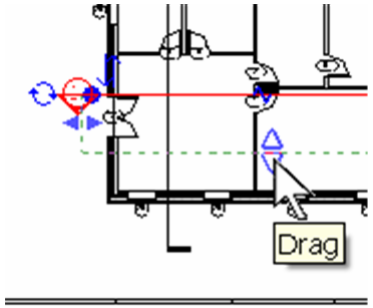
Flip the section. Cycle through different symbols for the section line. Change the symbol at each end of the section line.

16. Click the arrow symbols to flip the section.



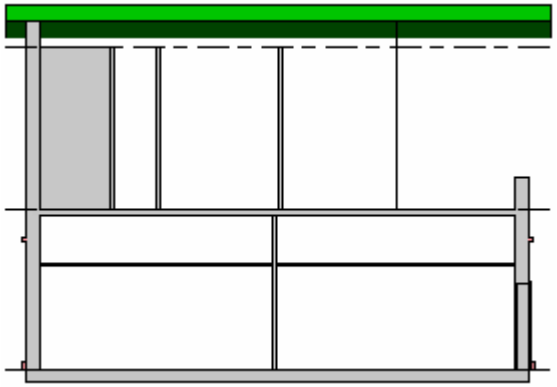
17. In Plan Level 1, select the horizontal section line.

18. Drag the blue triangle (in the middle of the green dashed line) so that this point is above the exterior south wall.



When you move this point, you change a view parameter value: Far Clip Offset. You can change it in the view properties by assigning a value in the field.

19. Make the section view active.



The section view is now cut by the far clipping plane.

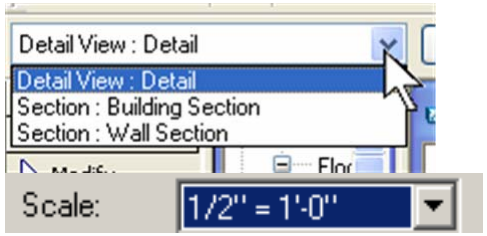
Add a Detail Callout

20. From the Design Bars View tools click Callout.

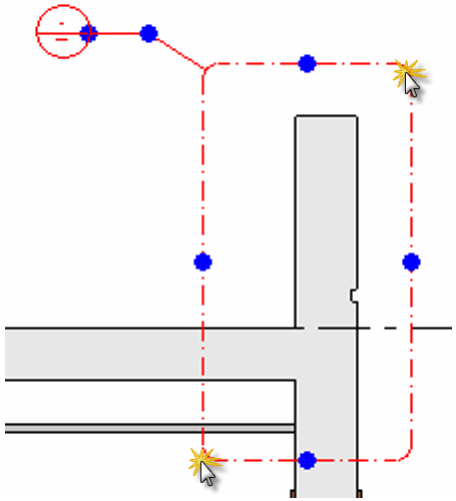
You can modify the scale later in the callout view properties.

21. On the Options Bar, change the Type to Detail Callout.

22. Check that Scale is set to ½” = 1’-0”.

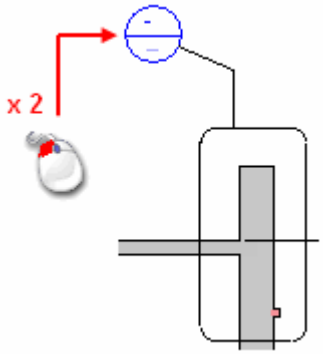


23. Draw the detail frame (click and drag) around the intersection between the floor and the exterior wall on the right side of the building, as shown in the image.

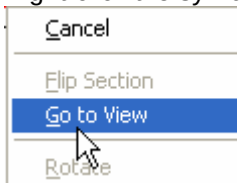


Adjust the size of the frame and replace the bubble by dragging the blue grips.

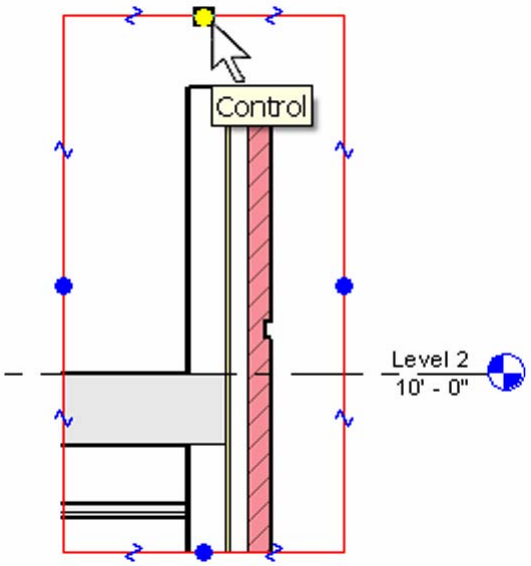
24. Double-click the bubble that is attached to the callout frame.



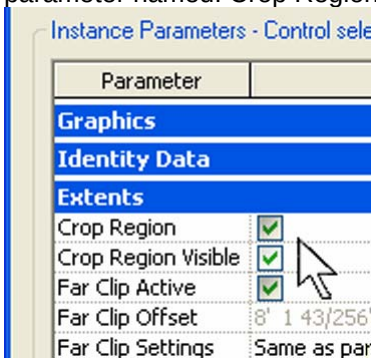
A callout view can be opened like the section view. Right-click the symbol, and then choose Go to View.



25. Select the frame around the view. Use the blue grips to resize the view so that you see only what you want to show in this callout.



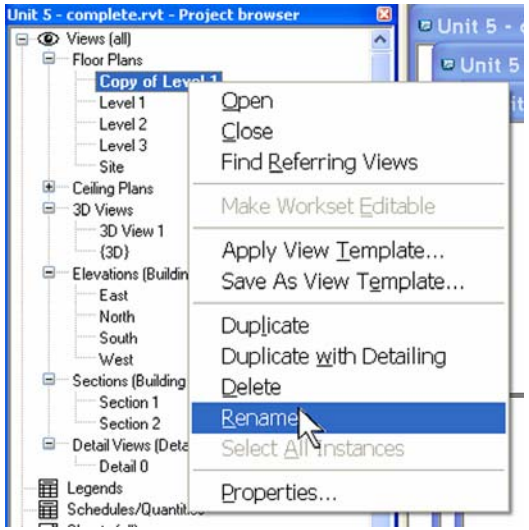
Display this frame in any graphical view. It's a view parameter named: Crop Region.



In a callout view (as in any other view) you can use detail tools. See Unit 14 for a complete description of this process.

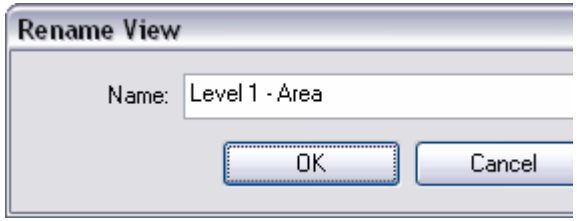
26. From the Project Browser, right-click Floor Plans - Level 1, and choose Duplicate.

27. From the Project Browser, right-click Copy of Level 1, and choose Rename in the context-sensitive menu.



Duplicate a view with detailing (Duplicate with Detailing) or without (Duplicate). If you choose Duplicate only, then none of the detail components (those that are view specific, such as dimensions, tags, annotations) are duplicated.

28. In the Rename View dialog box enter a new name for the view: Level 1 – Area, and click OK.

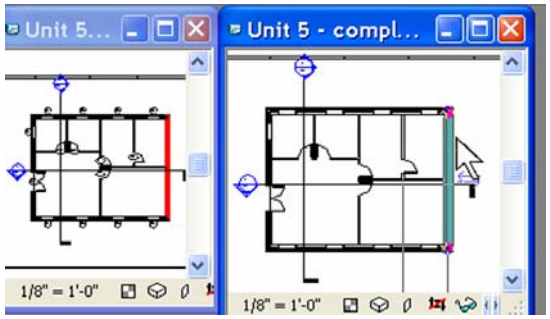


29. From the Window menu, choose Close Hidden Windows.

30. In the Project Browser, open Floor Plans Level 1.

31. From the Window menu, choose Tile.

    You can now see the views side by side.



32. In any view, move a wall. In all other views, that wall moves accordingly.

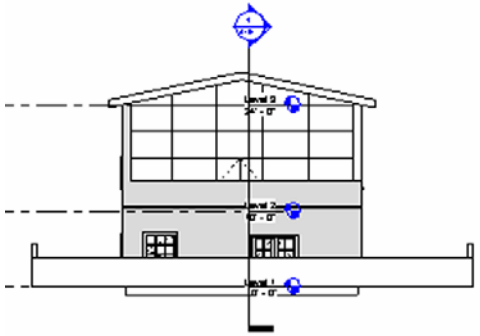
Keep in mind that it's the same wall in the same building. When you move that wall in any view, all other views where that wall is visible automatically update.

Even if you copy a view, you can choose to display it with a different scale, different detail level, different shading mode, and so forth.

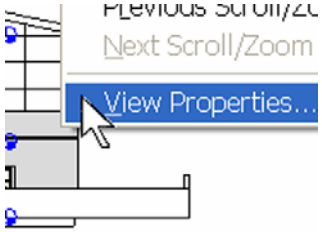
Working with Shade and Shadow

Autodesk Revit Building provides the ability to work with shade and shadow directly in any view. This is part of the view properties called advanced model graphics.

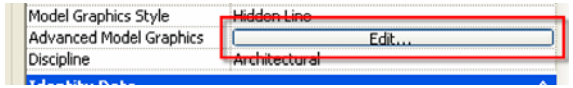
33. Set the West Elevation current.



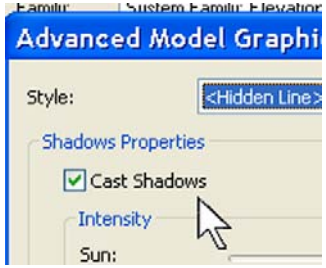
34. Right-click in the view, and choose View Properties.



35. Next to Advanced Model Graphics, click the Edit button.

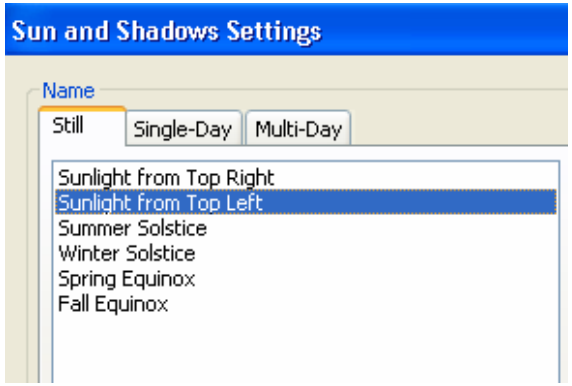


36. Select Cast Shadow.



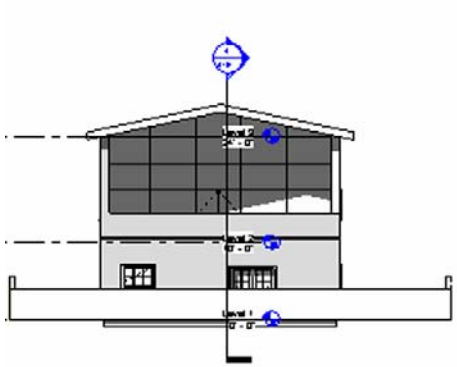
37. Click the browse arrow for Sun and Shadow Settings.

38. Change the preset to Sunlight from Top Left.



The sunlight from top left is in relationship to the plan view of the building.

39. Click OK three times to return to the drawing window.



The shadow is now generated on the elevation.

If the shadows do not show up immediately, change to a different view and return to this or try the refresh key on your keyboard (F8).

Creating Sheets

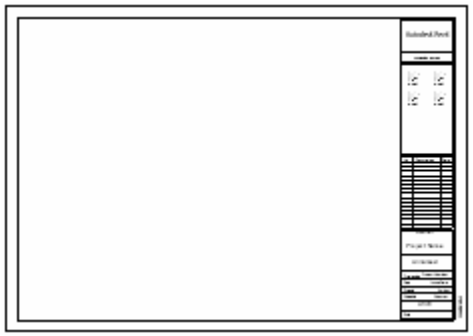
In Autodesk Revit Building, a sheet is another view of the building model. Sheets are listed in the Project Browser in their own category directly above the family list.

The overall flow is as follows:

- Create a sheet.
- Place any of the views (plans, sections, elevations) on the sheet by dragging it onto the sheet view.
- Adjust the properties of the plan view to meet your presentation needs.

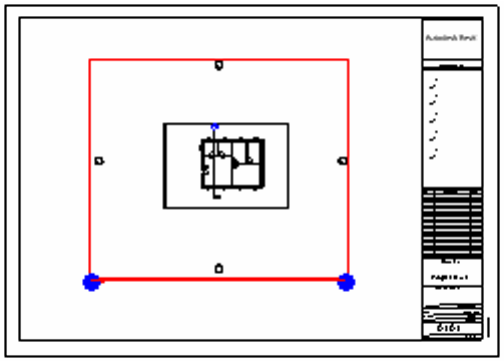
40. In the Project Browser, right-click Sheet and choose New Sheet from the context-sensitive menu.

41. In the Select a Titleblock dialog box, click OK (use the default E1 30 x 42 Horizontal).



To choose another title block, you have to first load it in your project. To load a title block, click the Load button in the Select a Titleblock dialog box.

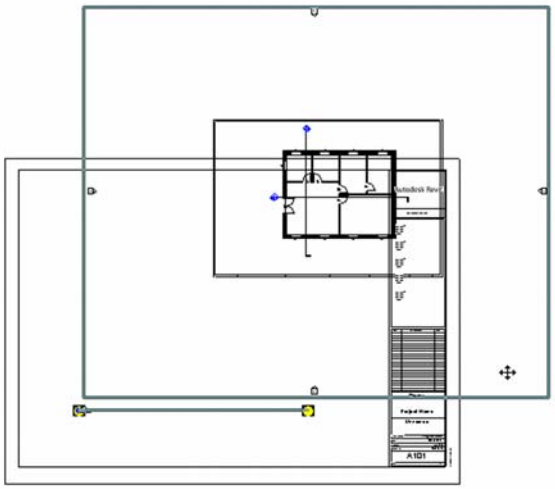
42. In the Project Browser, drag Floor Plans – Level 1 onto the sheet.



Autodesk Revit Building won't let you place the same view twice on a sheet—or the same view on two separate sheets. Instead, you duplicate the view you want place on two separate sheets.

The crop region determines the size of the view on the sheet. By default, the view is set to the extents of the objects in this view.

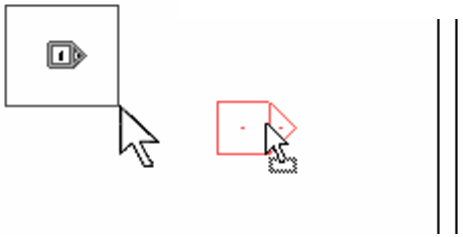
43. In the Project Browser, right-click Floor Plans – Level 1. Choose Properties, and change View scale parameter to 1/4” – 1’-0”. Click OK.



The view’s scale determines how large an area it takes up on the sheet.

Return the Scale of Floor Plan Level 1 to 1/8”

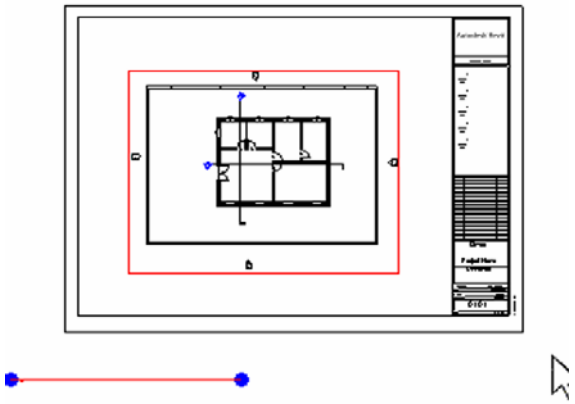
44. Open Floor Plans Level 1.
45. Select the elevation marker by dragging a window selection with the cursor.
46. Drag the elevation marker toward the surrounding low wall.



The elevation mark has two pieces: the square and the triangle. Select them both.

47. Open the sheet.

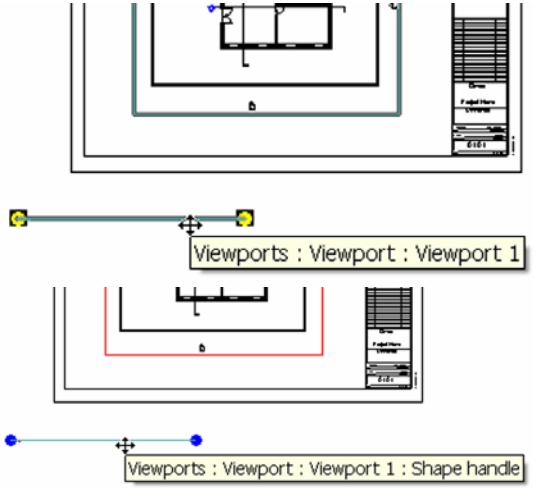
48. Drag the plan into the center of the sheet. Notice that the size of the view is now smaller.



The title of the view also moves with the plan view.

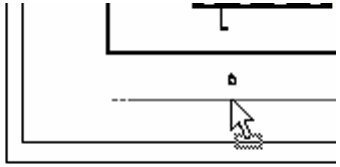
49. Move the title line at the lower left underneath the plan view by dragging it into place.

50. Hold your cursor over the title mark and press the Tab key until you cycle through to Viewports: Viewport: Viewport 1: Shape Handle.



If you cannot get the tooltip to appear with Viewports: Viewport: Viewport 1: Shape Handle, watch the status bar at the lower left for the same information identifier.

51. Click the left mouse button, and drag the title mark into place.

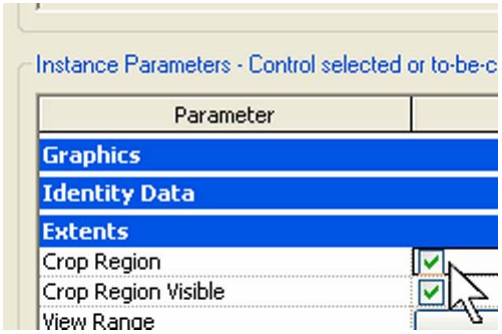


Adjust the Crop Region for the View

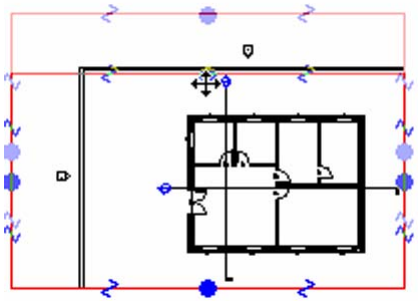
52. In the Project Browser, right-click Floor Plans – Level 1 and choose Properties.

53. Turn on the crop region for the view.

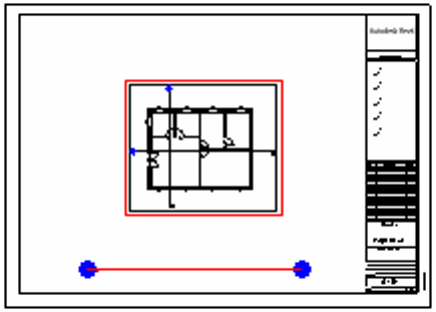
54. Set view Floor Plan>Level 1 current.



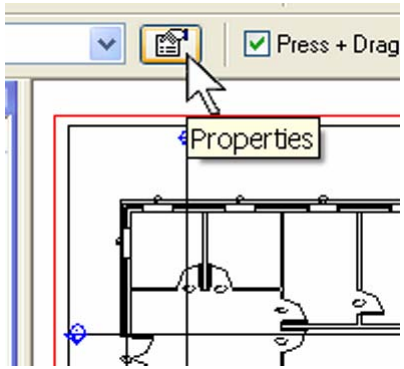
55. Select the crop region, and drag the blue grips in toward the building.



The drawing sheet now reflects the smaller bounds established by the crop region.

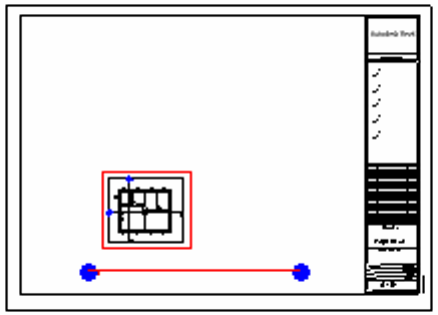


56. Open the sheet.
57. Select the viewport in the sheet.
58. Click the Properties button.



The properties of the viewport are linked to the properties of the view, in this case Floor Plan Level 1.

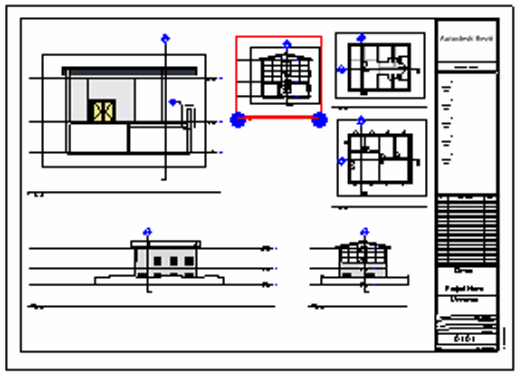
59. Change the scale of the viewport to 1/8” = 1’-0”.



When the view scale changes back to 1/8” = 1’-0”, the size on the sheet changes.

If the title mark is selected as part of the viewport, you can just drag the ends of the title mark into position. You can also use the Shape handle.

60. Repeat the preceding processes to lay out the sheet with the first and second floor plans, South and West elevations and sections, Section 1 and Section 2.
61. Make the Section 2 ¼” = 1’-0” to fit on the sheet as shown.



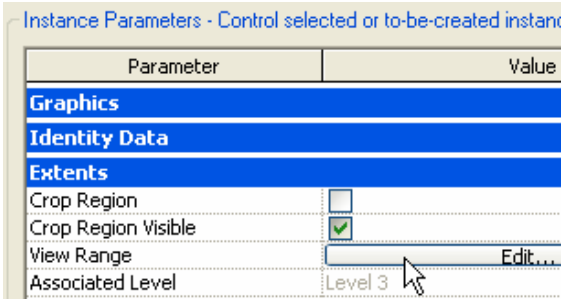
Take a look at the symbol of the section line. Autodesk Revit Building recognizes what sheet this section is positioned on and automatically fills in this information in the section bubble. Place the section on any other sheet, and the bubble updates automatically. Section bubbles are families that you can customize to display other information.

Unit 5, Exercise B: Display Control of Materials

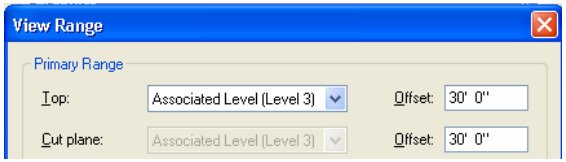
This exercise takes you through creating a material for the roof in the project from the last exercise.

Exercise Setup

1. Open the file Unit 5b – Start.
2. Set Floor Plans : Level 3.
3. Right-click in the view, and choose View Properties.
4. Next to View Range, click the Edit button.



5. Set the Top offset to 30’.
6. Set the Cut Plane offset to 30’.
7. Click OK to close the dialog boxes.

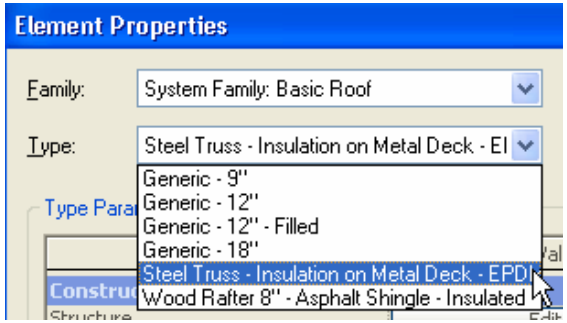


Create a New Roof Type

8. Click the roof, and then click the Properties button on the Options Bar.

9. In the Roof's Element Properties dialog box:

   a. Change the roof type to Steel Truss – Insulation on Metal Deck EPDM.
   b. Click the Edit/New button.

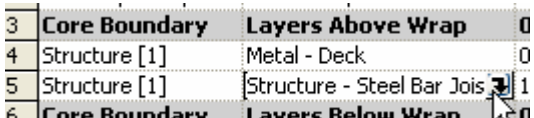


10. In the Type Properties dialog box:

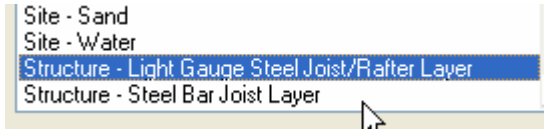
   a. Click the Duplicate button, and name the new roof type Steel Truss – Insulation on Sheathing with Metal Roof.
   b. Click the structure's Edit button.

11. In the Edit Assembly dialog box:

   a. Click the Preview button if you do not see a preview by default (a last-used setting).
   b. Click Layer 5's material, and then click the browse arrow that appears.

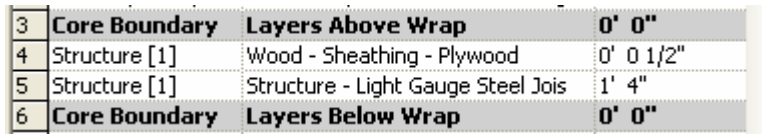


12. Click the Light Gauge Steel Joist material.



13. Repeat for layer 4, changing the material from Metal – Deck to Wood – Sheathing – Plywood.

14. Change the thickness of this layer to ½".



Do not close the Edit Assembly dialog box yet.

Create a New Material and Assign to the Roof Type

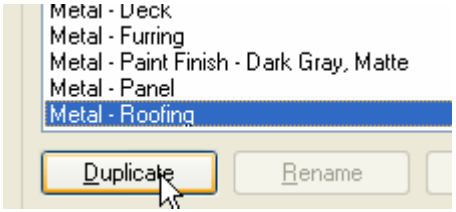
In this section you will continue editing the assembly but create a new material on the fly.

All materials defined in the project file can be accessed by choosing Materials from the Settings menu.

In this example, you access these material definitions directly from the Edit Assembly dialog box.

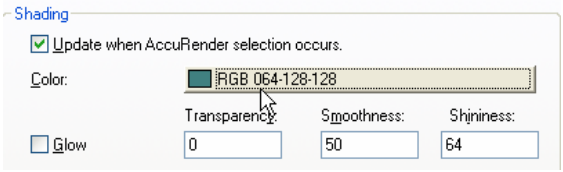
15. Click Layer 1's material, and then click the browse arrow that appears.

16. Click the Metal Roofing entry, and then click the Duplicate button.



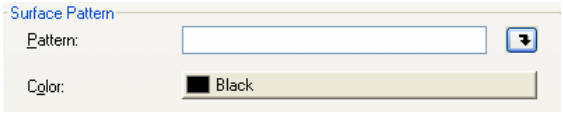
17. Enter Metal – Roofing Standing Seam as the name of the new material.

18. Click the Color button in the shading portion of the Material dialog box, and pick a teal green color for the roof.



This color is used in the model only when the view is set to shading or shading with edges.

There are currently no standing seam materials provided with the software. If you have a JPG, you can create an AccuRender™ material from the image file. Because you are not going to render this building, for this exercise leave this setting as you found it.



The Surface pattern is empty for this material. There is no Standing Seam fill pattern either. You will also create these on the fly.

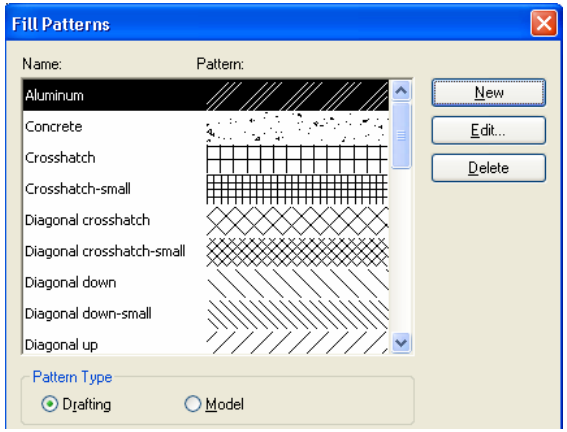
Create a New Fill Pattern for the Material

In this section you create a new fill pattern on the fly to use in the material you just created.

19. Click the browse arrow to the right of the empty surface pattern field.

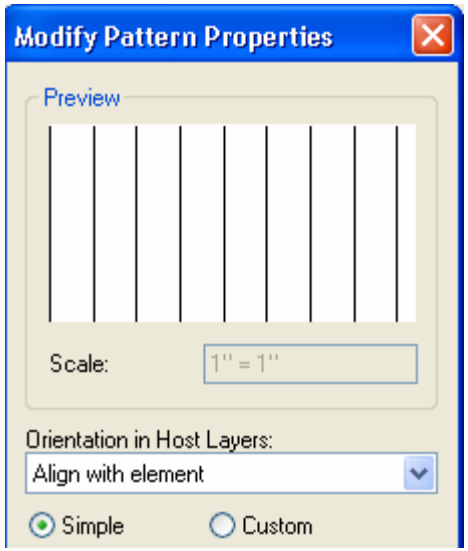
20. In the Fill Patterns dialog box:

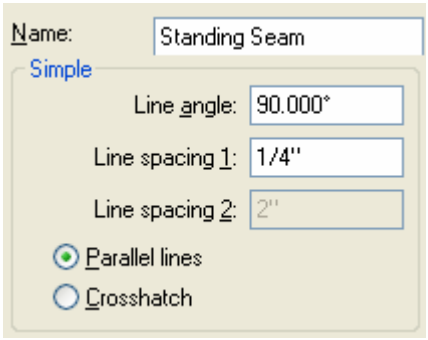
a. Click the Drafting radio button.
b. Click the New button.



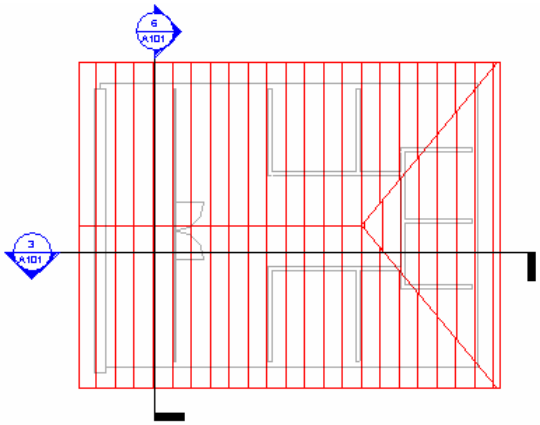
21. In the Modify Pattern Properties dialog box:

a. Set Orientation in Host Layers to Align with Element.
b. Click Simple radio button.
c. Name the pattern Standing Seam.
d. Set the line angle to 90.
e. Set the line spacing to ¼".
f. Click the Parallel Lines radio button.

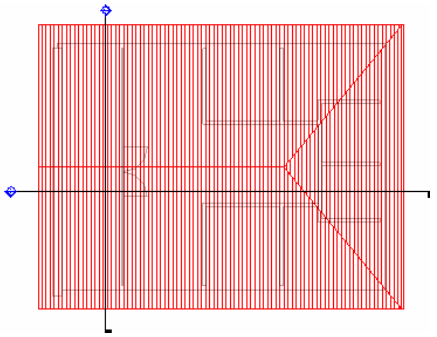




22. Click OK six time to close all dialog boxes and return to the drawing window.



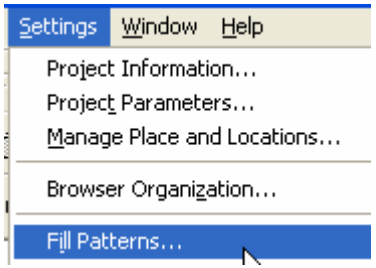
Drafting patterns change their scale depending on the view scale. Changing the scale of the view to ½" = 1' – 0" keeps the plotted distance between the lines consistent at ¼".



Create a Model Fill Pattern and Assign to the Material

In this section you modify the material to use a new model fill pattern.

23. From the Settings menu, choose Fill Patterns.

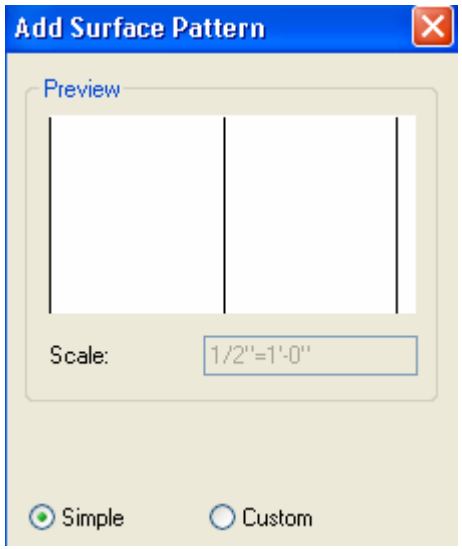


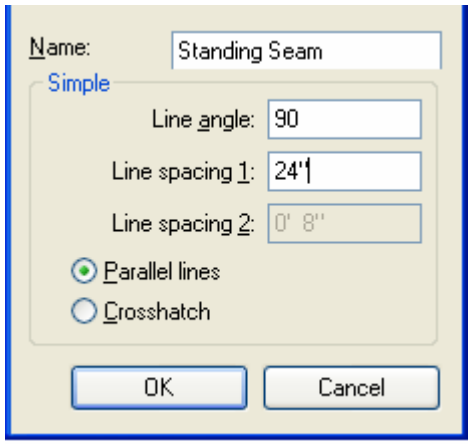
24. This time click the Model radio button and then click the New button.

25. In the Add Surface Pattern dialog box set:

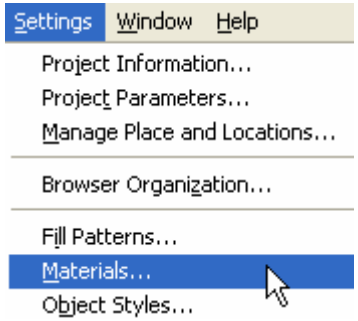
    a. Type = Simple
    b. Name = Standing Seam
    c. Line angle = 90
    d. Line spacing = 24”
    e. Parallel Lines

26. Click OK to close all dialog boxes.

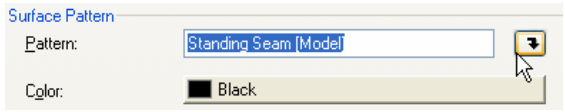


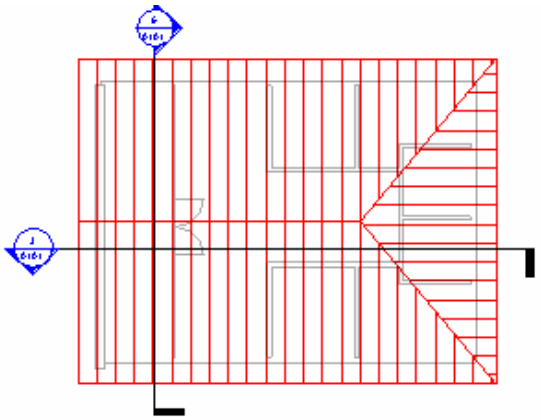


27. From the Settings menu, choose Materials.



28. Set the material’s surface pattern to Standing Seam (Model).





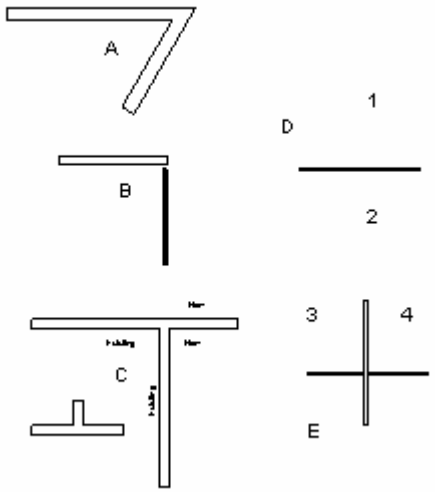
Model surface pattern dimensions are set by the fill pattern definition and do not vary by drawing scale.

Unit 5, Exercise C: Fine-Tuning Wall Cleanup and Display

This exercise illustrates some of the display and cleanup control you have over walls in your Revit Building project.

Exercise Setup

1. Open file Unit 5c – Start. Open Floor Plan Level 1.
2. Verify that the view's detail level is set to Coarse.



Set Fill for Coarse Level Display

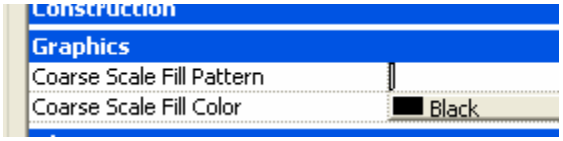
Revit Building walls have a separate control for the display detail level Coarse. This coarse fill pattern and color allow you to poche the entire width of the wall regardless of the number of components in the wall.

This setting is a type parameter for the wall.

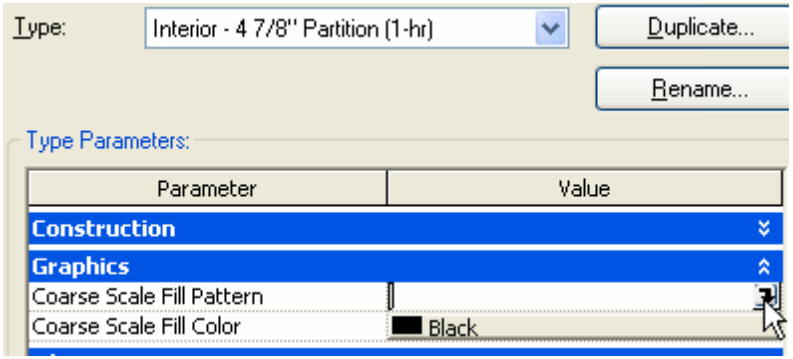
3. Select any wall and open its properties.

4. Click the Edit/New button to access the wall's type properties.

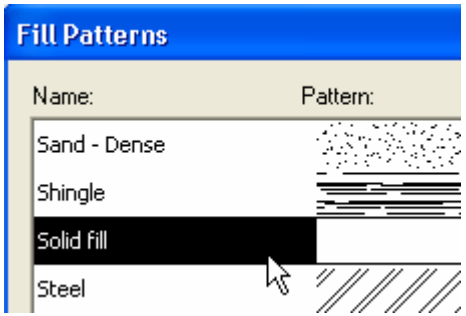
5. Verify that Coarse Scale Fill Color is Black.



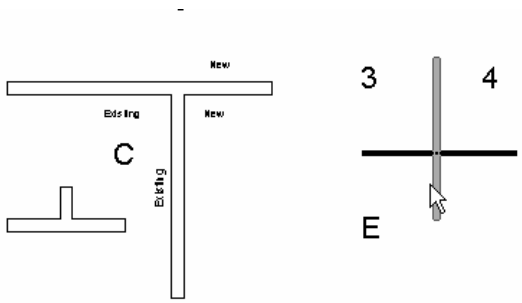
6. Click in the Value field of the Coarse Scale Fill Pattern parameter, and click the browse arrow that appears in the field.



7. Click Solid Fill for the fill pattern.



8. Click OK two times to close all dialog boxes and return to the drawing window.



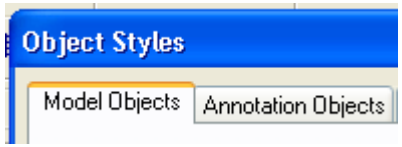
Because this is a type parameter, you need to repeat this process for all wall types used in the project.

Global Control of Linework Display of the Walls: Object Styles

9. Set the View Detail level to Medium.

10. From the Settings menu, choose Object Styles.

11. On the Model Objects tab in the Object Styles dialog box, scroll down the list of objects and expand the walls category.



The Object Styles dialog box controls the lineweight, color, and linetype. This is also where you can assign materials to objects. In all cases if the object is set to “By Category” for any of these parameters, these are the values referred to.

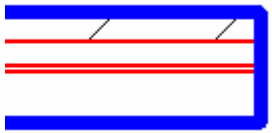
12. Change the Walls Cut Line color to Blue and Common Edges to Red.

Category	Line Weight		Line Color
	P...	Cut	
Walls	2	5	Blue
Common Edges	2	2	Red
Hidden Lines	2	2	Black
Wall Sweeps - Cornice	1	5	Black
Windows	2	2	Black

Changes you make in the Object Styles dialog box are global and apply to all views.

13. Click OK to return to the drawing window.

The object styles are now applied to all wall types in the project. The wall’s Cut (pen 5 and blue) refers to the outer edge of the wall. The wall’s subcategory



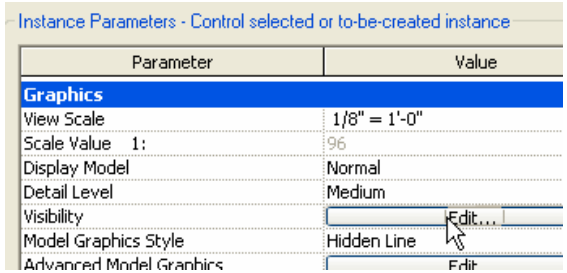
Common refers to the lines common to the layers in the wall.

Override Linework Display of the Walls: View Visibility/Graphics by Category

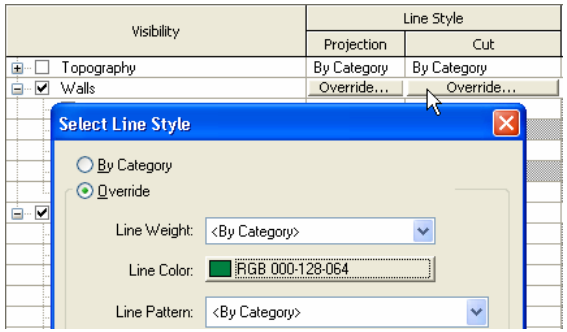
Each view has its own override to the global object style settings. A couple of the previous exercises have used this control to manipulate how objects are displayed in specific views.

The Visibility/Graphics dialog box also has overrides to the wall component display graphics.

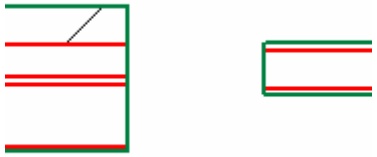
14. Open the View properties for Floor Plans: Level 1.
15. Next to Visibility, click the Edit button.



16. Click the wall's Cut Line Style, and set the override line color to a dark green.
17. Click OK to close all dialog boxes and return to the drawing window.

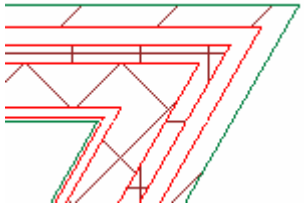


These changes are only for the current view.



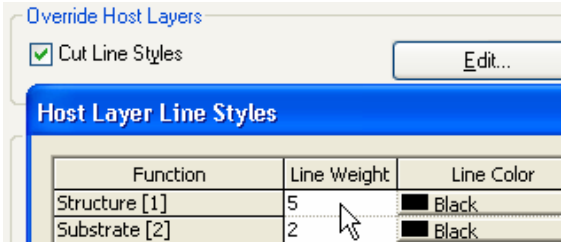
18. Return to the view's Visibility/Graphics Override dialog box, and on the Model Objects tab set the Override Model Patterns Cut Pattern Color to dark red.
19. Click OK to return to the drawing window.

All cut patterns for all layers in the wall type take on the override.

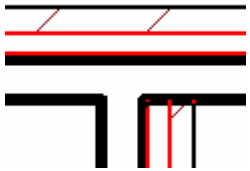


Override Linework Display of the Walls: View Visibility/Graphics and Cut Line Styles

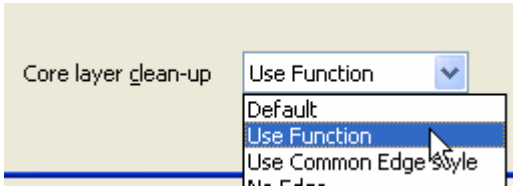
20. Return to the view's Visibility/Graphics Override dialog box.
    a. Select the Cut Line Styles check box.
    b. Click the Edit button.
    c. Set the Structure[1] to linewieght 5.
21. Click OK to close all dialog boxes and return to the drawing window.



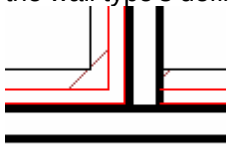
Any layer in the wall type definition assigned to the structure layer now has the wider (pen 5) lineweight assigned to it.



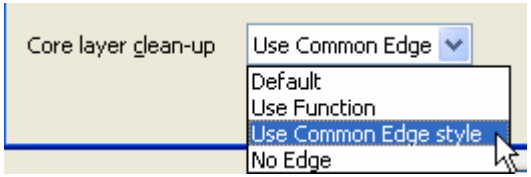
22. Return to the view's Visibility/Graphics Override dialog box.
    a. Click the Cut Line Style's Edit button.
    b. Set Core Layer Clean-up to Use Function.
23. Click OK to close all dialog boxes and return to the drawing window.



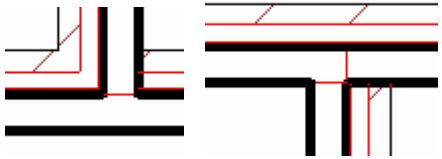
This setting affects only the layers within the core of the wall type's definition.



24. Return to the view's Visibility/Graphics Override dialog box.
    a. Click the Cut Line Style's Edit button.
    b. Set Core Layer Clean-up to Use Common Edge Style.
25. Click OK to close all dialog boxes and return to the drawing window.



This setting affects only the layers within the core of the wall type's definition. Joins between individual walls are shown but use the common edge style graphic line.



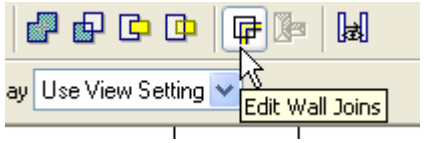
26. Repeat the step and set Core Layer Clean-up to No Edge.

No edges are shown at the core cleanup condition between joins.

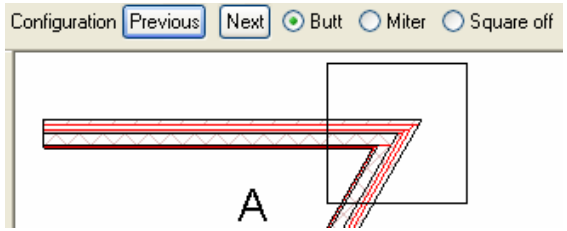
Wall Clean Up and Joins

Revit Building walls automatically clean up as they are added to the project. This section guides you through control of some special conditions.

27. Zoom into Condition A in the project.
28. Click the Edit Wall Joins tool on the toolbar.



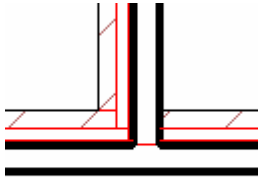
29. Hover your cursor over the intersection of the walls until you see a square appear around the intersection, and then click that area.



Once an intersection has been selected to edit, the configuration control appears on the Option Bar. The Next and Previous buttons cycle through various ways this intersection can be cleaned up.

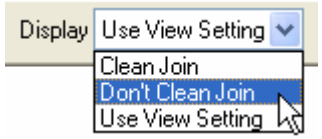
30. Click the Square Off radio button and then the Next button until you cycle through to the solution shown at right.

31. While still in the Edit Wall Joins mode, click the intersection of the inverted T at condition C.

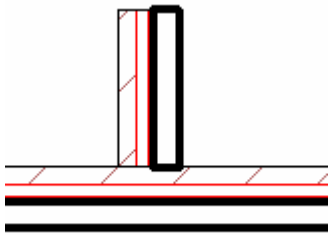


This illustrates a condition that might happen when adding a new wall that abuts an existing wall. In this case you do not want the core penetrating through the existing (horizontal) wall.

32. On the Option Bar, use the Display drop-down to select Don't Clean Join.



The join is disallowed, and the wall does not cut through the existing brick face.

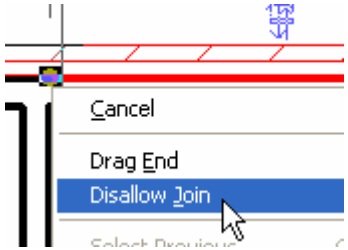


This condition is similar to the last; however, three walls make up the intersection. You cannot disallow all joins because you still want the two existing walls to clean up.

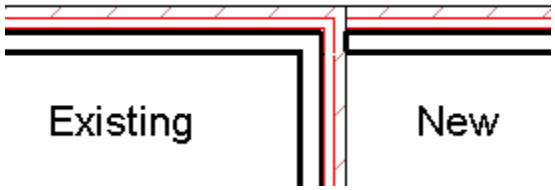
33. Click the Modify tool to exit the Edit Wall Joins function, and zoom into the other intersection at condition C.

34. Click the right wall of the three walls at this intersection, and right-click the blue end grip of this wall.

35. Choose Disallow Join from the context-sensitive menu.



36. Drag the wall end to the exterior face of the existing brick.

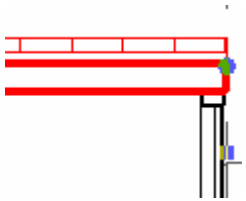


Wall Wraps

You have control over the wrapping behavior of each of the components in a wall type definition.

37. Zoom into Condition B in the project.

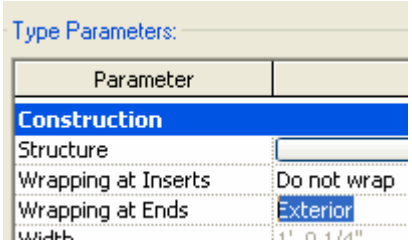
38. Open the type properties of the horizontal wall.



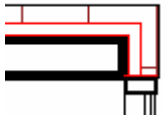
In this case, the exterior finish system does not wrap around the end of the wall to provide closure to the curtain wall.

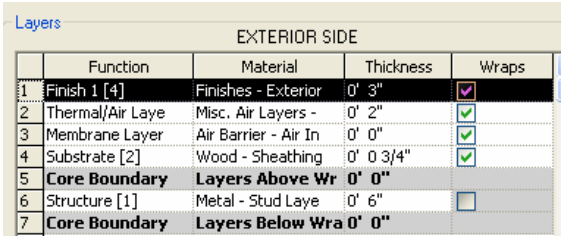
39. Change Wrapping at Ends to Exterior.

40. Click OK to close all dialog boxes and return to the drawing window.

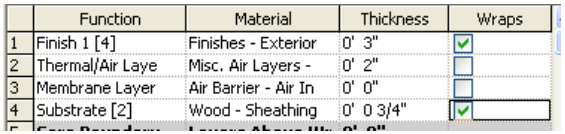


The exterior layers now wrap around the end of the wall.





Within the structure of the wall type, you can control which layers will wrap.

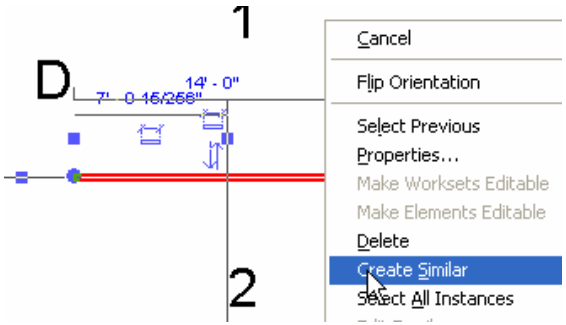


Join Geometry

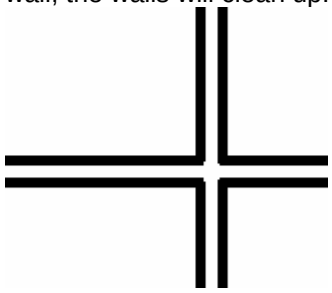
Join Geometry has several uses. In general the join geometry will create a relationship between two objects. In this case the intersection between the walls will then clean up.

41. Right-click the wall at condition D, and choose Create Similar.

42. Draw a vertical wall from the number 1 to 2.

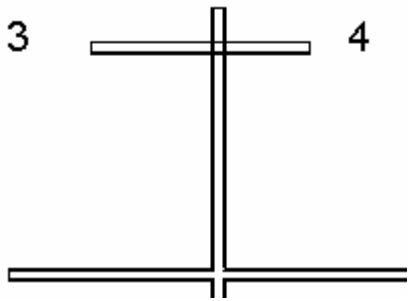


As long as the walls do not cross near the end of a wall, the walls will clean up.



43. Right-click the wall at condition E, and choose Create Similar.

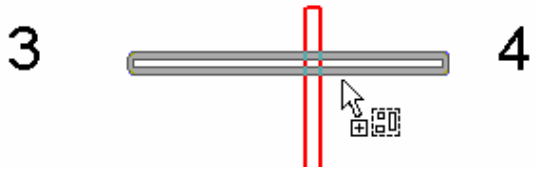
44. Draw a vertical wall from the number 3 to 4.



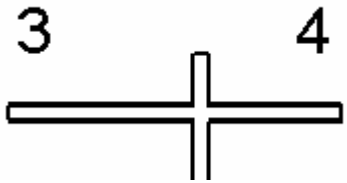
If crossing walls do not clean up, you can use the Join Geometry tool to force the cleanup.

45. Click the Join Geometry tool on the toolbar.

46. Click one of the walls, then the other.



The two walls now clean up with each other.

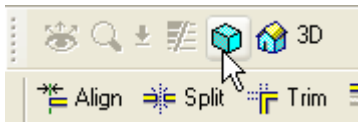


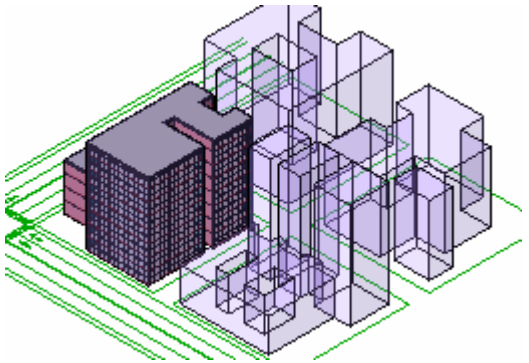
Unit 5, Exercise D: Sun and Shadow Studies

This exercise leads you through using the sun and shadow features of Autodesk Revit Building.

Exercise Setup

1. Open file Unit 5d – Start.
2. Set the 3D Views : {3D} current.
3. Click the Show Mass tool on the toolbar.



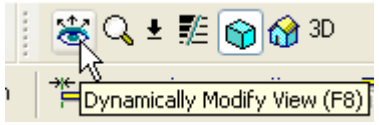


Duplicate the 3D View

Create a new view for the sun studies.

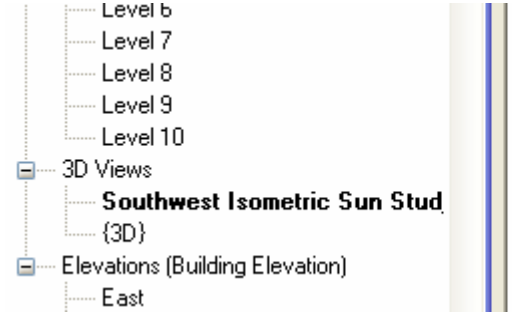
Although not required, you could do the sun study in the 3D view. Because many of the settings for sun studies are view specific, creating a view specifically for the sun study is a good idea.

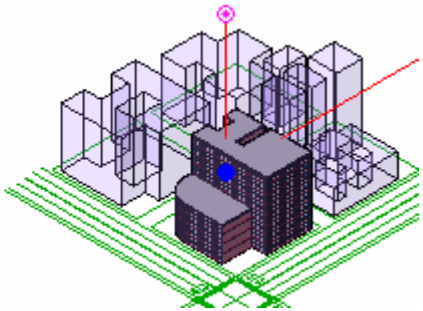
4. Click the Dynamically Modify View tool.



5. In the Dynamic View dialog box:
   a. Click the expansion bar at the right of the dialog box.
   b. Click the Orient to a direction, and click Southwest Isometric.
   c. Click the Save button.

6. Name the new view Southwest Isometric Sun Study.



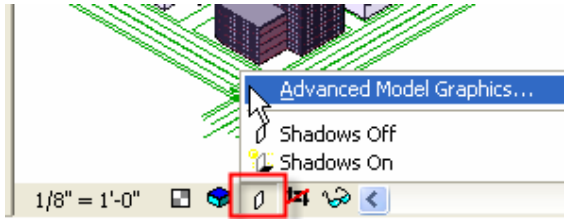


Set the Sun Study Parameters

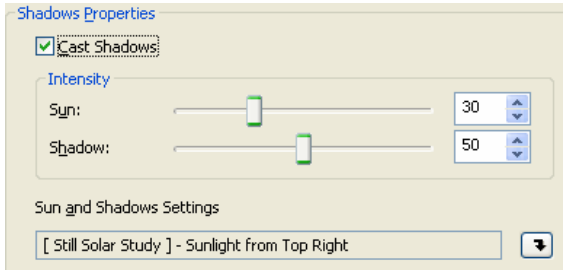
The parameters that drive the sun study function are held in the advanced model graphics for the view.

You can access the advance model graphics either through the view properties or the context-sensitive menu of the drawing area window as shown here.

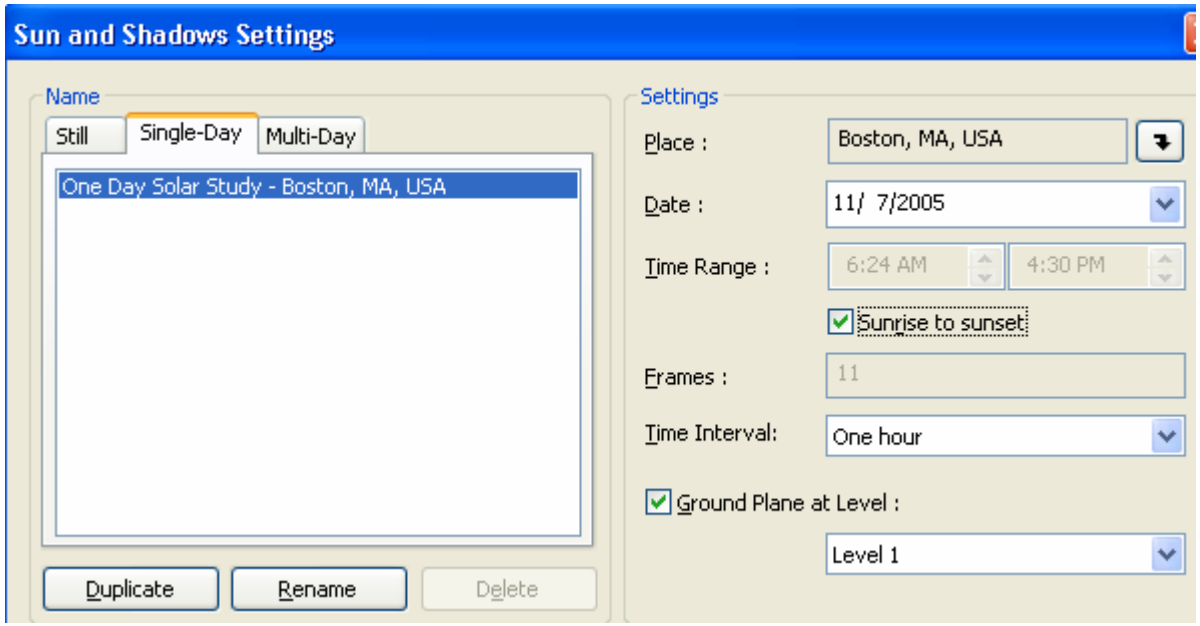
7. Click the Shadows context-sensitive menu of the drawing window.
8. Choose Advanced Model Graphics.



9. In the Advanced Model Graphics dialog box:
   a. Select the Cast Shadows check box.
   b. Click the Sun and Shadows Settings arrow.



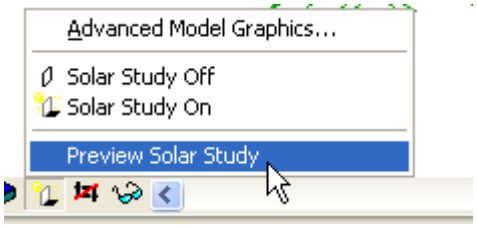
10. In the Sun and Shadows Settings dialog box:
    a. Click the Single-Day tab.
    b. Change the place settings, and date and time intervals to your preferences.
    c. If you do not have a toposurface in the model (discussed in Unit 12), leave the ground plane selected.
11. Click OK to close all dialog boxes and return to the drawing window.



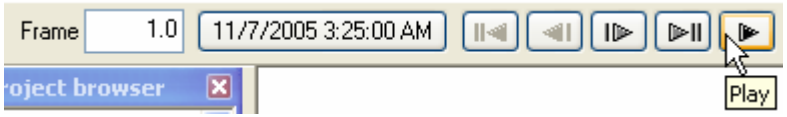
Preview the Sun Study in the View

With the sun study parameters set, you are now ready to view the sun and shadows cast on the building model.

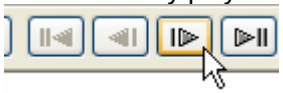
12. On the Shadows context-sensitive menu of the drawing window, and choose Preview Solar Study.



13. Click the Play button on the Options Bar.



The Sun Study plays through the day, cycling at the interval specified in the sun and shadow settings.



Click the Next Frame button to manually walk through the study.

Export the Sun Study to an AVI File

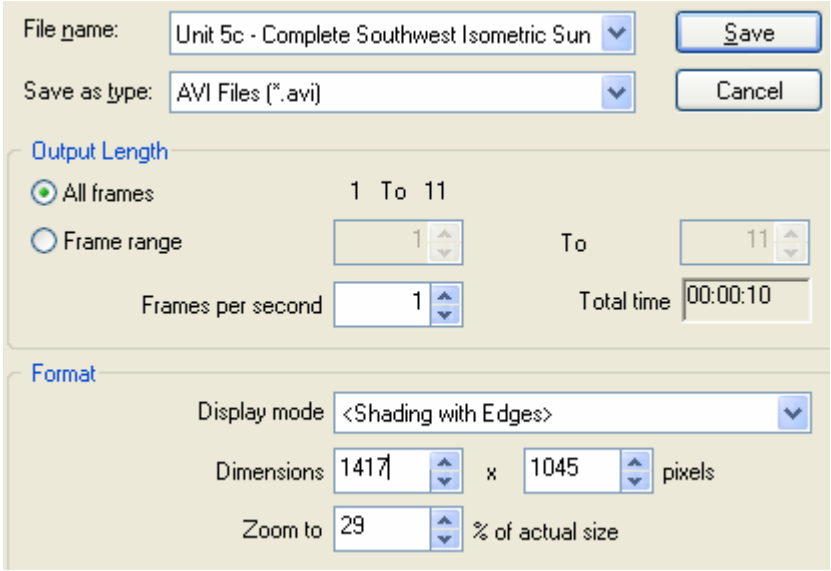
With the sun study parameters set and previewed, you are ready to export the sun study to a movie format file.

14. From the File menu, choose Export>Animated Solar Study.

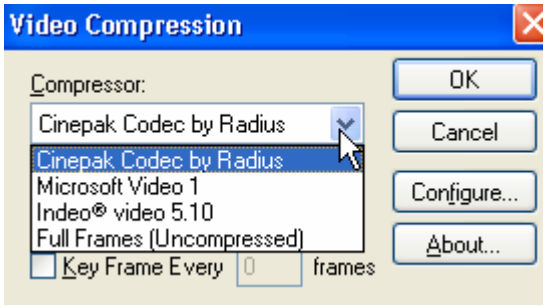
15. In the Save As dialog box, set the following:

    a. Name the AVI file.
    b. Change the frames per second to 1, as you have left the default at 1 frame per hour. Having 15 frames per second would make for a very short AVI!
    c. Adjust the format display mode and dimensions to your preferences.

16. Click the Save button.



17. Change the compression codec if you want, and click OK.



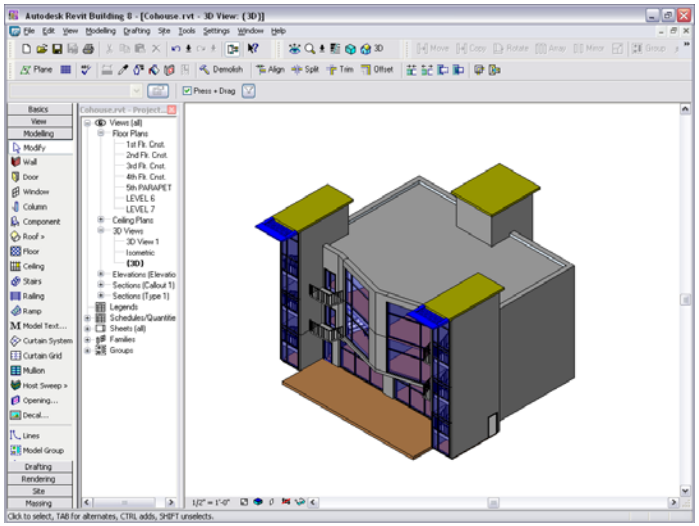
The compressors available depend on the software installed on your machine. Full Frames is the most compatible compression method but also produces the largest file.

Unit 5, Exercise E: Importing an Autodesk Revit Building Model into Autodesk 3ds Max

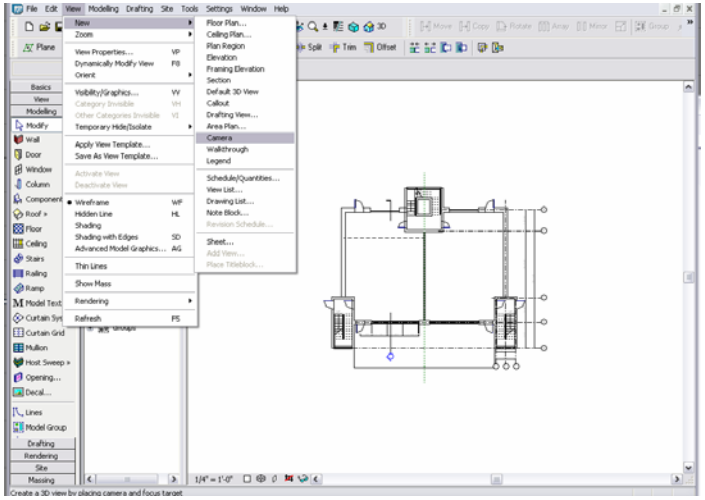
The following exercise describes how to import a Revit Building model into Autodesk 3ds Max software for visualization.

Set up Your Model for Export

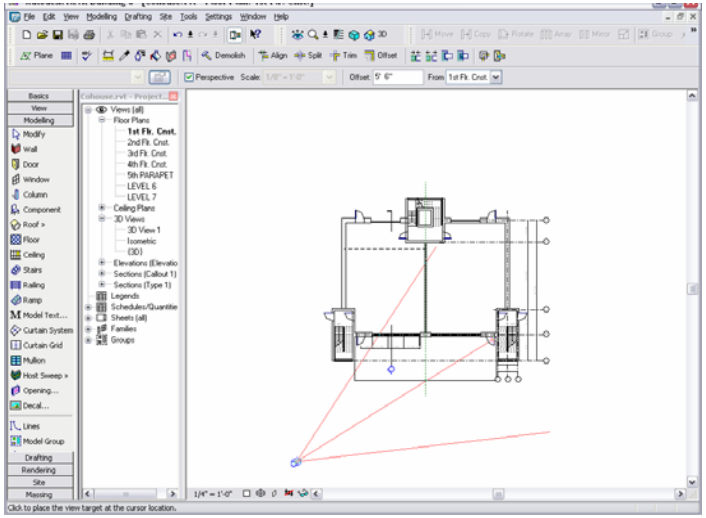
1. Before exporting your model, find the appropriate 3D view. Either use the default 3D view, or create your own by placing a camera.



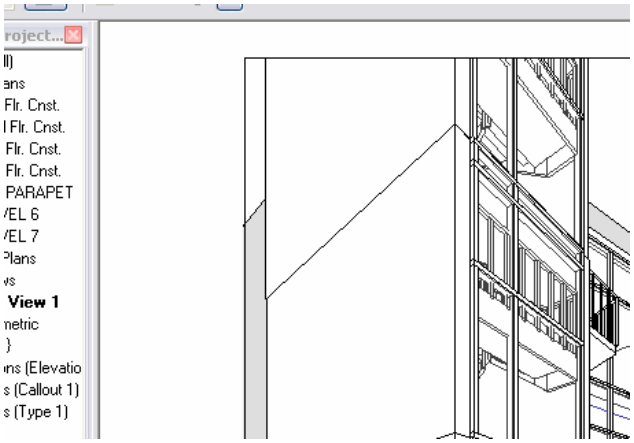
2. If you prefer to set up a camera, simply go to a plan view. From the View menu, choose New>Camera.



3. Place the camera to create the appropriate view.



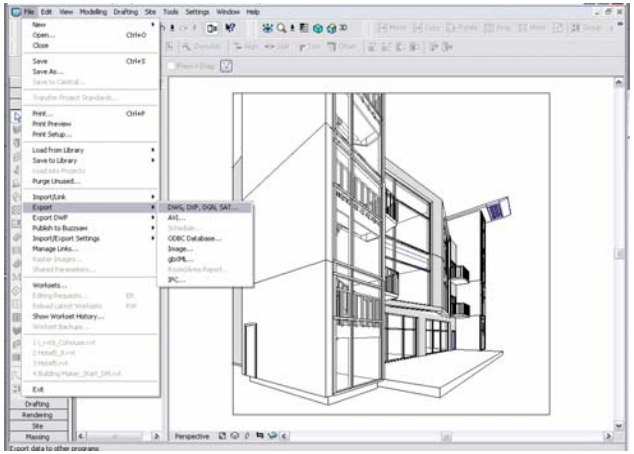
4. With the camera in place, your 3D view is now ready for export.



Export Your Model

Autodesk Revit Building exports data in a variety of file formats, including DWG™ format.

5. To export your design to the DWG format, from the File menu, choose Export>DWG, DXF, DGN, SAT.



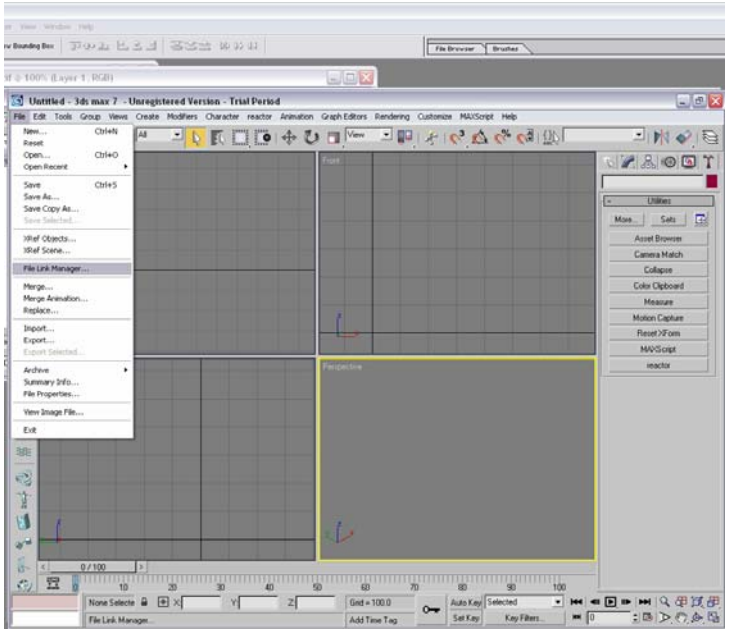
6. Choose a location to save your exported model, accept the default values, and click OK. When exporting a camera view, you see an alert indicating that the entire model, including everything not seen in the current view, will be exported. Click OK.

Link Your Model to 3ds Max

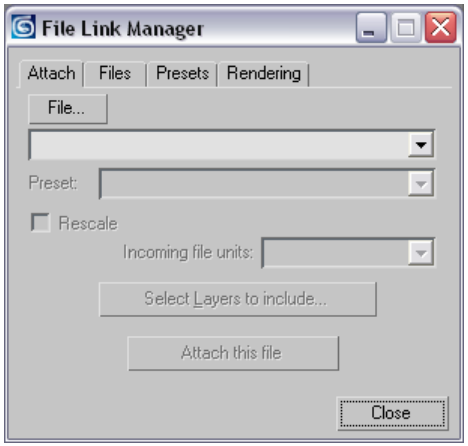
You can either import DWG files into a 3ds Max session or link them. Linking a DWG file to a 3ds Max session gives you the advantage of

making subsequent changes in Revit Building and reloading them, via an exported DWG file, into 3ds Max without any data loss.

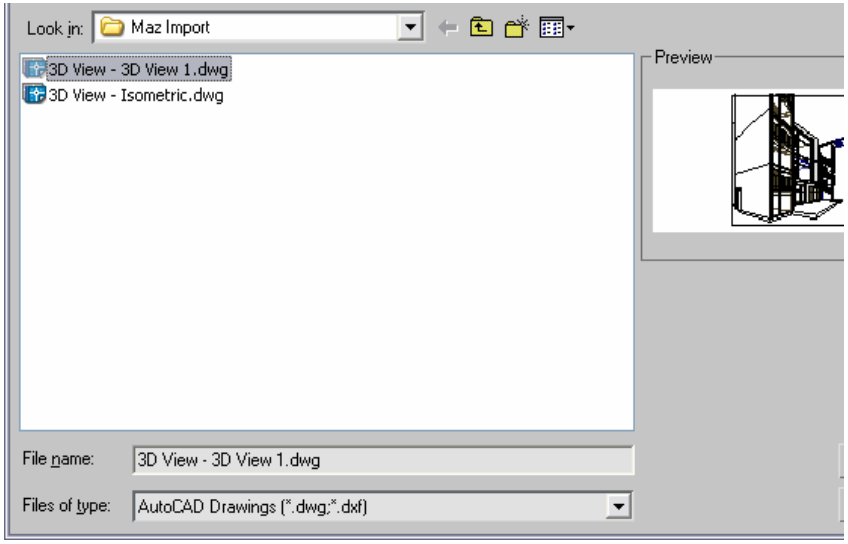
7. To link the DWG file, from the File menu, choose File Link Manager.



8. In the File Link Manager dialog box, click the File button on the Attach tab and browse to the exported DWG file.



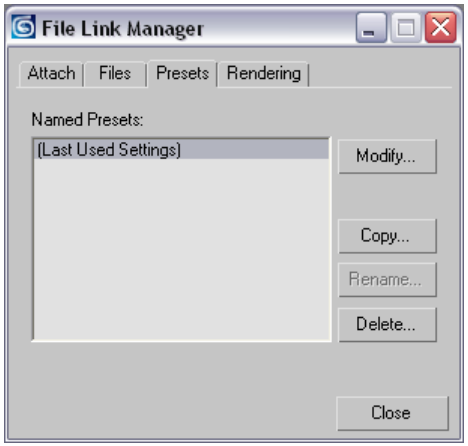
9. Select the DWG file, and click Open.



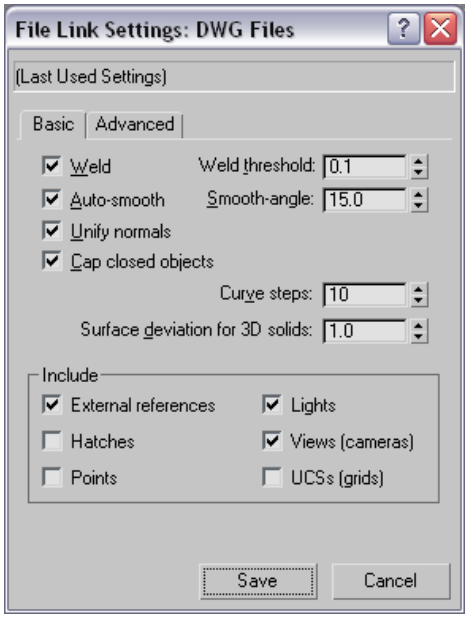
Make sure that any cameras created in Revit Building are also available in 3ds Max.

10. In the File Link Manager dialog box, click the Presets tab and modify a Named Preset.

11. If you do not want to modify an existing preset, copy it and then modify it.

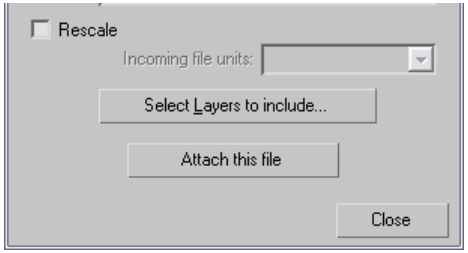


12. There are several options on this tab. To ensure that your Revit Building cameras are available in 3ds Max, make sure the Views check box is selected.

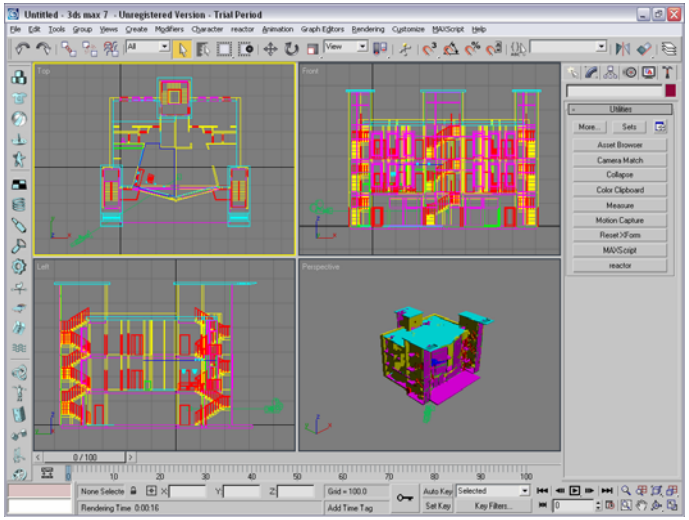


13. Save your modifications and then go back to the Attach tab in the File Link Manager dialog box.

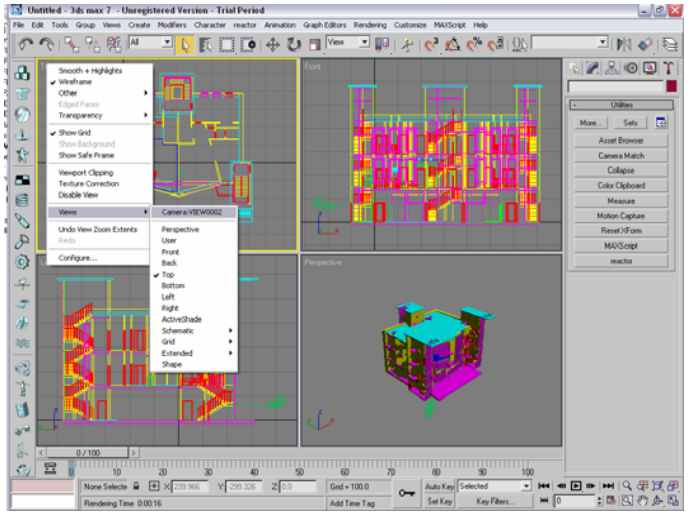
14. Click the Attach This File button to load the DWG file into 3ds Max. Then click Close.



15. Your model is now loaded into 3ds Max.



16. Once the model has been loaded, you can change the view to one of the camera views created in Revit Building by simply right-clicking the view name in the upper-left corner of the viewport and choosing Views>Camera: View # (where # represents the number of the Revit Building camera).



Your Autodesk Revit Building model is now ready for visualization in 3ds Max!

Unit 6

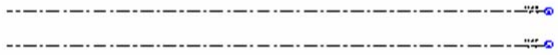
Theory: Design Constraints

Autodesk Revit Building: Levels, Reference Planes, and Grids

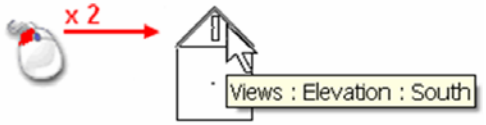
This unit covers the basics of design constraints.

Create Project File and Add Footing Level

1. From the File menu, choose New>Project.
2. Use the Workbook Imperial Template.rte in the location you placed the workbook data sets.
3. In the Project Browser, open Elevations South.

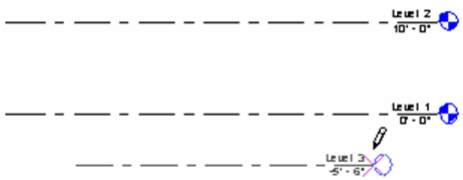


Double-click the triangle symbol of an elevation in the project to automatically open the corresponding elevation.



4. Select one of the level lines, and left drag the left grip toward the elevation markers, as shown in graphic.

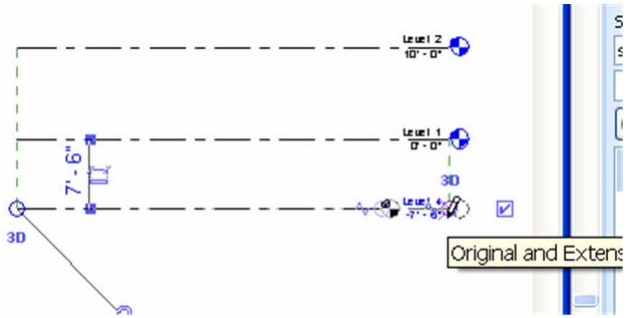
5. On the Basics Design Bar, click Level and click two points below Level 1. It does not matter where your two clicks are (use the image as a guide).
6. On the Basics Design Bar, click Modify and select the level you just added.



To place a new level, you must be in elevation view or in a section view.

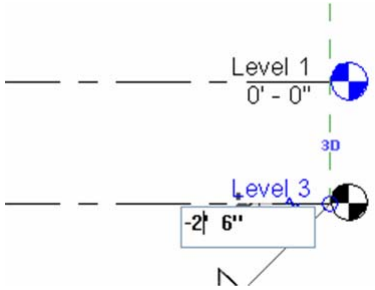
7. Drag the blue dot on the left until it is aligned with the existing ones.

8. Do the same for the blue dot on the right.



Autodesk Revit Building helps you here: As soon as the points are aligned, Revit Building displays a green dashed line along these points. You then see a blue padlock, which indicates that all the points are locked together. If you move one, all the others follow.

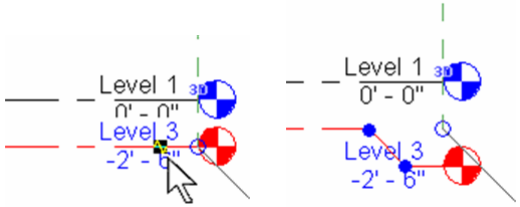
9. With the level still selected, click the text of the dimension of this new level. Change the value to -2'- 6".



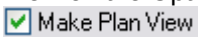
If you know the absolute elevation of a level, you can type it directly by clicking the text that is below the level line.

10. On the Design Bar, click the Modify tool, and select the new level.

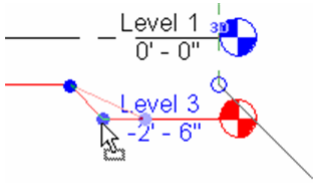
11. Click the squiggle grip to offset the mark from Level 1.



Each time you create a level, Revit Building automatically creates a view for that level. If you don't want a view for a level, clear Make Plan View on the Options Bar.

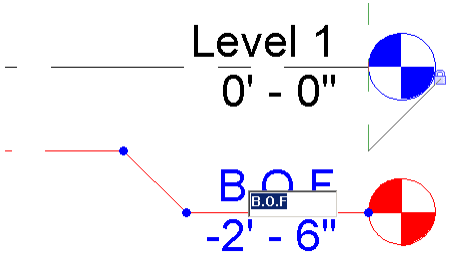


12. Drag the blue circle grips to adjust the leader away from the mark.



You can choose to rename the level in the Project Browser by right-clicking this view and choosing Rename from the context-sensitive menu.

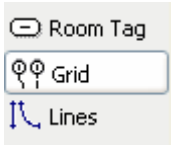
13. Click the name of the new level (Level 3), and change this name to B.O.F. (Bottom of Foundations). Revit Building asks if you want to rename the corresponding view. Click Yes.



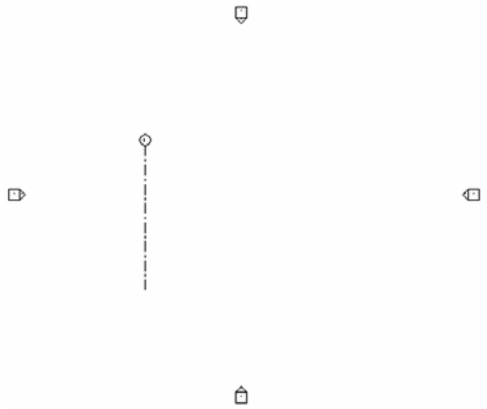
Add Grid Lines

Grids lines and level line marks behave much the same way and have similar controls for the marks.

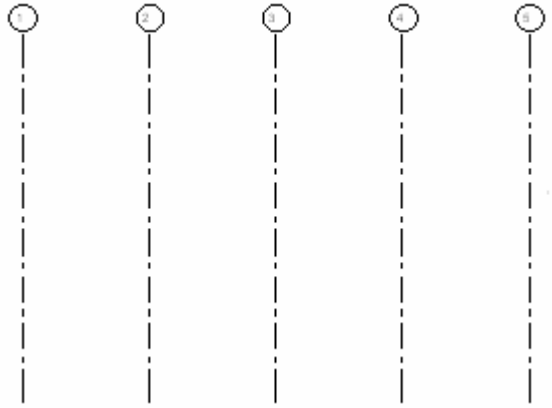
14. In the Project Browser, open Floor Plans Level 1.
15. On the Basics Design Bar, click Grid.



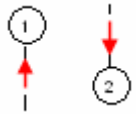
16. Click two points to place the first vertical gridline. Pick from bottom to top, or south to north.
17. On the Basics Design Bar, click Modify and select the gridline in the project.



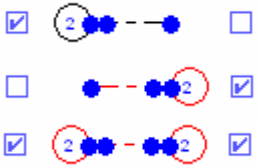
18. On the Edit toolbar, click Array.
19. On the Options Bar, set the following:
    a. Keep Linear.
    b. Keep Group and Associate selected.
    c. In the Number box, type 5.
    d. Keep Move to 2nd selected.
20. Click the gridline, move your cursor to the right, and on your keyboard, type 18' and press Enter.



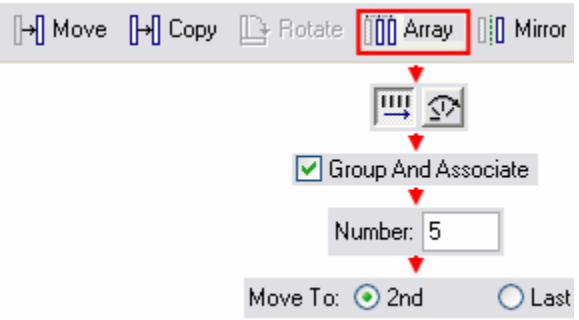
The direction used to draw the gridline defines the side where the bubble is attached.



If you draw it in the wrong direction, you can use the check box that appears at the end of the gridline when the gridline is selected.



Note: The same concept applies to level markers.

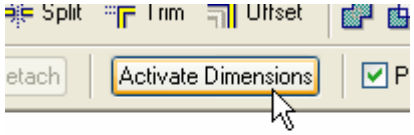


When you've finished the array, you can easily change the number of copies. If necessary, click an element in the array to display the number of copies.

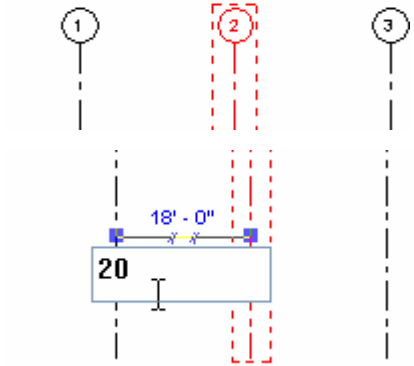
Adjust Arrayed Elements

Modifying a dimension between arrayed elements will modify all arrayed elements.

21. Click gridline 2, and on the Options Bar, click Activate Dimensions.



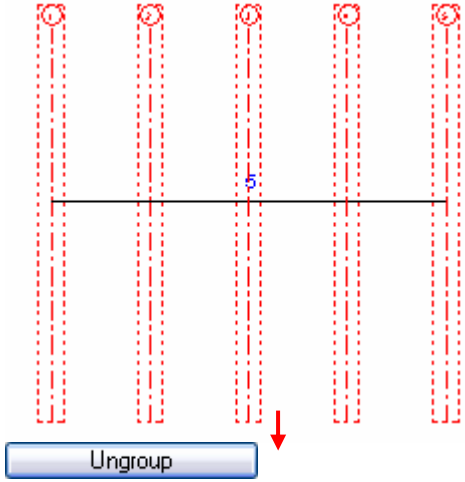
22. Click the dimension that appears, and type 20 to enter 20 feet for the distance.



The entire grid system adjusts to the new dimension.

23. Select all the vertical gridlines, and on the Options Bar click Ungroup.

24. Press Esc.



Each gridline can now be moved individually.

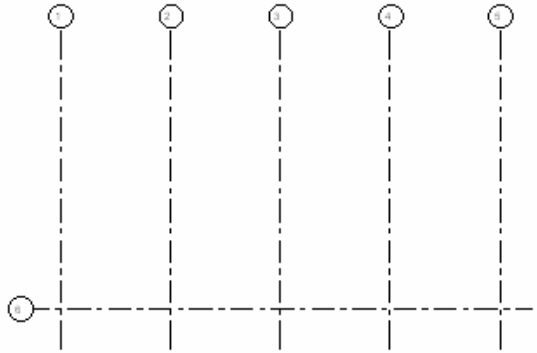
Now that you've ungrouped the element, the number of elements in the array can no longer be changed automatically.

The gridlines adjust as if you had used the Copy tool to create the five gridlines.

Add Horizontal Grids

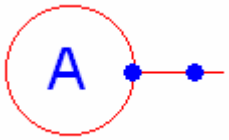
25. On the Basics Design Bar, click Grid.

    a. Click two points to place the first horizontal gridline, from right to left.
    b. Press Esc twice.

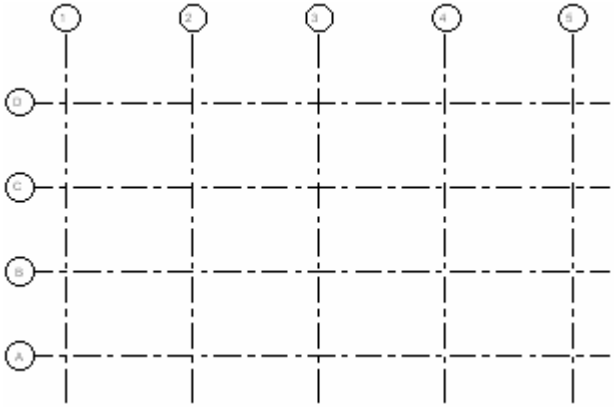


26. Zoom around the bubble of the horizontal gridline.

27. Select the gridline. Click the text in the bubble, change the value to A, and press Enter.



28. Create an array with this gridline. Clear Group and Associate. The distance between two lines should be 10’ and the number of copies set to 4.



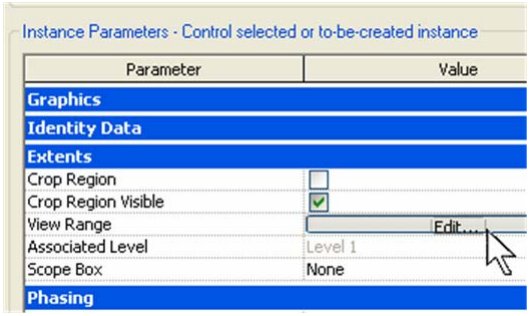
Arrays in Autodesk Revit Building are powerful. You can move one element in the array and all the others move accordingly. Note, however, that this occurs only if you have selected Group and Associate on the Options Bar before array creation.

Add Foundation Walls Constrained to Grids

When you draw foundation walls, by default they extend down from the current level rather than up from it. You can change the view range to allow you to see these walls as they are drawn.

29. Right-click in the view, and choose View Properties.

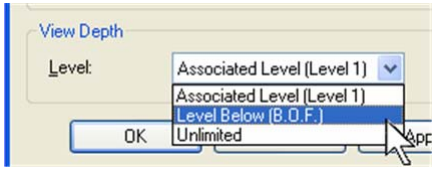
30. In the Element Properties dialog box, click Edit next to View Range.



31. From the View Depth drop-down list, select Level Below.

32. In the View Range dialog box, click OK.

33. In the View Properties dialog box, click OK.

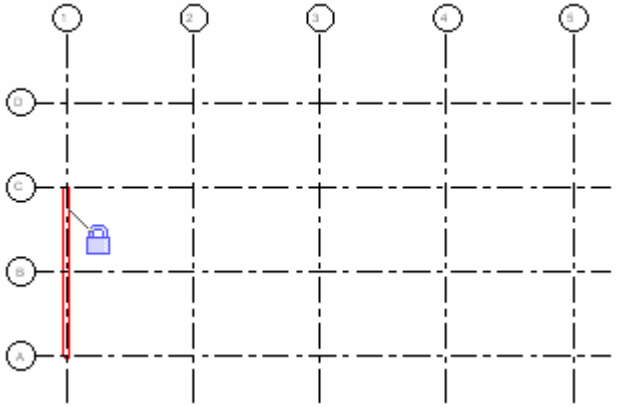


34. On the Basics Design Bar, click Wall.

35. On the Options Bar:

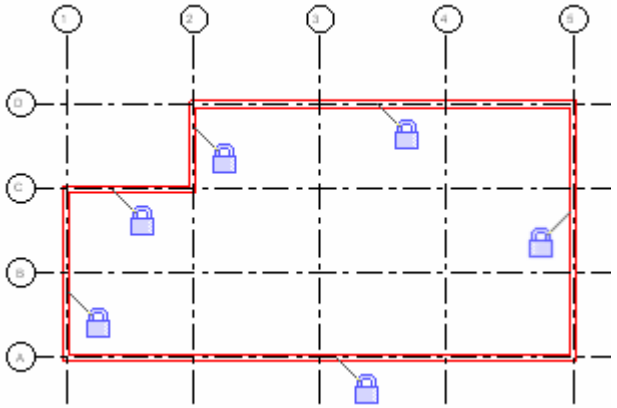
    a. Set type as Basic Wall: Foundation – 12" Concrete.
    b. Set Depth to Level B.O.F.
    c. Check that alignment is set to Wall Centerline.
    d. Clear Chain.

36. Draw a first wall from the intersection between lines 1-A and intersection 1-C. Click the lock symbol to lock the wall with the gridline.

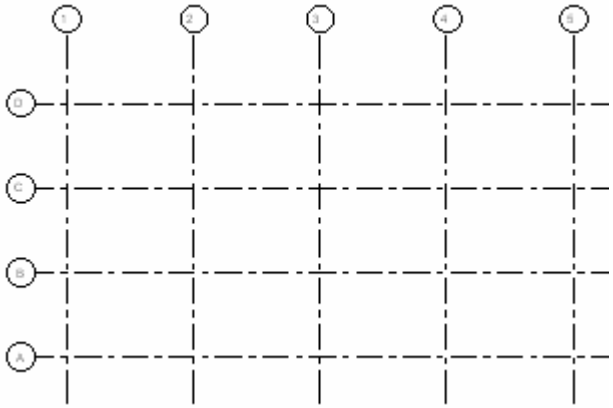


The foundation wall is positioned below the current level. If you don't change view depth, you cannot see the new wall that you are going to add.

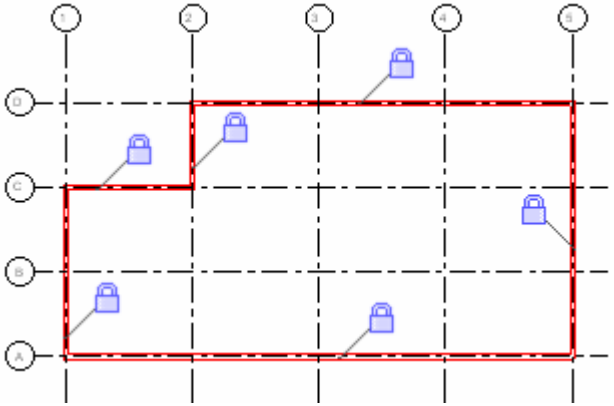
37. Using the image as a guide, add five walls. All of them must be locked with the corresponding gridline. Lock each wall section immediately after drawing it.



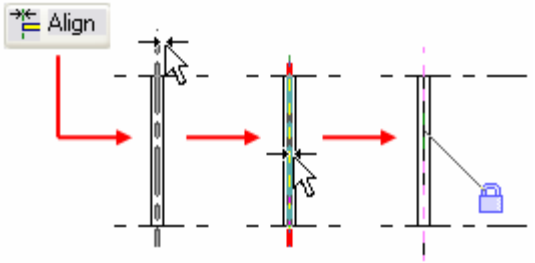
38. Right-click in the view, and choose View Properties.
39. In the Element Properties dialog box, click Edit next to View Range.
40. In the View Depth drop-down list, select Associated Level.
41. In the View Range and View Properties dialog boxes, click OK.



42. On the Basics Design Bar, click Wall.
43. On the Options Bar:
    a. Set type: Basic Wall: Generic- 8".
    b. Set Height to Level 2.
    c. Check that alignment is set to Wall Centerline.
    d. Clear Chain.
44. For the foundation walls, lock each wall to the corresponding gridline.



If you've used the Chain option, you probably don't see the padlock. Use the Align tool to lock the relationship between the gridline and the wall.

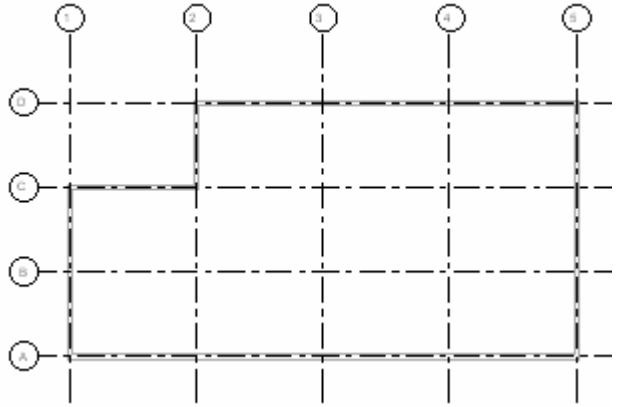


The foundation walls disappear because they are not in the view range.

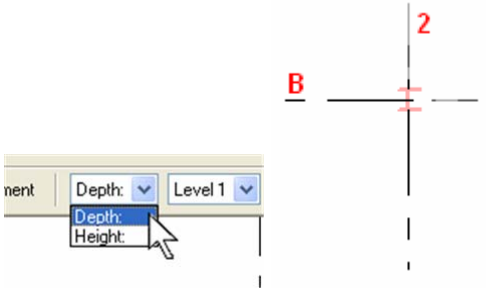
Add Structural Members

Like foundation walls, structural members are often drawn down from the current level to the level below. This setting is similar to Walls on the Options Bar.

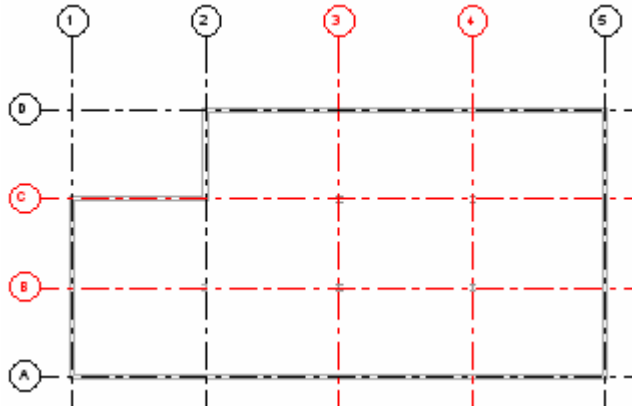
45. Go to Floor Plans Level 2.



46. From the Structural Design Bar, click Structural Column.
47. On the Options Bar set:
    a. Type = W-Wide Flange-Column: W10X49
    b. Depth = Level 1
48. Click the intersection between gridline B and 2.



49. On the Options Bar, click Grid Intersection and select gridline B, C, 3, 4.

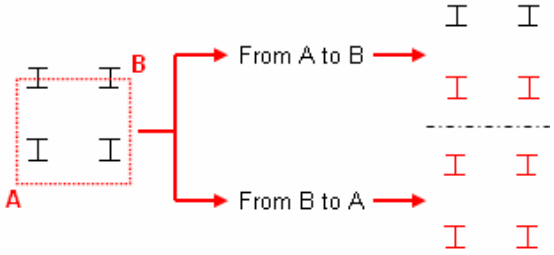


If you do not see the Structural tab on the Design Bar, you can add it by right-clicking anywhere on the Design Bar and selecting it from the context-sensitive menu.

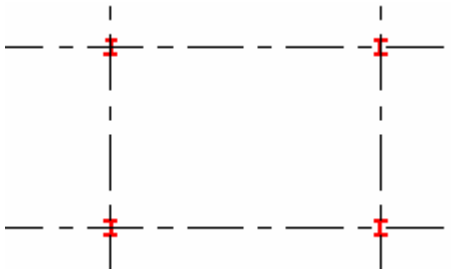
Structural components are automatically locked with gridlines. Click precisely at the intersection; zoom in if necessary.

Most structural elements, including the foundation, are drawn extending down. This includes the foundation wall and structural columns.

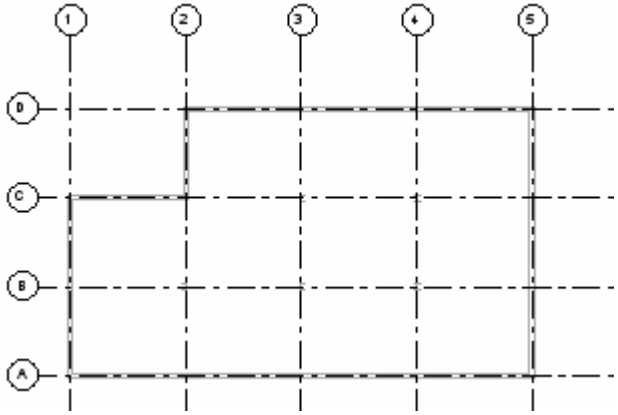
To enable multiselect, press the Ctrl key or select by frame: click two points that define the frame. The direction used to create the frame determines selection mode.



50. Click Finish on the Options Bar.

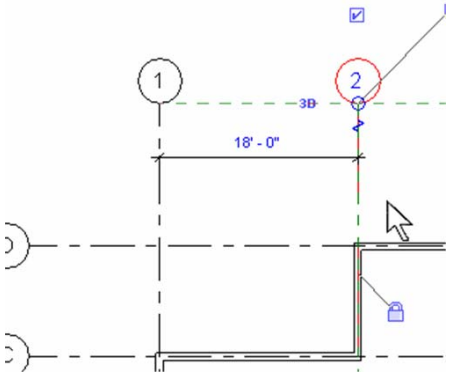


51. Press Esc twice.



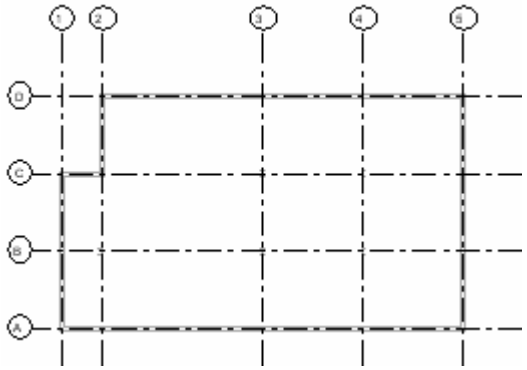
52. Click the dimension tool on the Basic Design Bar.

   a. Click gridline 1.
   b. Click gridline 2.
   c. Click a point to place the dimension.



53. Click the Modify tool, and select gridline 2.

54. Change dimension value to 7’.



Because the wall between grids C and D along grid 2 has been locked or constrained to grid 2, it (and the foundation wall below this view) moves with the gridline.

Add an Extruded Roof—Create and Set Work Plane

Unit 1 leads you through creating a simple roof by footprint. When you create a roof by footprint with the Pick Walls option, there is a soft or inherent constraint between the roof and the walls that generated them.

In this part of the exercise, you create a roof by extrusion. The extrusion roof is a shape generated by lines drawn in a reference plane perpendicular to the normal plan working plane. Once constructed, the extruded roof is defined by the location of its reference plane.

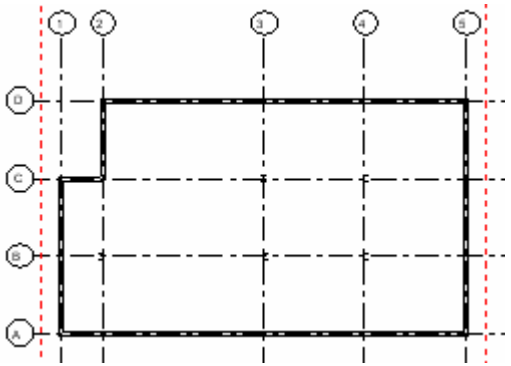
Drawing a reference is like drawing a line: you click two points (start, end).

55. Go to Floor Plans Level 1.

56. On the Basics Design Bar, click Reference Plane.

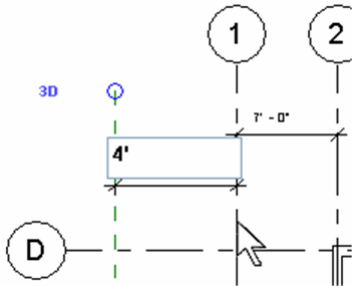
57. Add a reference plane on the west and east sides of the building.

58. Press Esc twice.



59. Add a permanent dimension from the reference plane to Grid 1.

60. Select the reference plane, and change the value of the dimension to 4’.

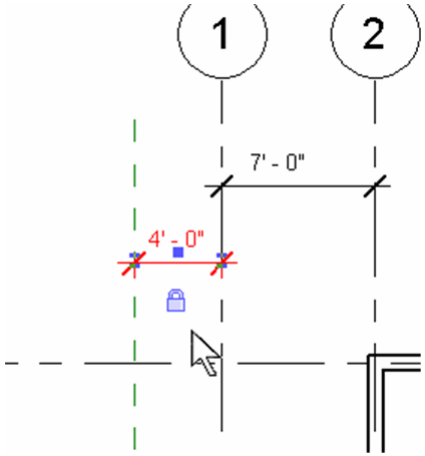


To convert a temporary dimension into a permanent dimension, simply click the symbol below the dimension line.

To lock the dimension, select it and click the blue padlock symbol near the dimension line.

61. Select and lock the dimension.

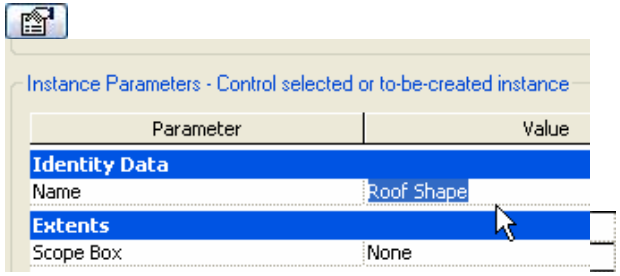
62. Repeat the same operations for the east side.



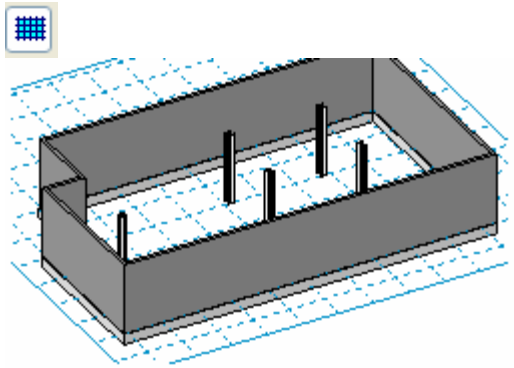
63. Select the east side reference plane, and on the Options Bar, click Properties.

64. In the Element Properties dialog box, type Roof Shape in the Name parameter.

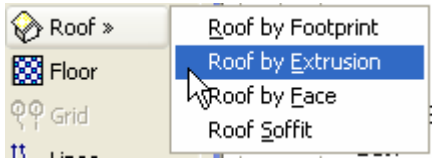
65. In the Element Properties dialog box, click OK.



66. Open the 3D view, and click Work Plane Visibility on the Tools toolbar.



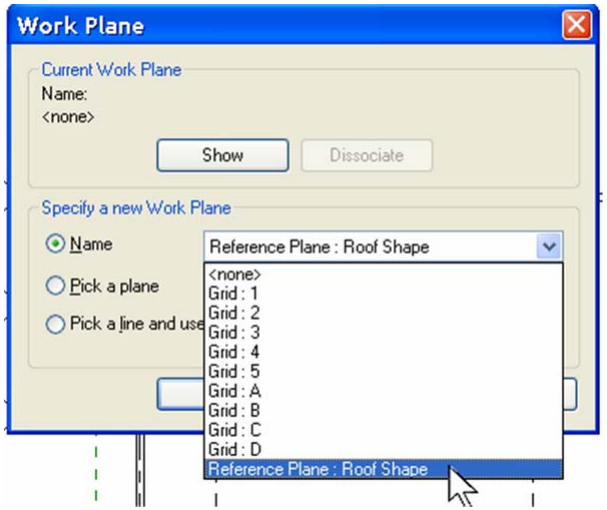
67. On the Basics Design Bar, click Roof>Roof by Extrusion.



The blue grid is the work plane on which you create the sketch. In most cases Revit Building automatically creates a work plane that enables you to sketch. If Revit Building can't find a solution, it prompts you to select a suitable work plane.

68. In the Work Plane dialog box, select Roof Shape from the Name drop-down list.

69. Click OK in the Work Plane dialog box.

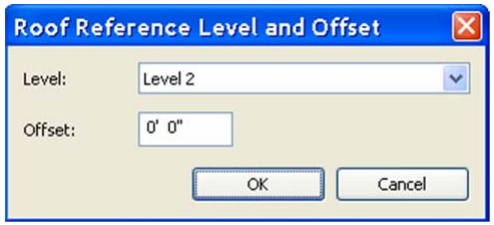


As you can see, if you name a reference plane, it automatically creates a work plane. This is a useful feature.

Work planes can be defined by a face on an object (a wall, for example), a reference plane, or a line.

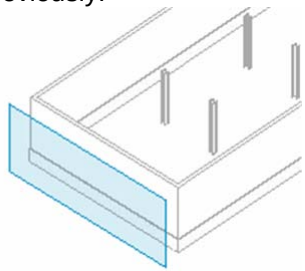
Notice that each of the gridlines is also automatically considered to be a work plane.

70. In the Roof Reference Level and Offset dialog box, click OK to accept Level 2 as a reference level for the roof.



71. Open the 3D view, and click Work Plane Visibility in the Tools toolbar.

Work plane is aligned with the reference plane placed previously.



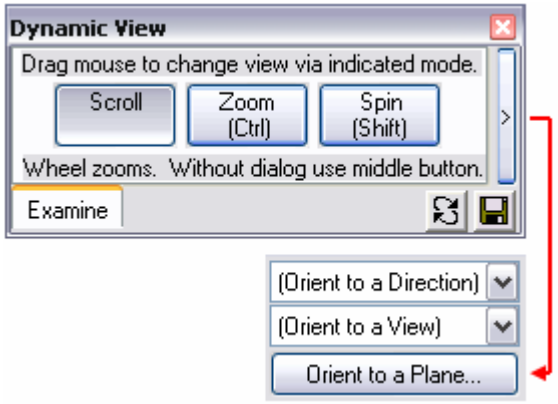
To sketch the roof, it is easier to have a point of view perpendicular to the work plane.

Add an Extruded Roof—Set View to Work Plane

You can use one of the existing elevations, or set the view to the work plane as shown here.

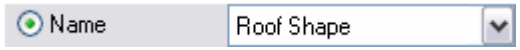
72. Press F8 on your keyboard.

73. Expand the Dynamic View dialog box, and click Orient to a Plane.



74. In the Select Orientation Plane dialog box, select Roof Shape from the Name drop-down list.

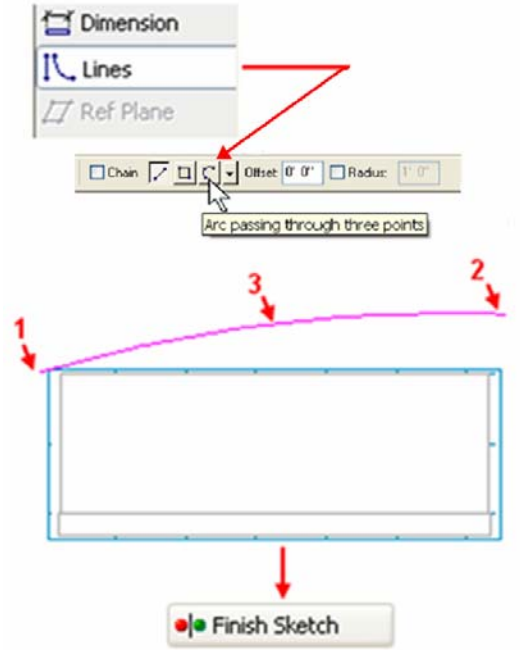
75. In the Select Orientation Plane dialog box, click OK.



76. With the Line tool selected in the Design Bar, click Arc (Arc passing through three points) in the Options Bar.

77. Draw an arc, using the image as a guide.

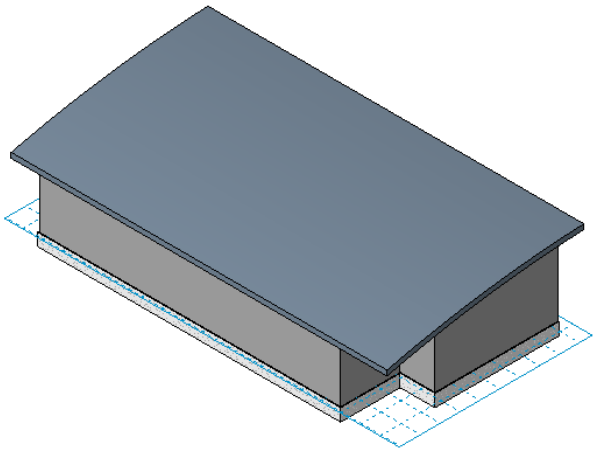
78. Click Finish Sketch on the Design Bar.



79. From the View menu, choose Orient>Northwest.

80. Highlight an exterior wall, press Tab, and click to select the walls.

81. On the Options Bar, click Attach and select the roof.

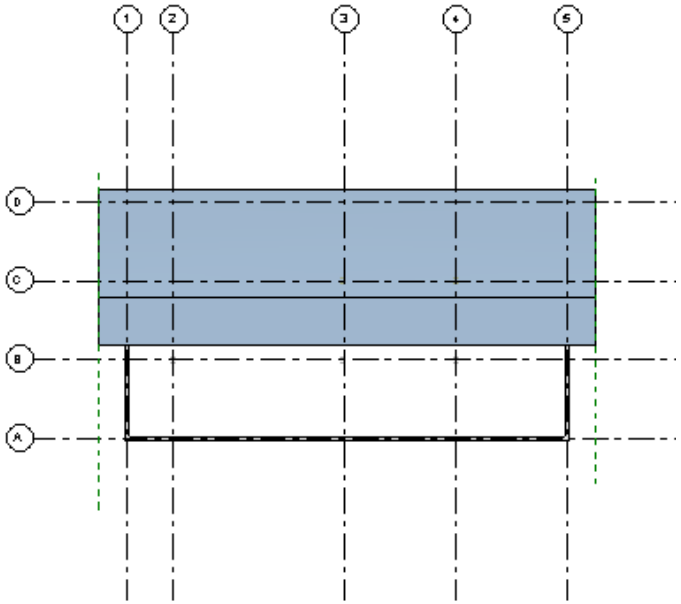


82. Go to Floor Plans Level 2.

83. Click Align on the Tools toolbar.

84. Click the west reference plane.

85. Click the edge of the roof.



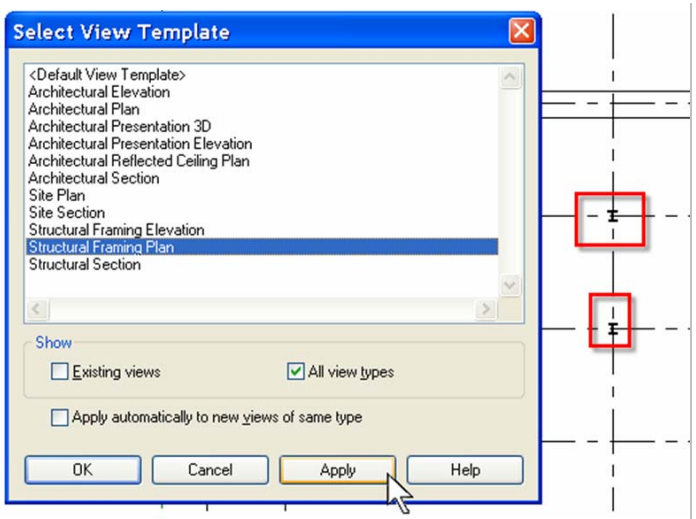
Introduction to View Templates

A View template stores all the parameters of a view. You can create and apply these as needed to quickly adjust the view settings.

86. In the Project Browser, right-click Floor Plans: Level 2 and choose Duplicate.

You should now be working in a view titled Copy of Level 2.

87. From the View menu, choose Apply View Template.
88. Select Structural Framing Plan.
89. Click Apply.

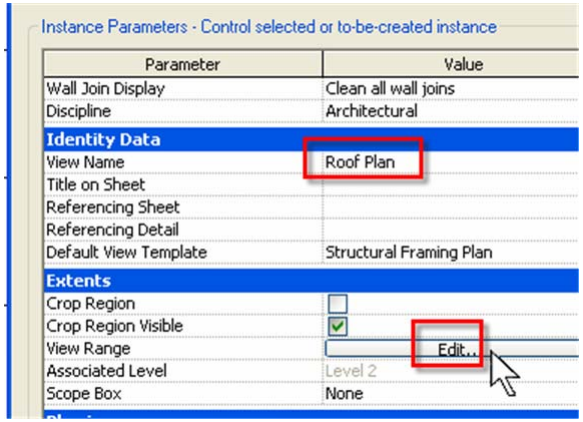


The cut plane for a framing plan is much lower, so you see less of the roof.

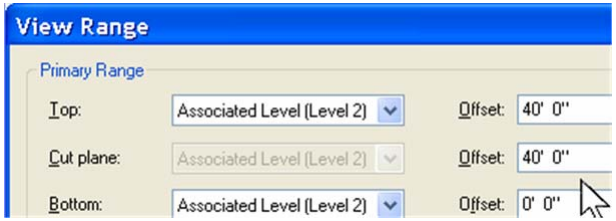
Also, the columns that were gray now show up solid.

90. Select Architectural Plan.
91. Click Apply, and then click OK.

92. Right-click in the view, and choose View Properties.
93. In the View Properties dialog box:
    a. Change the name to Roof Plan.
    b. Click the View Range's Edit button.



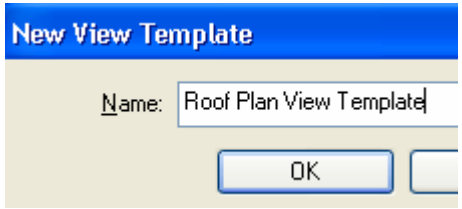
94. In the View Range dialog box, change the Top and Cut plane values to 40'.
95. Click OK two times to return to the drawing window.



96. From the View menu, choose Create Template from View.

97. Type Roof Plan View Template for the template name.

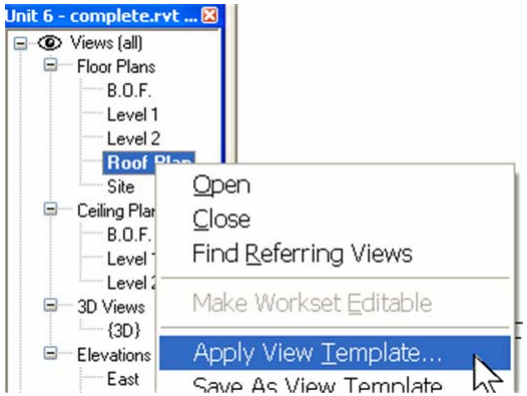
98. Click OK two times to return to the drawing window.



99. Change to the Level 2 view.

100. In the Project Browser, right-click floor plan Level 2 and choose Apply View Template.

101. Select Roof Plan View Template from the list, and click OK.



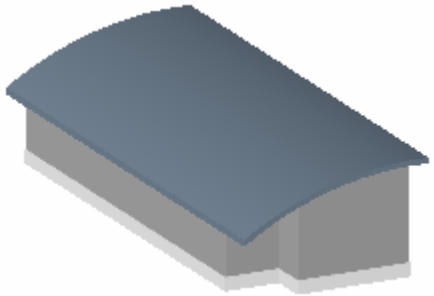
The View template you made and its parameters are applied to the Level 2 view as well.

The next lesson explores View Templates in more depth.

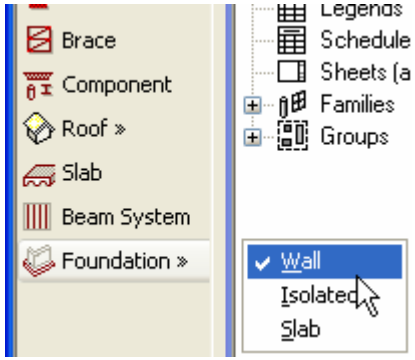
Add a Strip Footing

102. Open the 3D view. Rotate the view to see the building in isometric.

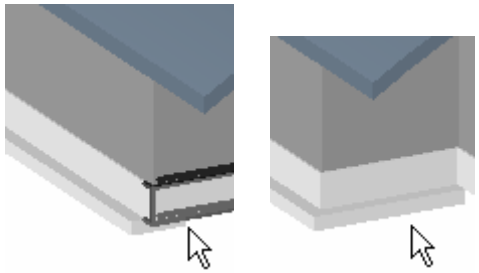
103. Click the Work Plane Visibility tool to turn off the grid.

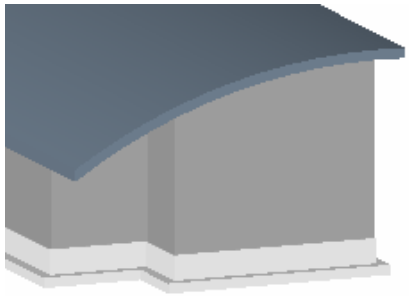


104. On the Structural Design Bar tab, click the Foundation>Wall tool.



105. Click lower wall to add the continuous footing to the lower stem walls.





Now that your model is filled out, explore the constraints still on the walls and gridlines.

Unit 7

Theory: Design Information Organization

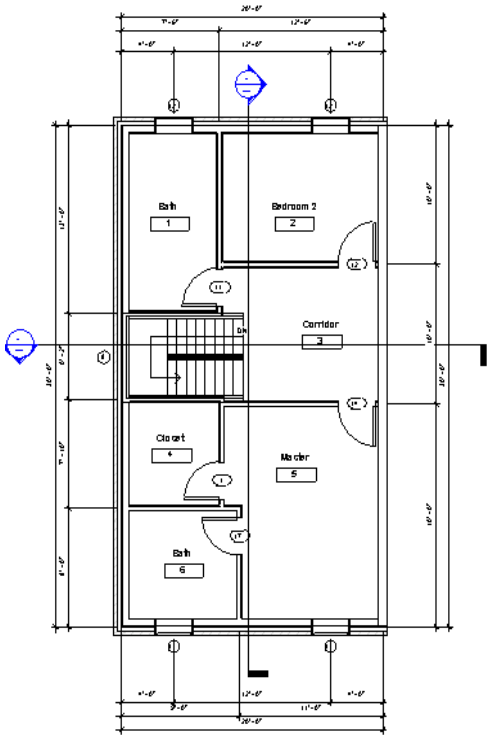
Autodesk Revit Building: Components, Categories, and Subcategories

This unit has two exercises. The first exercise provides a quick overview of the organization and structure of Autodesk Revit Building design objects. The second exercise explores the user-created organizational system of Revit Building groups.

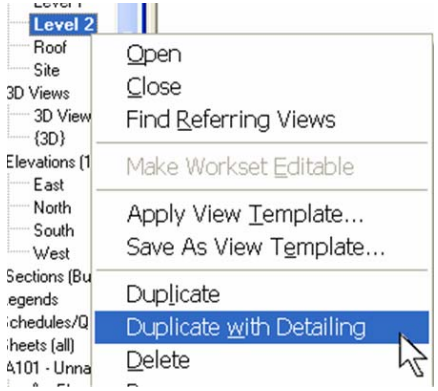
Unit 7, Exercise A

In this exercise you create and apply a view template to explore the categories and subcategories of object styles that are the basis for object organization and structure in Revit Building.

1. Open file Unit 7a – start. The file should open with the Floor Plan Level 2 active.
2. The plan view has a view template assigned to it (1/4” Architectural Plan).



3. In the Project Browser, right-click Floor Plans: Level 2, and choose Duplicate with Detailing.



Duplicate with Detailing copies the annotation elements that are placed in that view.

The new view has dimensions, tags, and other annotation copied from the original view.

Although you could use Duplicate rather than Duplicate with Detailing here, you are going to take care of these elements with a view template.

4. Right-click Floor Plans: Copy of Level 2, and choose Rename.

5. Rename this to Level 2 Furniture.

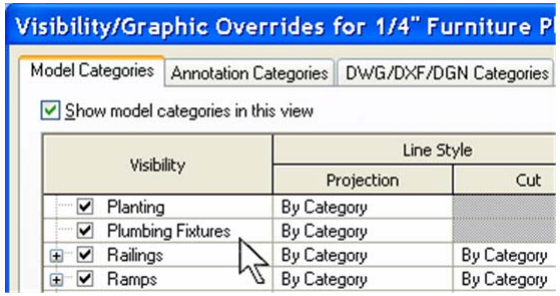
Edit the Furniture Plan View Template

6. From the Settings menu, choose View Templates.

7. Set the view template to edit to 1/4” Furniture Plan.

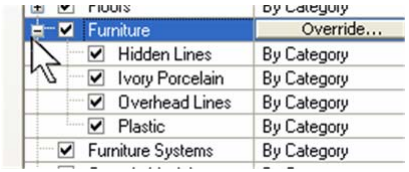
8. Under Visibility, click Edit.

9. On the Model tab, note that Plumbing Fixtures is set to By Category.



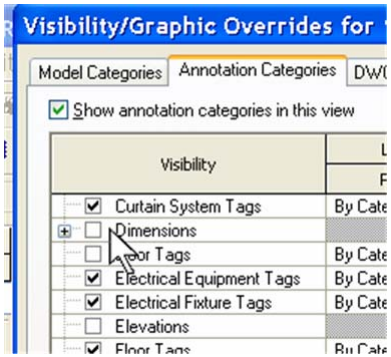
When a view uses the By Category setting, it is looking to the Settings>Object Styles for its display parameters. There are no overrides set for this view.

10. Expand the Furniture category.



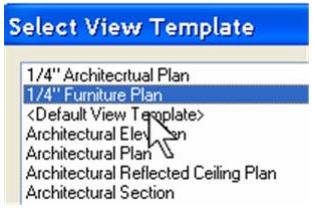
These are the subcategories of Furniture. In general, subcategories are established by the families as you load them into the project.

11. Click the Annotation tab.
    a. Clear Dimensions.
    b. Clear Door Tags.
    c. Clear Window Tags.
12. Verify that Elevations and Sections are cleared.
13. Click OK two times to return to the drawing window.



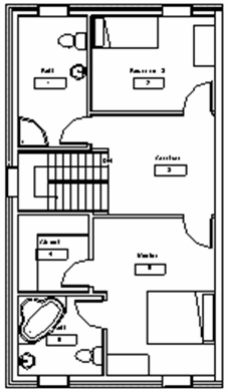
Clearing these elements tells Revit Building not to display them when you apply this view template.

14. In the Project Browser, right-click Level 2 furniture, and choose Apply View Template. Select 1/4” Furniture Plan.



You can save visibility settings in view templates and recall them to be assigned at any point to any view. The visibility settings define what categories and subcategories are visible within a view.

15. Note that the furniture now appears, and the door and window tags and dimensions disappear per the settings in the view template.



To save the active visibility setting that you define as a view template, from the View menu, choose Save as View Template.

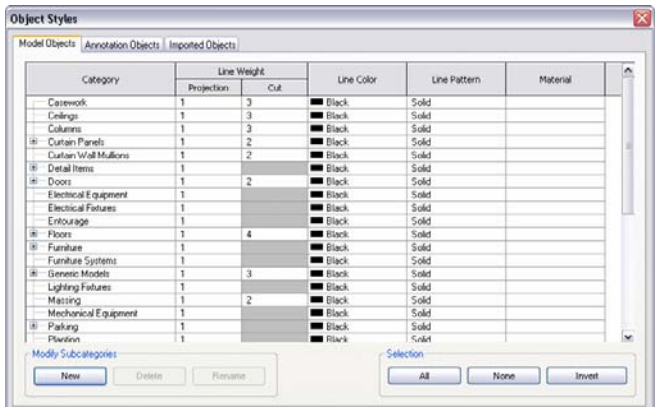
To apply a view template, from the View menu, choose Apply View Template, or right-click in the Project Browser and choose Apply View Template.

Changing Object’s Display Globally

The object styles control the linework representation for all the objects. Changes you make in this dialog box affect all views that do not have an override in place.

Use Category/Subcategory structure to manipulate the settings for lineweight, line pattern, and material for the objects.

16. From the Settings menu, choose Object Styles.



The Object Styles dialog box has three tabs: Model Objects, Annotation Objects, and Imported Objects.

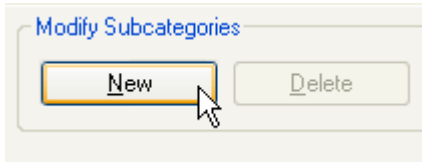
You can control the appearance of model and annotation objects from the first two, while on the third tab you can control display settings for imported objects such as DWG format files (line color, weight, style).

17. Scroll down the window to Plumbing Fixtures, and change color to Red. Click Apply.

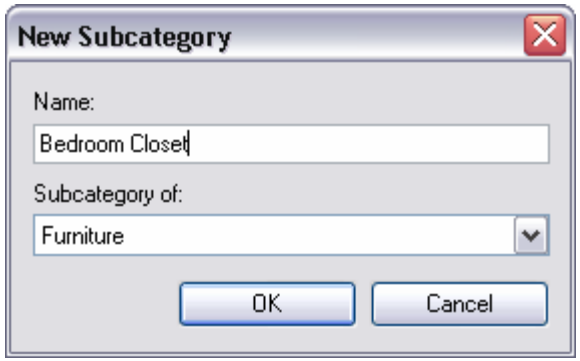
Because styles are not view specific, changing the color of a category affects the display of that category in all views.

18. Scroll and expand the window, and select the Furniture category.

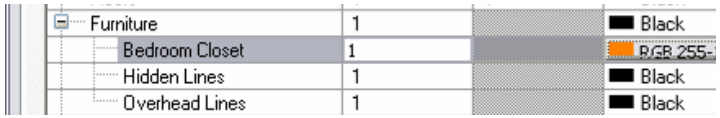
19. Add a subcategory by clicking the New button.



20. Name the new subcategory Bedroom Closet.



21. Click OK, and change the subcategory color to Orange by clicking the line color column.

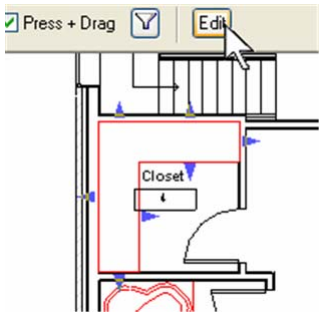


Assign the Closet Shelf to the New

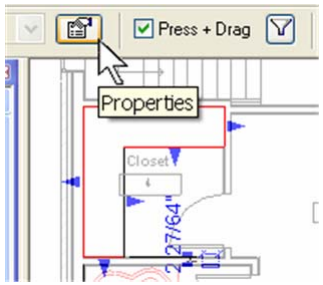
Subcategory

22. Select the furniture item inside the closet in the main bedroom (see image). It's an in-place family.

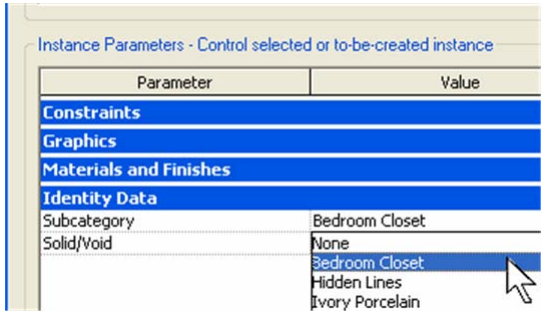
23. On the Options Bar, click Edit.



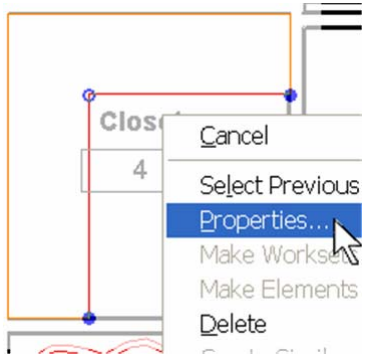
24. Again, select the shelf in the closet, and on the Options Bar, click the Properties button.



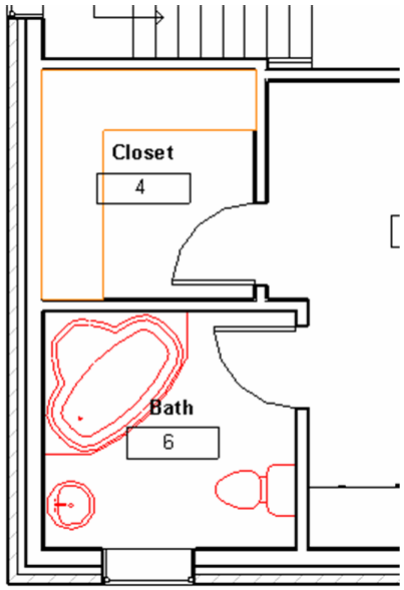
25. Change the subcategory to Bedroom Closet.



26. Right-click the symbolic lines defining the closet, and choose Properties. Assign the subcategory Bedroom Closet.



27. Click OK to close window, and click Finish Family on the Design Bar. Note the color change of the component.

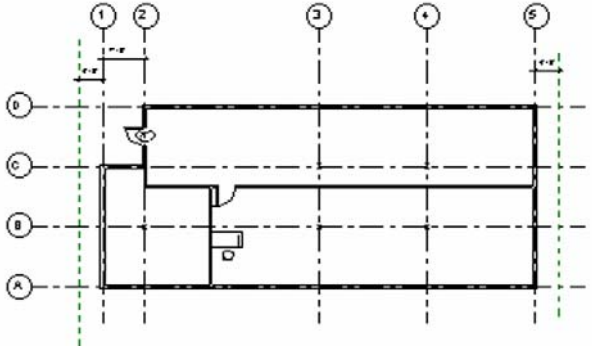


The visibility of the Bedroom Closet subcategory can be switched off even if the rest of the furniture is visible. Open the Visibility settings for this view and expand the Furniture category. The Bedroom closet subcategory is now available as a parameter that you can control by object style for all views, or by visibility graphics for view overrides.

Unit 7, Exercise B

This exercise explores the user-created organizational system of groups.

Open the data set Unit 7b - start.rvt.

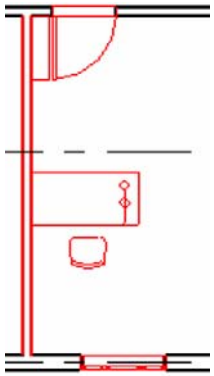


Verify that Floor Plans Level 1 is current.

Create a Group

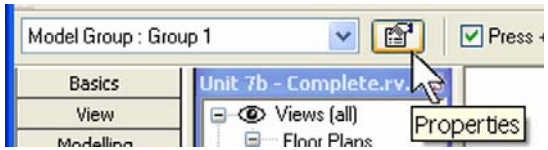
1. Zoom into the desk and chair.

2. Select the shelf, door, window desk, and chair.



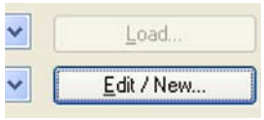
3. Click Group on the toolbar.

4. Click Properties on the Options Bar.



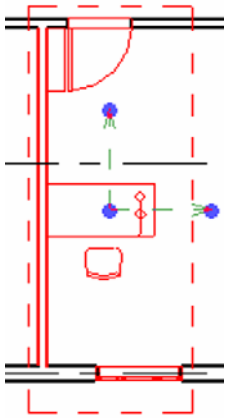
The group is created, but is named Group 1. It is a good habit to name your groups as you create them.

5. In the Properties dialog box, click Edit/New.



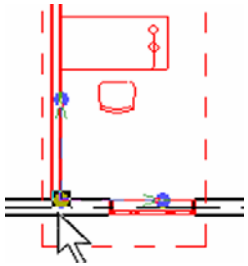
6. In the type properties, click Rename.

7. Name the new group Typical Office, and click OK to return to the drawing window.



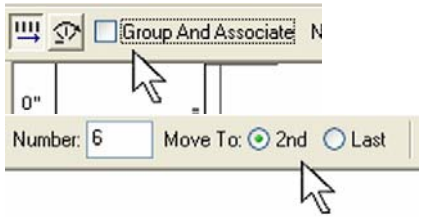
The group has three grips. The middle grip is the insertion point of the group.

8. Drag the insertion grip to the lower-left corner of the space.

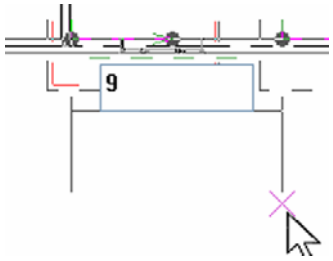


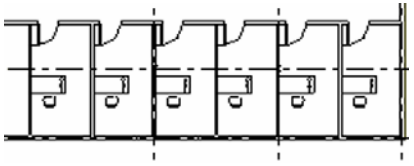
Array the Office Group

9. With the group still selected, click the Array tool, and on the Options Bar, set:
    a. Array type = linear
    b. Clear Group and Associate
    c. Number = 6
    d. Move to 2nd
    e. Constrain = checked



10. Click anywhere in the drawing window.
11. Drag to the right.
12. Type in 9 for 9'.
13. Press the Enter key.



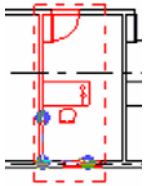


The array is created. You cleared Group and Associate because the office parts are already in a group.

Edit the Group

You can modify, add, or subtract from the objects in the group.

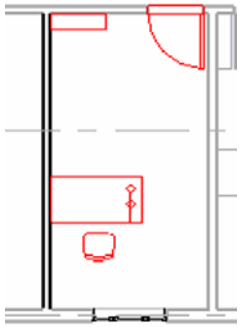
14. Click any of the groups.



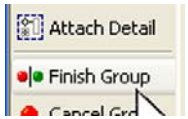
15. On the Options Bar, click the Edit Group tool.

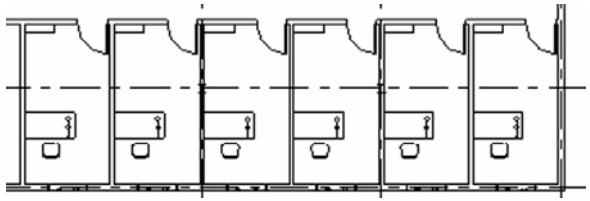
The group is open for editing. Those objects not in the group are dimmed and not accessible.

16. Move the desk, chair, and lamp toward the window.
17. Move the door against the right wall.
18. Rotate the shelf.



19. Click the Finish Group tool on the Design Bar.



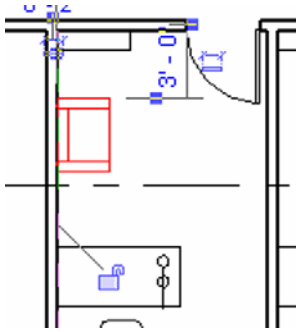


The change is propagated through each of the offices. Even objects such as doors and windows that have relationships to the other elements can belong to and be modified by groups.

Add Objects to the Group

To add objects to the group, the object must exist in the project drawing window before you edit the group

20. Use the Component tool to add a Chair-Corbu to the left office.

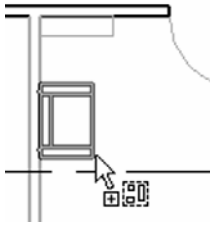


21. Click any of the groups.

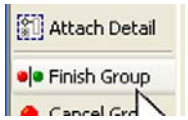
22. On the Options Bar, click the Edit Group tool.

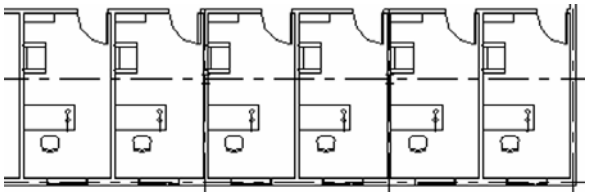
23. Click the Add to Group tool.

24. Click the chair you added.



25. On the Design Bar, click the Finish Group tool.





The chair is added to each of the offices.

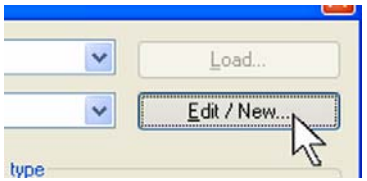
Duplicate the Group

Once a group has been defined in the project, it acts much like any other Revit Building object. You can create types based on the original.

26. Click the left office group.

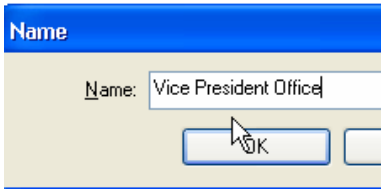
27. On the Options Bar, click Properties.

28. Click the Edit/New button.

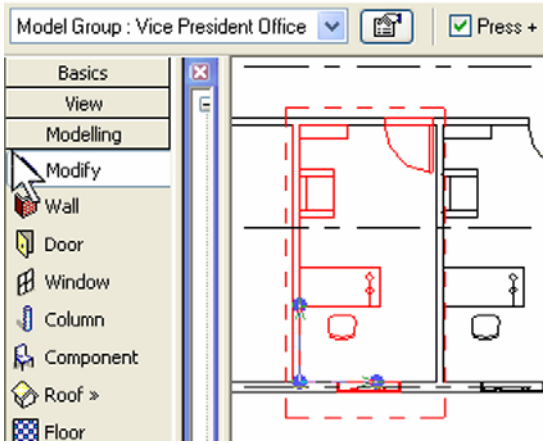


29. Click the Duplicate button.

30. Name the new group Vice President Office.



31. Click OK to return to the drawing window.



The group selected when you accessed the properties takes on the new group definition.

Modify the New Group

32. Select the Vice President Office groups.

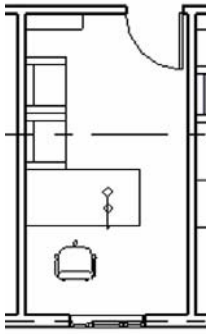
33. On the Options Bar, click the Edit Group tool.

34. Copy the Chair – Corbu.

35. Change the desk type to 72” x 36”.

36. Change the chair type to Executive.

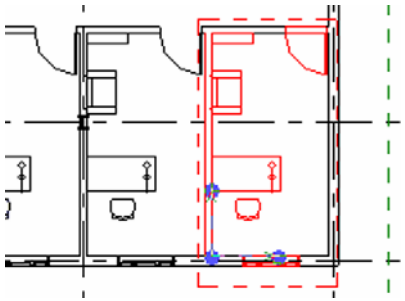
37. On the Design Bar, click the Finish Group tool.



Apply Group Type to Another Group

38. Click the group on the far right.

39. On the Options Bar, change the group type to Vice President Office.

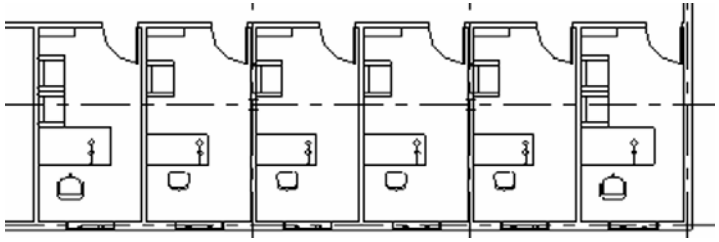


Groups can be powerful tools for working with sets of objects in the Revit Building environment.

On your own, further explore the use of groups. Create an entry for the building. Can you create groups that you can swap out for one another, showing different solutions to the entry design?

You can insert groups using the Design Bar>Modeling tab>Model Group tool.
You can export groups and load groups using the File menu: Save to Library and Load from Library. These files are stored as RVG files outside the project (RVT) environment.

40. Save and close the project.



Unit 8

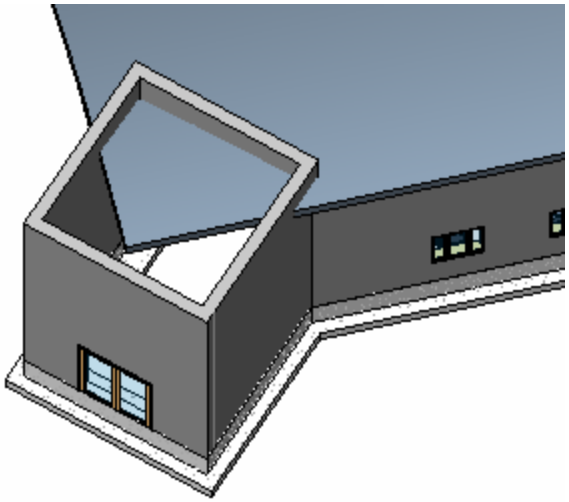
Theory: Domain-Specific Knowledge

Autodesk Revit Building: Roofs

This exercise takes you through adding more detail to the roof and looks at how to put together multiple roofs to achieve different forms.

Exercise Setup

1. Open the data set Unit 8 – start.rvt.

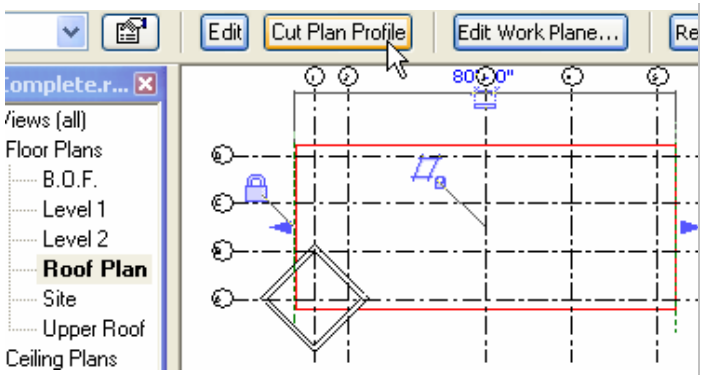


This data set is the same as the building at the end of exercise 7b. The southwest corner has been added, and a new level called Upper Roof has been created.

Clip the Extruded Roof

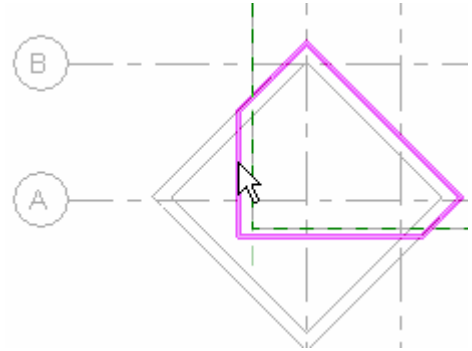
Any extruded roof (as opposed to a roof by footprint) can be cut using the Cut Plan Profile tool.

2. Set the Roof Plan view current.
3. Click the roof in the plan.
4. On the Options Bar, click the Cut Plan Profile tool.



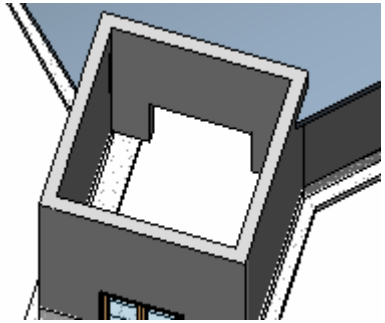
This initiates sketch mode. Just draw the shape you want to remove from the extruded roof. This shape must be closed.

5. Draw a shape that follows the outer edge of the upper walls.



Notice the linework on the south and west sides is outside the roof. Try not to make the lines coincident with the edge of the roof.

6. On the Design Bar, click the Finish Sketch button.

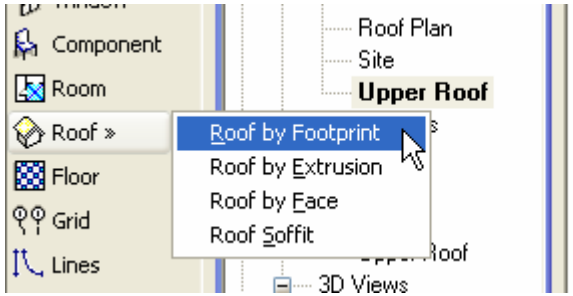


The shape that was sketched is now removed from the extruded roof.

Roof by Footprint: Pick Walls Versus Lines with Offsets

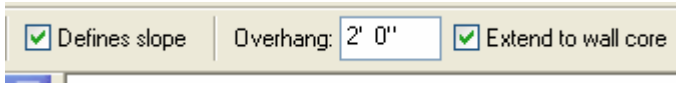
In this section you create an upper roof on the entry walls. Although an earlier unit illustrates Roof by Footprint, this section covers some of the limitations and workarounds using the roof you create here as a basis for a slightly more complex (to Revit Building) roof.

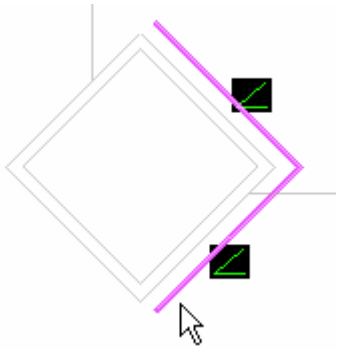
7. Set the Upper Roof view current.
8. Click the Roof>Roof by Footprint tool.



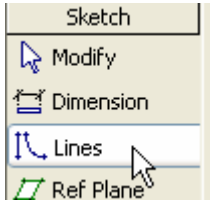
9. On the Sketch Design Bar, click Pick Walls.

10. On the Options Bar, set:
    a. Defines slope = selected
    b. Overhang = 2'-0"
    c. Extend to Wall Core = selected
11. Click the two east walls to create the lines as shown at right.

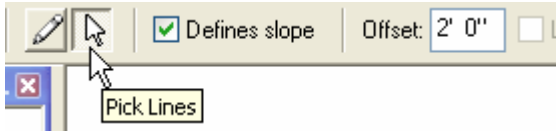


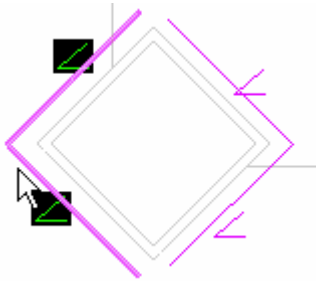


12. On the Sketch Design Bar, click Lines.

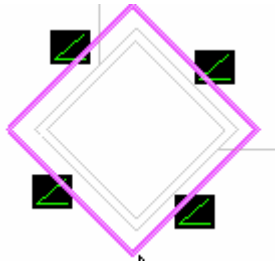


13. On the Options Bar, set:
    a. Draw method = Pick Lines
    b. Defines slope = selected
    c. Offset = 2'-0"
14. Draw the two lines on the west side, as shown in the image.



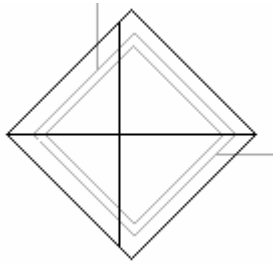


15. Use the Trim tool to clean up the corners of the linework.



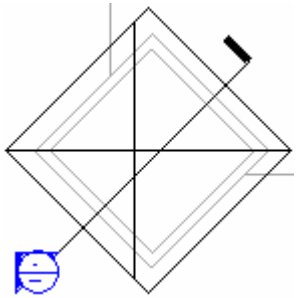
16. On the Sketch Design Bar, click Roof Properties.
17. Set the Rise/12” = 4”.
18. Click OK to return to the drawing window.

19. On the Sketch Design Bar, click Finish Roof.

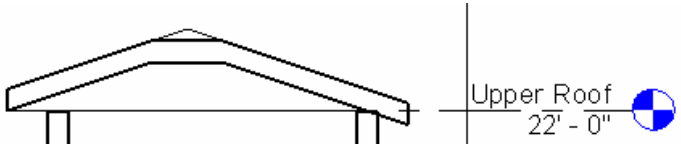


The roof is created, but it is not symmetrical to the entry walls. This is because of the differences in the lines created by picking walls versus using the Line tool.

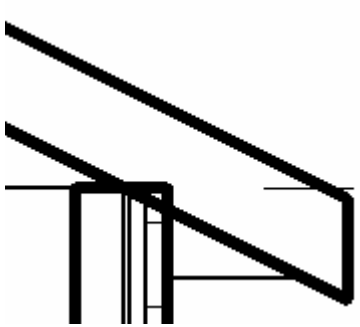
20. Add a section as shown here.



21. Open the Section view, and tile the two views; Section 1 and Upper Roof.



The sketch lines drawn with the Line tool originate at the edge of the roof at the level the roof is constrained to (left side of image).
The sketch lines drawn with the Pick Walls tool establish the facia edge of the roof below the level by a distance determined by the slope of the roof over the overhang setting, in this case, 4/12 over 2 feet.



Align Eaves is a tool available in sketch mode of a footprint-type roof.

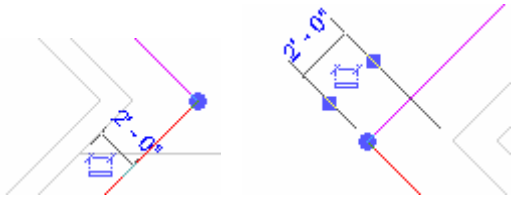
Align Eaves

22. Set the Upper Roof view current.

23. Click the roof.

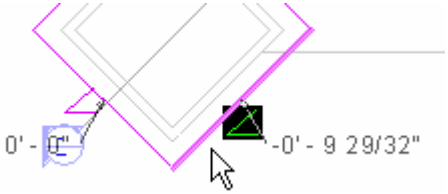
24. On the Options Bar, click the Edit button.

25. Click each of the lines, and use the temporary dimensions to adjust the distance to the face of the wall to 2’-0”.



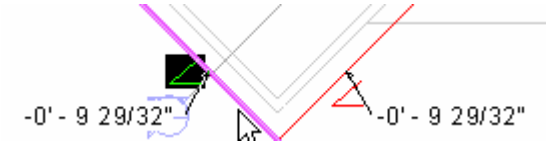
26. On the Sketch Design Bar, click the Align Eaves tool.

27. Click the eave to align (the southeast line).



Notice also that the Pick Walls tool had Extend to Core selected. The outside face of the core (the metal studs) of the wall is used, and the overhang of 2’ is calculated from this point rather than the exterior face of the entire wall. As such, the overhang on the picked walls is slightly less than the overhang of the drawn-line segments.

28. Click the eave to align (the southwest line).



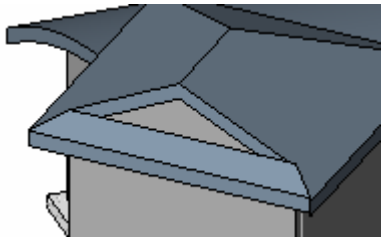
29. Repeat for the northern lines. All the sketch lines should now be set to the same value.

30. On the Sketch Design Bar, click Finish Roof.

The roof should now be symmetrical to the underlying entry walls.

Multiple Roofs

You sometimes need to create two or more roofs to complete the shape you are looking for. Any roof with a discontinuity in the form probably needs to be created out of two different roof objects. This section guides you though creating a simple example of such a roof as shown at right.



31. Open the roof sketch for editing.
    a. Set the Upper Roof view current.
    b. Click the roof.
    c. On the Options Bar, click the Edit button.

32. On the Sketch Design Bar, click **Roof Properties.**

33. Set Rise/12” = 6”.

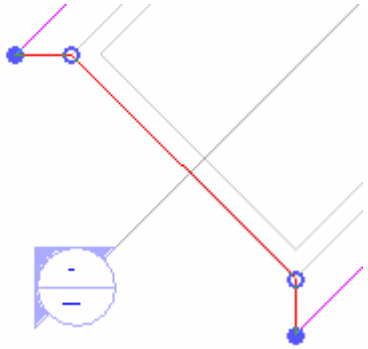
34. Click OK to return to the drawing window.

35. Delete the southwest line.

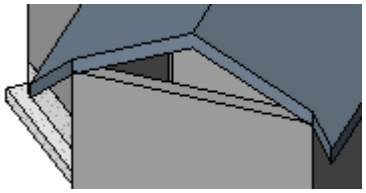
36. On the Sketch Design Bar, click Lines, and on the Options Bar, set:

    a. Draw Method = Draw
    b. Defines Slope = Unchecked
    c. Offset = 0'-0"

37. Draw the three lines on the west side shown in the image. Verify that these lines do *not* define slope.

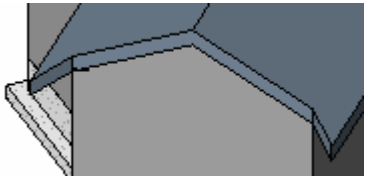


38. On the Sketch Design Bar, click Finish Roof.



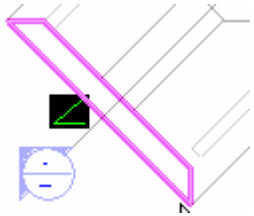
39. If you want, you can extend the wall to the roof by:

    a. Opening a 3D view
    b. Clicking the southwest wall
    c. Clicking Top/Base Attach on the Options Bar
    d. Clicking the roof to attach to



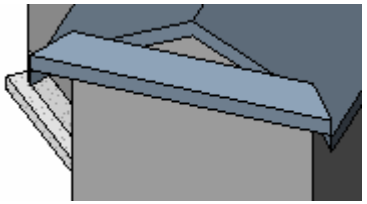
Add the second roof to complete the form.

40. Set the Upper Roof view current.
41. Click the Roof>Roof by Footprint tool.
42. Use the Line tool to draw the lines shown at right.



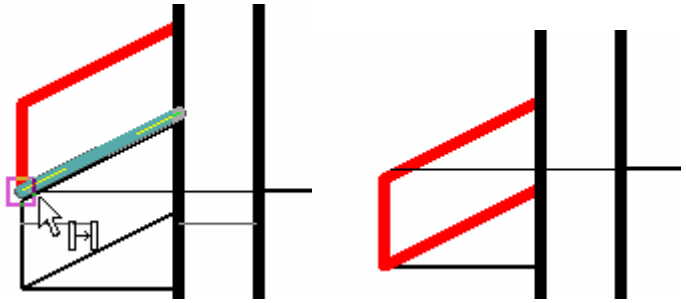
Note only the outermost line defines a slope. The other three do not.

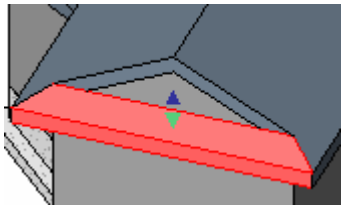
43. On the Sketch Design Bar, click Finish Roof.



The roof is finished, but like the first roof in the exercise, the linework is based at the upper roof level rather than the eave of the existing roof.

44. Open the section view and use the Move tool and snaps to move the roof into place using the roof beyond as the reference.



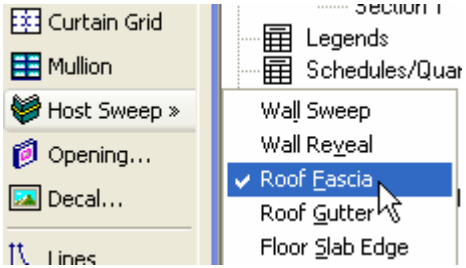


Add Fascias and Gutters

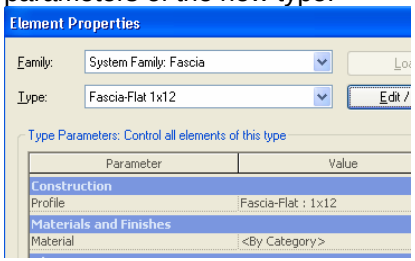
Revit Building provides the ability to sweep a shape around the edge of a roof. This can be any shape stored in a roof sweep type of profile family. The odd thing about many of the sweeps is that although the shape definition is stored in a family (RFA) file, the definition is buried (or nested) in a system family definition in the project file.

45. Open the 3D view of the project.

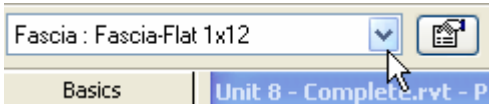
46. On the Design Bar, click the Modeling tab and then click the Host Sweep>Roof Fascia tool.



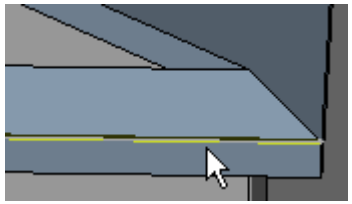
Note the fascia is a system family (defined only in the project, not as an RFA file). There are other families you can load and use in the project, but you would need to duplicate this type and assign the loaded profile into the type parameters of the new type.

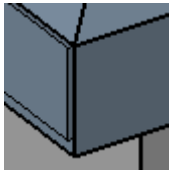


47. There is only one type defined in this project.



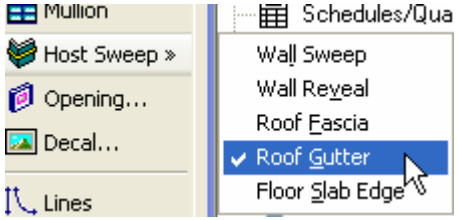
48. Click the upper edge of the fascia area of a roof.



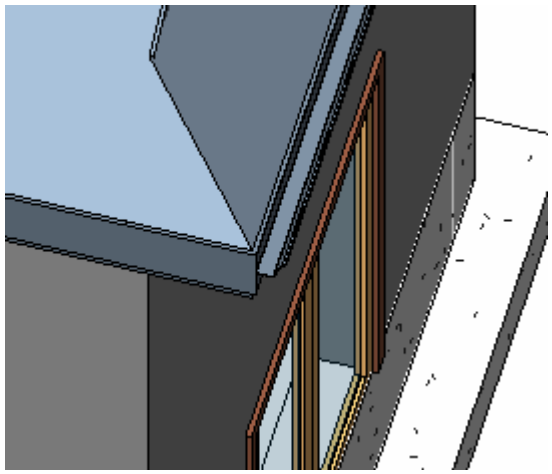


49. Continue clicking edges to add the fascia to each edge of the roof.

50. On the Design Bar, click the Modeling tab and then click the Host Sweep>Roof Gutter.



51. Click the fascia edge about the entry door.



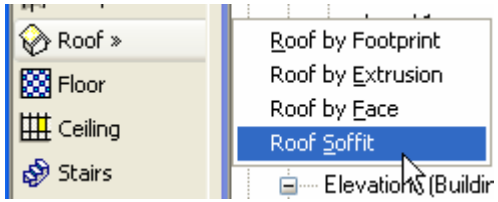
Be careful as you select. Because the inside face of the fascia, the roof, and the outside face of the fascia are all very close together, it is easy to add the gutter to the wrong edge.

Add Soffits

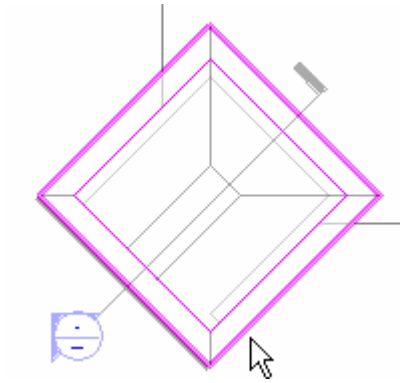
Creating a soffit in Revit Building is much like creating a roof.

52. Set the Upper Roof level current.

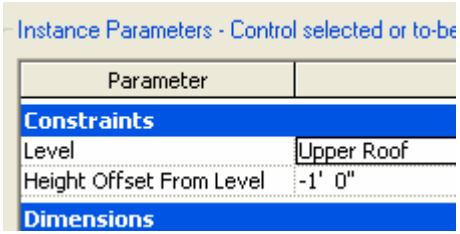
53. Click Roof>Roof Soffit.



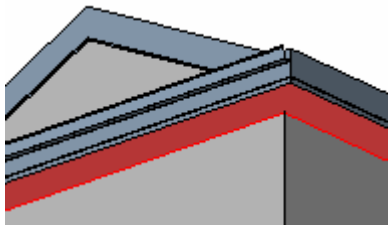
54. Draw two sets of lines, as shown in the illustration.



55. On the Sketch Design Bar, click Roof Soffit Properties, and set the Height Offset From Level to -1’-0”.

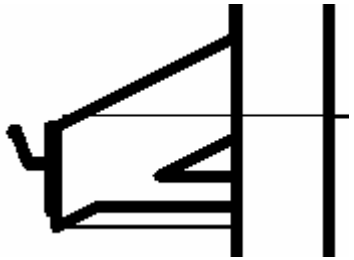


56. On the Sketch Design Bar, click Finish Sketch.

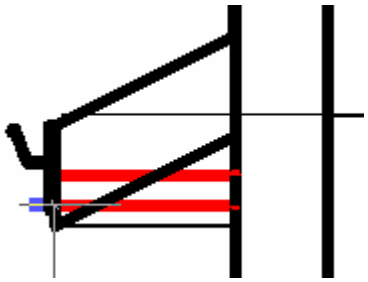


57. Click the Join Geometry tool.

58. Click the soffit, and then click the roof.



Although there are automatic selection tools that enable you to select roofs and walls, because this is not just a single roof, you may find it easier to draw the lines manually.



The two geometries are joined, and the profile line wraps both objects.

Unit 9

Theory: Delaying Specificity

Autodesk Revit Building: Massing

This unit shows how to use the massing tools.

There are two exercises in this unit. This first exercise guides you through the process of adding mass elements to a Revit Building project. The second illustrates the software's ability to import Sketch-up files and how to use them as mass elements.

Unit 9, Exercise A: Mass Components and Building Maker

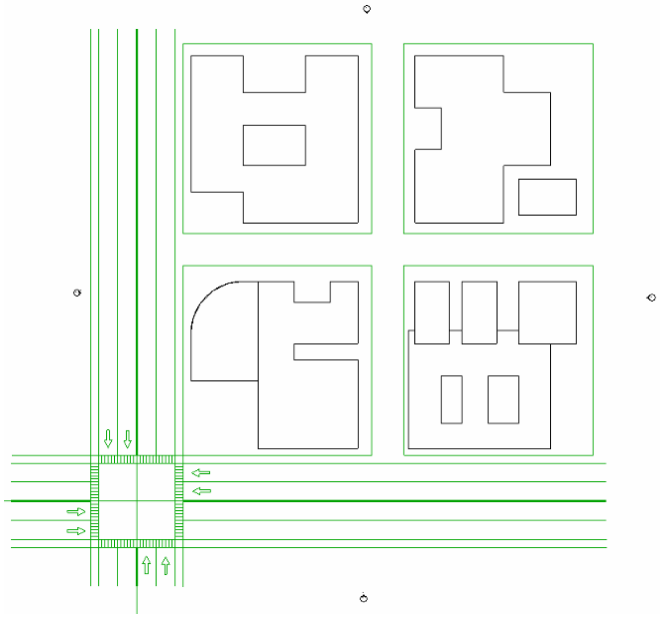
In this exercise you work with Autodesk Revit Building software's Building Maker. Building Maker is a collection of tools that includes

- Mass elements composed of solid forms and void forms
- Walls, floors, roofs, and curtain systems associated with the mass faces

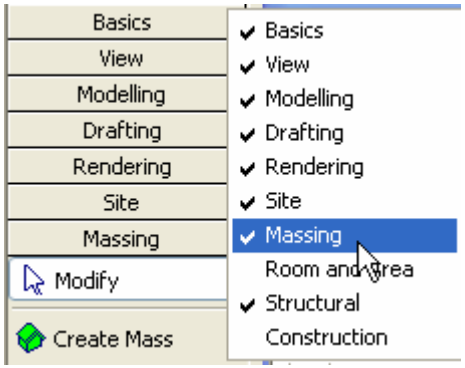
The general workflow in this exercise is to create the mass forms, apply the building elements to the faces, modify the forms, and then update the building elements to the new geometry of the changed form.

Exercise Setup

1. Open file: Unit 9a – Start.rvt.



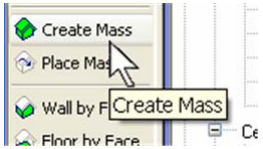
2. In site view, right-click the Design Bar and choose Massing from the context-sensitive menu to show the Massing Design Bar if it is not already visible.



Design Bars can be displayed or hidden to optimize screen space.

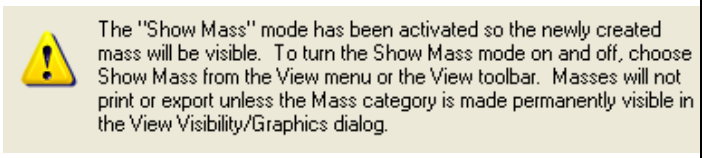
Add a Mass

3. On the Massing Design Bar, click Create Mass.

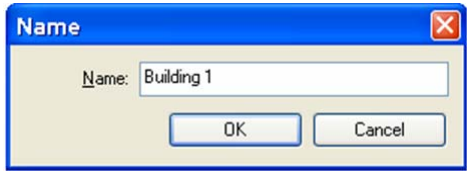


Both Additive (Add Mass) and Subtractive (Cut Mass) Masses are created in sketch mode.

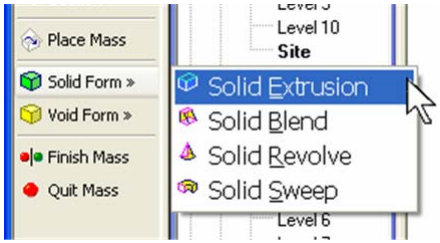
4. Click OK in the Show Massing dialog box if it appears.



5. Give the massing a name.



6. The Massing dialog box appears. Click Solid Form>Solid Extrusion.



Forms can be created in four ways (Extrusion, Blend, Revolve, Sweep) and can be either solid or void. Voids are subtractive forms that cut geometry from solid forms.

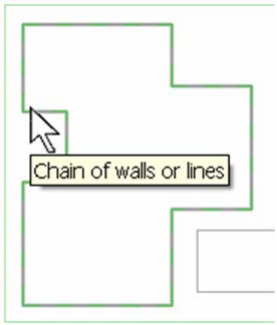
7. On the Options Bar, enter 70'. Click the pick lines (the Arrow symbol) option on the Options Bar.

Sketch lines can be drawn or selected. When selecting, it's possible to automatically lock the lines to the original drawing by clicking the Lock option on the Options Bar.

8. Zoom into the upper-right city block, and

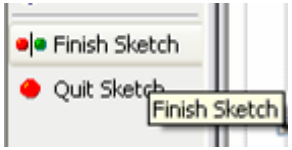
highlight one of the lines that defines the building footprint.

9. Hover the cursor over one of the lines. Press Tab, and then click to select all the lines.



Like selecting a chain of walls, you can click connected lines to generate sketch lines by using the Tab key.

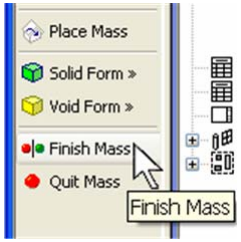
10. Click Finish Sketch to complete the mass.



Quit Sketch discards the lines that were drawn in sketch mode.

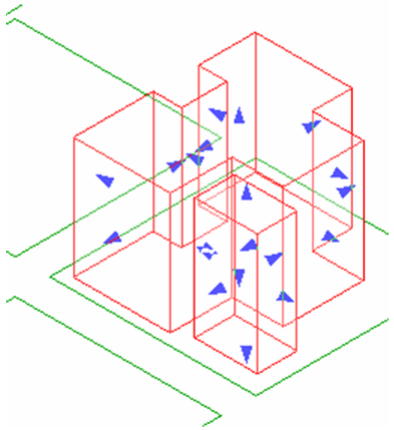
11. Repeat steps 6–10 to create a mass for the small building on the same block.

12. Click Finish Mass to complete the mass.



This is a nested series of sketch modes. One mode takes you to the mass creation set of Design Bar options. When you start a solid or void, you drop down one more level and the Design Bar changes to a more familiar sketch mode. You must click Finish Sketch and Finish Mass to complete the command.

13. Change to the 3D view.



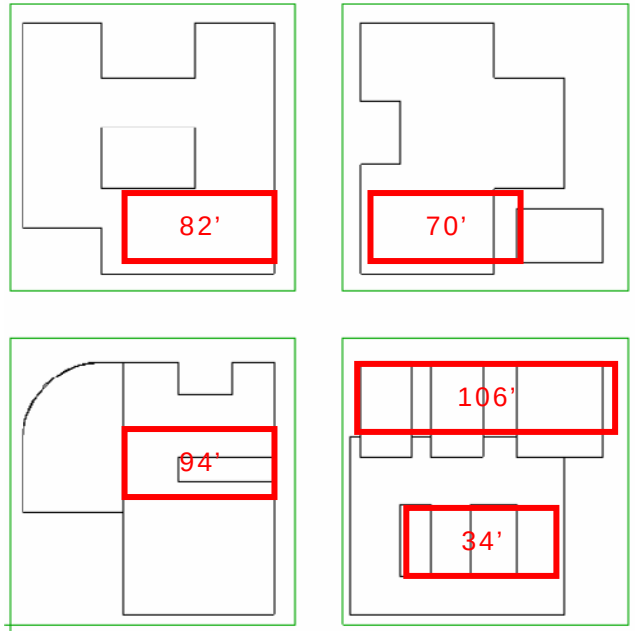
You have drawn two shapes in the mass element sketch mode. These will be two parts on a singular mass element when selected.

Add the Remaining Masses

14. Return to the site view and repeat the process with all the building footprints in the blocks.

15. Set the mass heights as shown in the image on the right.

    Note: Because some masses have two loops of lines, as in the building in the upper left, use Tab to select both of the closed-line loops.

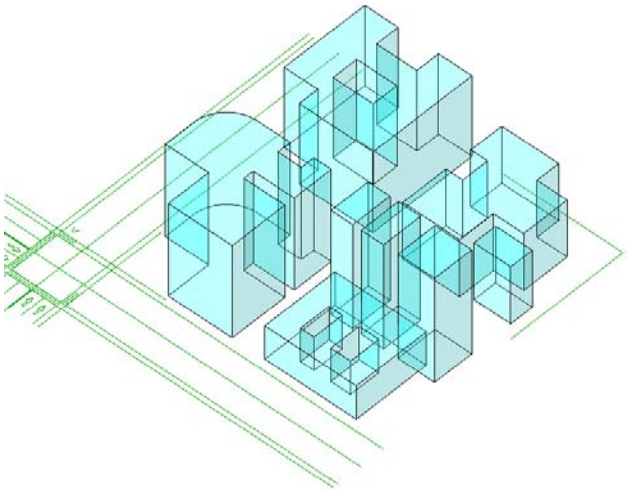


Change heights (or depths) after creating the masses by selecting the mass, opening its Properties window, and changing the value in the Beginning and End fields.

Note that for some buildings, you may have to complete the sketch by drawing lines instead of just selecting them.

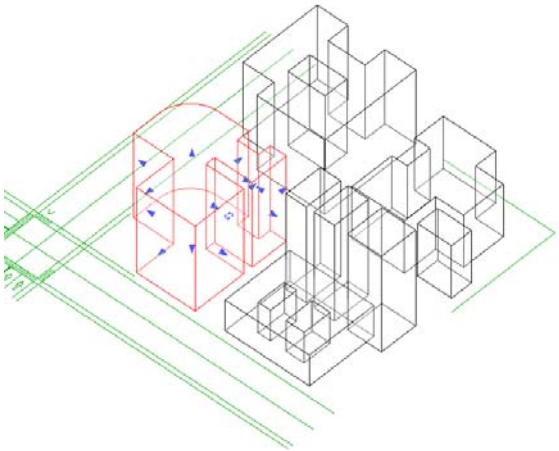
Create the building at the lower right as two different solids within one mass element. Don’t try to make it two parts of the same solid extrusion.

16. Open the 3D view. Type SD for a shaded view of the massing.



17. Resize the southwest mass by dragging the blue grips that appear (one grip for each face).

Edit masses directly in any view by selecting the grips and dragging.

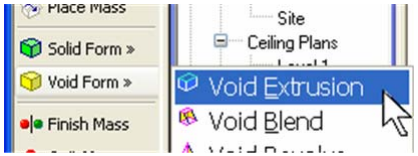


Edit the SW Mass to Add a Void

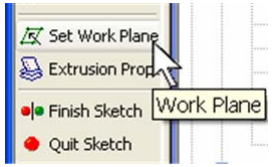
The process of adding a void—or subtractive solid—is the same as creating the original solid.

18. With the lower-left mass still selected, click Edit on the Design Bar.

19. Click Void Form>Void Extrusion.

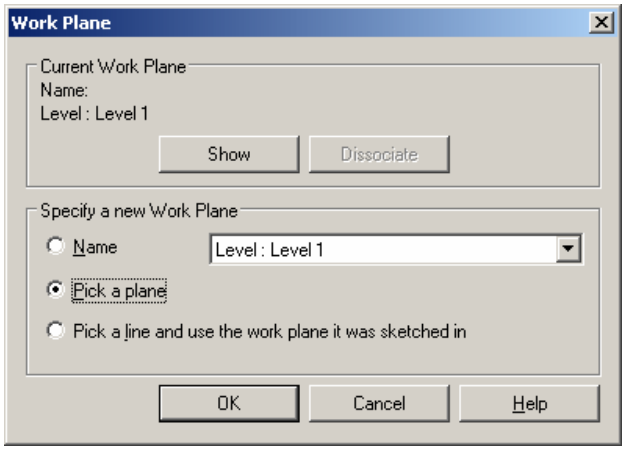


20. On the Sketch Design Bar, click Set Work Plane.



Setting a work plane allows automatic change of the coordinate system in a simple way.

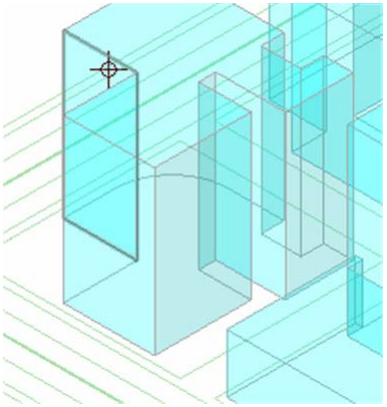
21. The Work Plane dialog box appears. Select Pick a Plane.



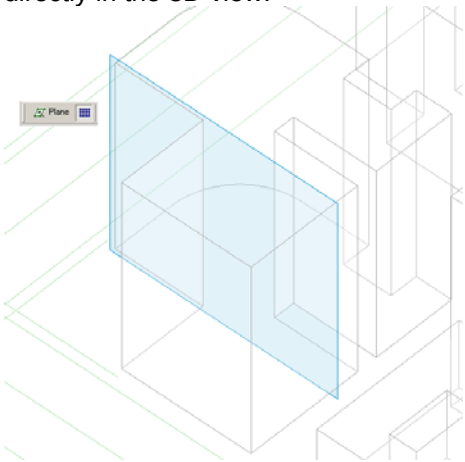
Select any face, reference plane, or gridline as an active work plane. In the Name drop-down are named reference planes, levels, and gridlines.

22. Click the vertical face of the mass located on the lower-left block.

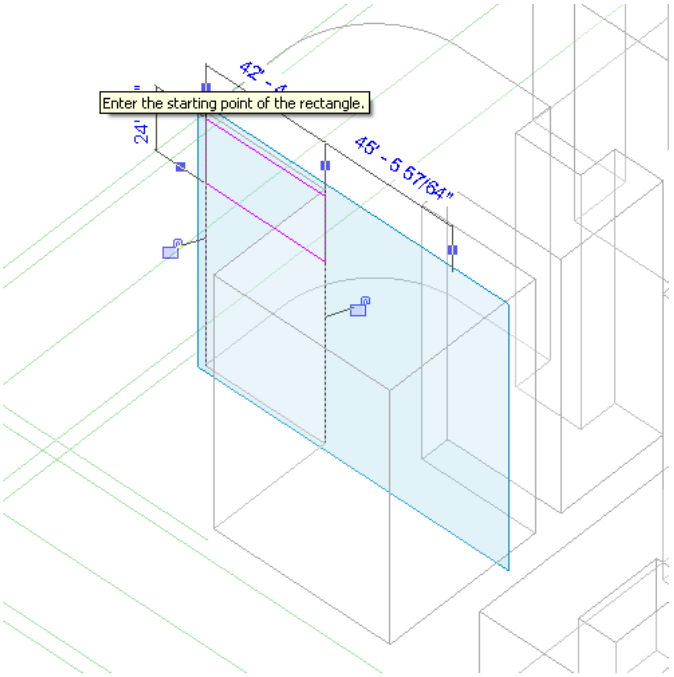
23. On the Design Bar, click the Work Plane Visibility button to see the active work plane.



In this case you are selecting a vertical face directly in the 3D view.



24. Select the Line tool, and draw a rectangle-based sketch. Autodesk Revit Building automatically changes the relative coordinate system to vertical.

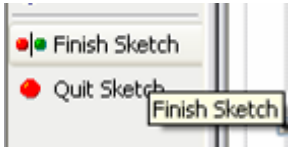


Switch to an elevation view, or create a section if you prefer not to draw in axonometric view.

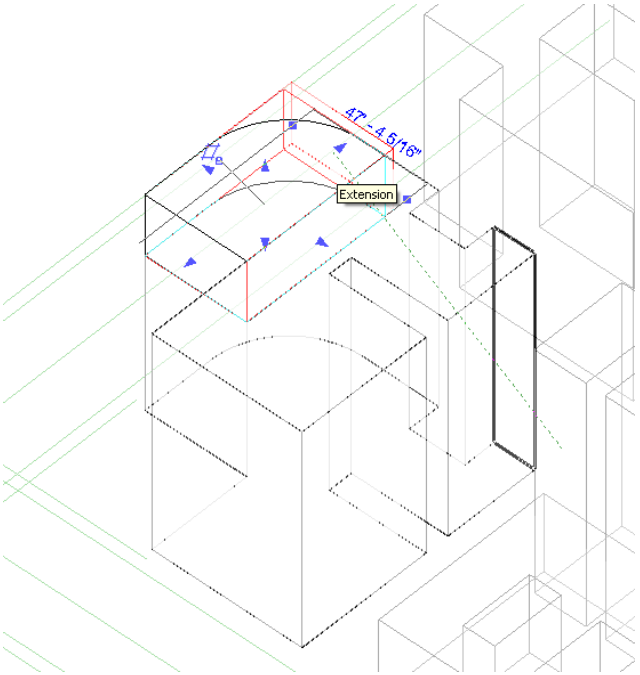
25. On the Options Bar, set the depth of the void extrusion to 50'.

In this case the depth refers to the horizontal plane, as you are drawing on a vertical plane.

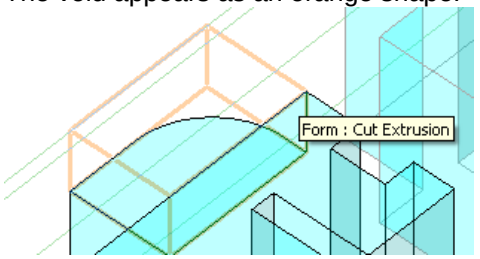
26. Click Finish Sketch.



27. Drag the shape handle of the void until it snaps to parallel geometry to make the void cut completely through the solid.



The void appears as an orange shape.



You do not need to be exact with the void. Once you are done with mass sketch mode, the void disappears.

28. Click Finish Mass to complete the mass.

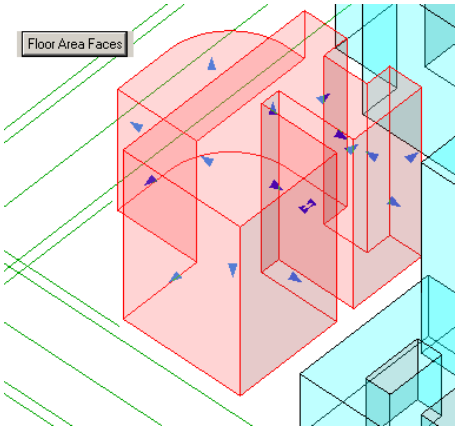
Create a Gross Floor Area Schedule

Revit Building provides the ability to get information from the rough mass model, enabling you to dynamically see changes in either the graphical form of the mass, or in the tabular form of a schedule.

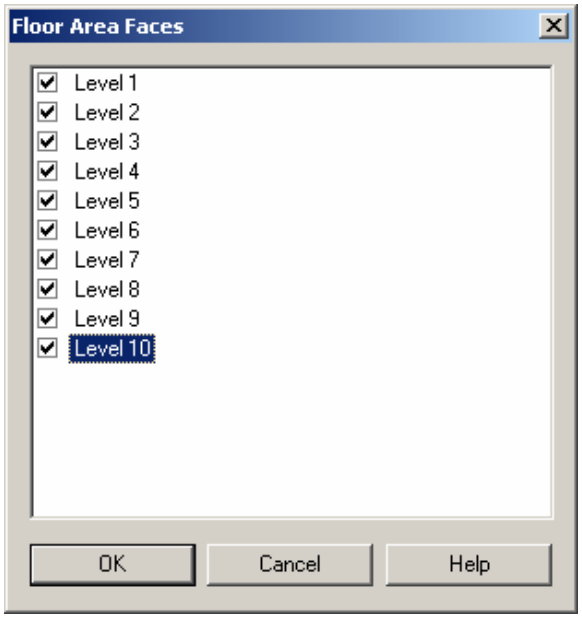
For the schedule to work, the floor areas must first be assigned to the mass object.

29. Select the southwest massing (the one you have been working with).

30. On the Options Bar, click the Floor Area Faces button.



31. Select the check boxes for all the levels.



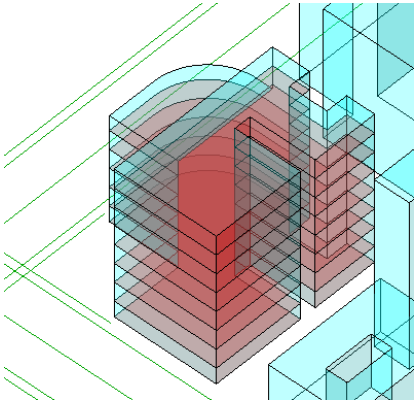
32. From the View menu, choose the Schedule/Quantities tool.

33. Select the Mass category.

34. Click OK.

Each level that intersects the massing is a candidate for a floor area face. These faces enable you to place floors and do quantity takeoffs from the massing object.

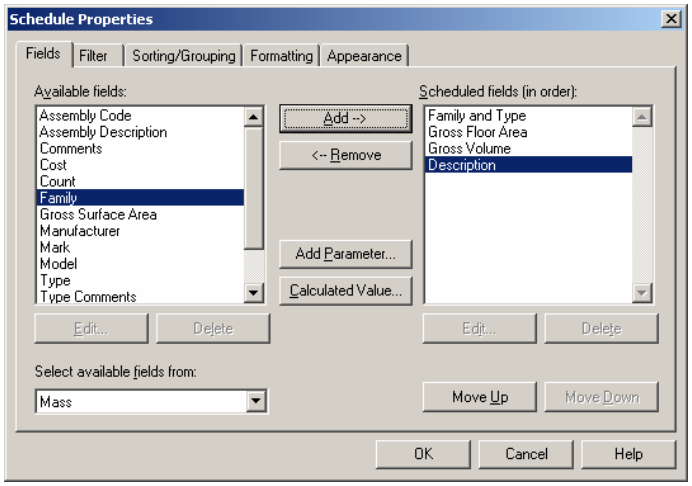
Planes are drawn at each level.



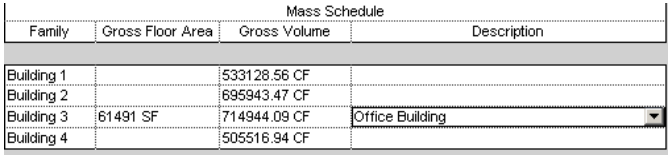
35. Add Fields:

    a. Family and Type
    b. Gross Floor Area
    c. Gross Volume
    d. Description

36. Click OK.



37. Add a description to Building 3—Office Building.



Mass Schedule

Family	Gross Floor Area	Gross Volume	Description
Building 1		533128.56 CF	
Building 2		695943.47 CF	
Building 3	61491 SF	714944.09 CF	Office Building
Building 4		505516.94 CF	

A gross building volume and floor area schedule can be generated and placed in a sheet. Only the building for which you created the floor areas shows a value in the Gross Floor Area column of the schedule.

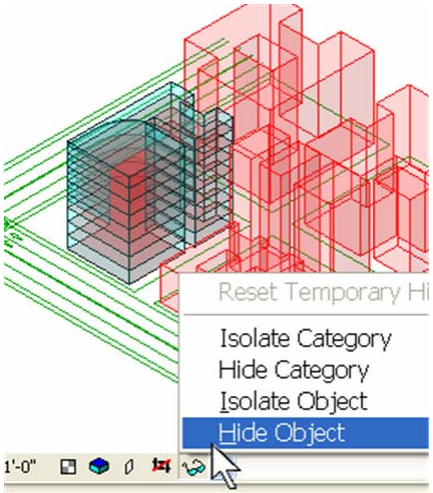
Add the Physical Floor Component

The floor areas created previously are simple vertical divisions of the mass that have no thickness. Use the Floor by Face tool to add floors into the mass.

You cannot use the Floor by Face tool until you have created the floor faces.

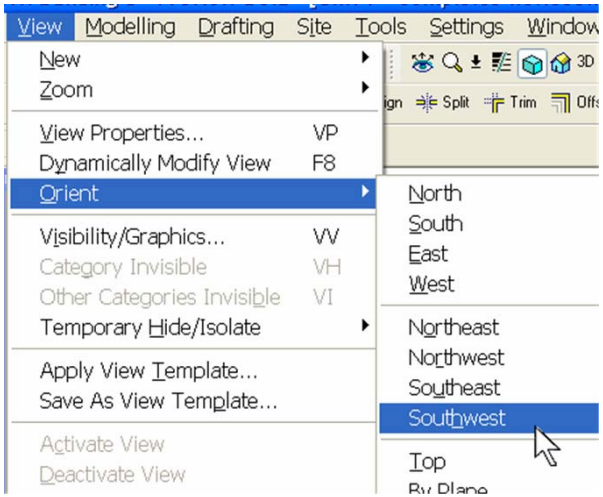
38. Isolate the southwest building.

    a. Open the 3D view.
    b. While pressing the Ctrl key, click each of the three building masses without floor assignments.
    c. From the drawing window's View toolbar, click Hide Object.

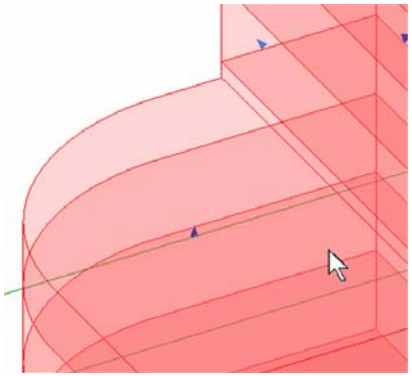


Use Hide Object/Isolate Object to work on one object in the project.

39. Use the View menu to orient the view to the southwest.

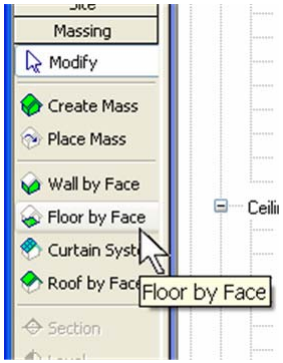


40. Change the height of the lower wing to just under one of the floor area faces.



41. Add floors to the building.

42. On the massing tab of the Design Bar, click Floor by Face.

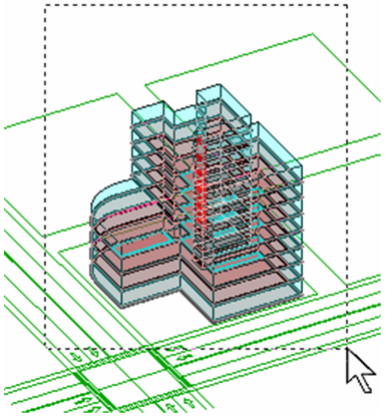


This tool places floors.

43. On the Options Bar:

a. Set floor type to LW Concrete on Metal Deck.
b. Verify that Select Multiple is selected.

44. Drag a selection window around the whole building.



45. On the Options Bar, click the Create Floors button.

The floors are automatically generated.

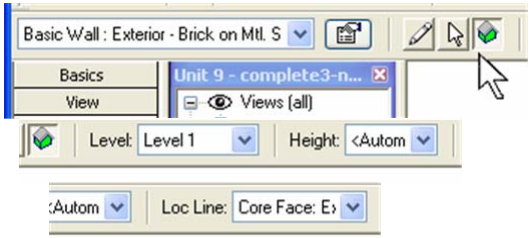
Create Walls

The Wall by Face tool enables you to create walls that are associated with the massing.

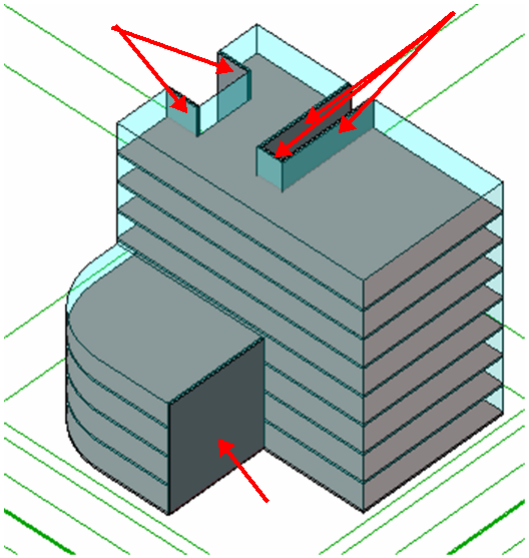
46. Click the Walls by Face tool from the massing tab of the Design Bar.

47. On the Options Bar, set:

a. Wall Type = Exterior Brick on Mtl. Stud
b. Draw Type = Pick Face (House Icon)
c. Height = Automatic
d. Loc Line = Core Face Exterior

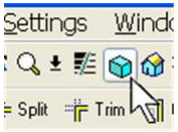


48. Click the walls shown at right.



Spin the model to select these faces. Hold down the scroll wheel and move the cursor to spin the model.

49. Click the Show Mass tool.



This tool enables you to move back and forth between seeing the massing and the floors and walls or just the floors and walls.

50. Click the Show Mass tool to show the mass again.

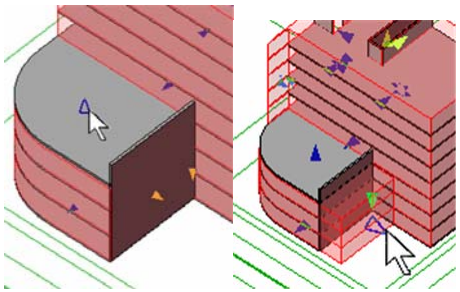
51. Adjust the building.

52. Click the Modify tool.

53. Select the mass.

54. Use the triangular face grips to modify the lower wing:

    a. Top face down one level.
    b. South face half the distance to the street.
    c. See illustrations at right.



If stray portions of the mass show up as you grip the mass faces, use the Edit button to access sketch mode and adjust the void extrusion to clean up.

55. Click any white area to deselect the building.

The building elements are now out of sync with the mass model.

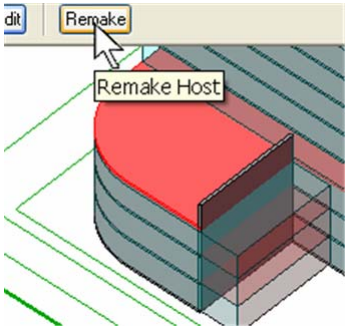
56. Resynchronize the building elements to the new mass form.

57. Select the floor exposed by dropping the top face.

58. On the Options Bar, click the Remake button.

59. Repeat, selecting the south wall of the lower wing.

60. Repeat for the lower three floors.



Add a Curtain Wall System

The Curtain System by Face tool allows you to create curtain walls that are associated with the massing.

61. On the Massing tab of the Design Bar, click the Curtain System by Face tool.

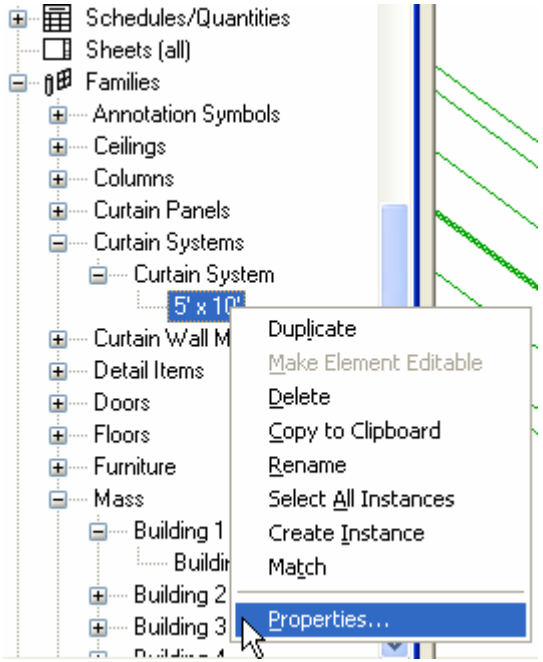
62. Select the remaining exterior faces.

63. From the Options Bar, click the Create System tool.

Adjust Curtain Wall System Spacing

64. In the Project Browser, expand Families>Curtain Systems>Curtain System.

65. Right-click the 5’ x 10’ type, and choose Properties.

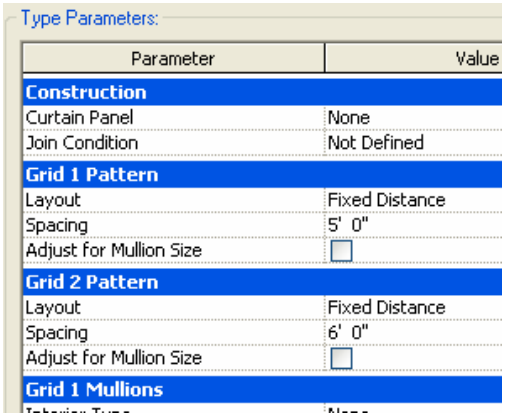


66. In the Type Parameters, set the Layout (Grid 1) (vertical spacing of the horizontal grid) to Fixed Distance and 5’ for the spacing.

67. Set the Layout (Grid 2) to Fixed Distance and 6’.

68. Click the Rename Button and enter 5’ x 6’ for the name.

69. Click OK.



Add Mullions to the Curtain System

70. From the Modeling tab of the Design Bar, click the Mullion tool, and on the Options Bar select All Empty Segments.

71. Click a curtain system face of the model.

Because you are editing the type, the changes you make apply to all curtain systems in the project.

72. Repeat for the remaining curtain system faces.

Add a Roof

73. In the Massing tab of the Design Bar, click the Roof by Face tool.

74. On the Options Bar:

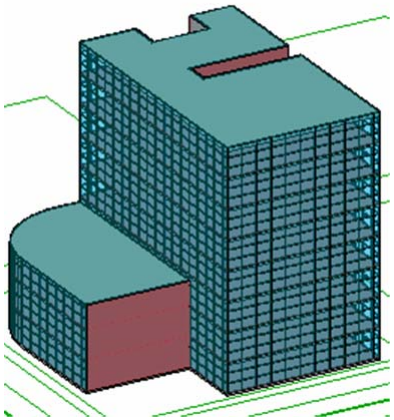
    a. Roof type = Steel Truss – Insulation on Metal Deck – EPDM

    b. Level = 9

75. Select the top face.

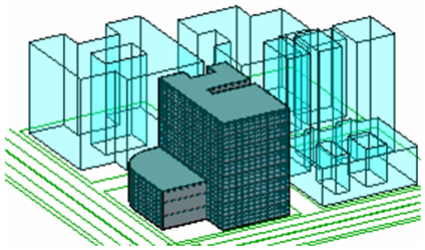
76. On the Options Bar, click the Create Roof tool.

77. Repeat, adding a roof at level 3 for the lower wing.



The process of adding a roof is the same as that for adding the walls or floors.

78. On the drawing window View toolbar, click the Isolate tool and select Reset Temporary Hide Isolate.



Note that if you come back to this project later, you may have to click the Show Mass tool to see the mass elements. Show Mass is not turned on by default in a new session.

Unit 9, Exercise B: Importing SketchUp Files

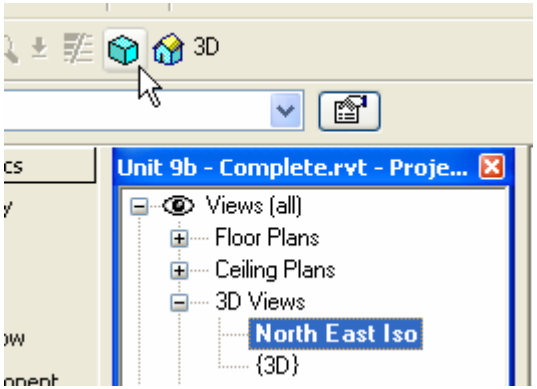
In this exercise you import a SketchUp file directly into the project as well as import a SketchUp file into a mass family as it is created.

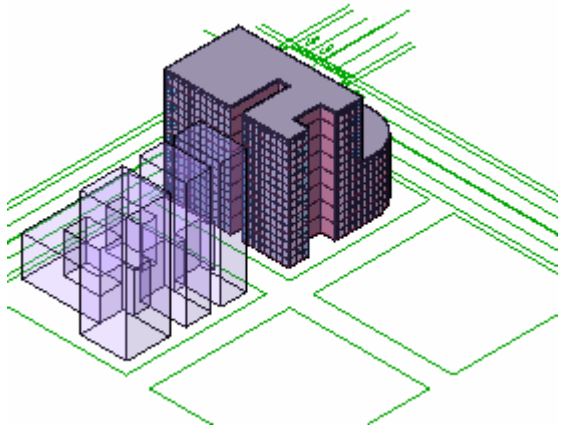
Exercise Setup

1. Open file: Unit 9b – Start.rvt.

2. Set the view 3D Views: North East Iso current.

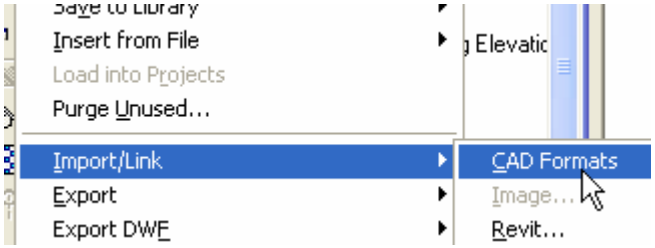
3. Click the Show Mass tool on the toolbar.





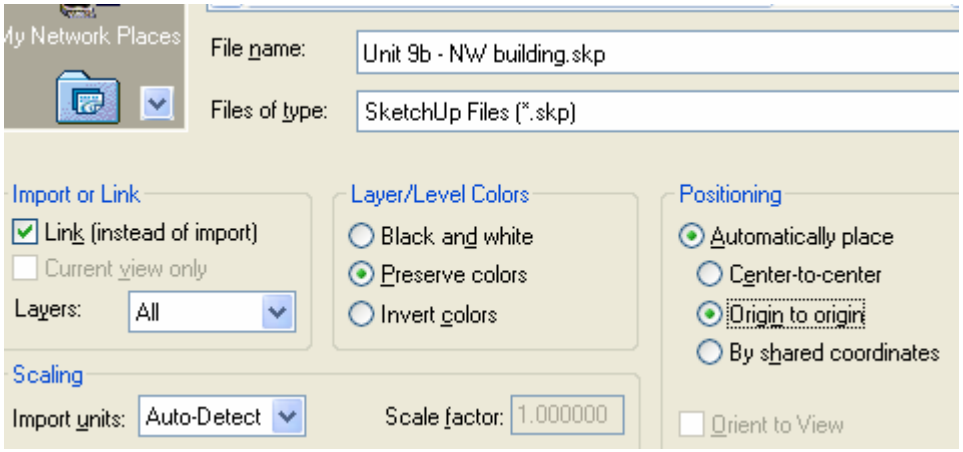
Import a SketchUp Model

4. From the File menu, choose Import Link>CAD Formats.

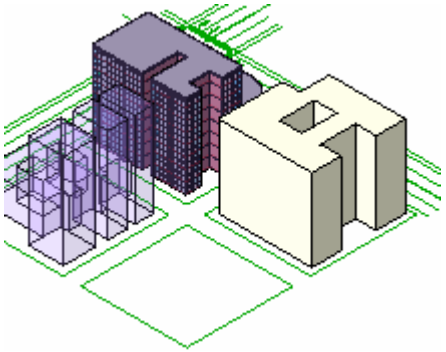


5. In the Import/Link dialog box, set:

   a. Files of type = SketchUp
   b. File to Import = Unit 9b – NW building.SKP
   c. Select Link Instead of Import
   d. Preserve Colors
   e. Automatically place Origin to origin



6. Click Open.



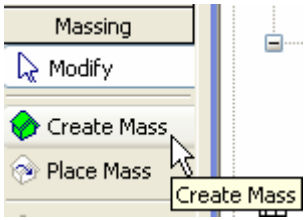
The SketchUp model is read into the Revit Building project.

Import a SketchUp Model into an In-Place Mass Family

While the SketchUp model is displayed in the Revit Building project, it acts as a solid block. For more flexibility with the SketchUp model, you can import it into an in-place mass or a Revit mass family (RFA).

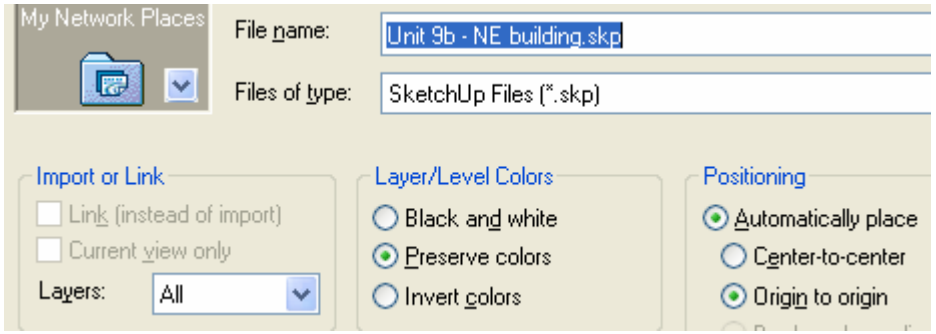
Once the SketchUp file has been nested inside a mass, you can use the Building Maker features as explained in Unit 9, Exercise A.

7. Click the Create Mass tool to start the In-Place Mass routine.



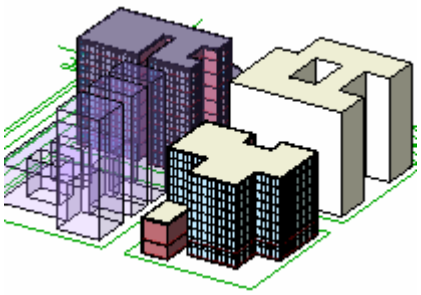
8. Name the new mass Building 5.

9. Repeat the steps in the first part of this exercise to import a SketchUp model. Import the SketchUp file: Unit 9b – NE building.skp.



10. On the Design Bar, click the Finish Mass button.

11. Apply walls, floors, and roof of your choosing.



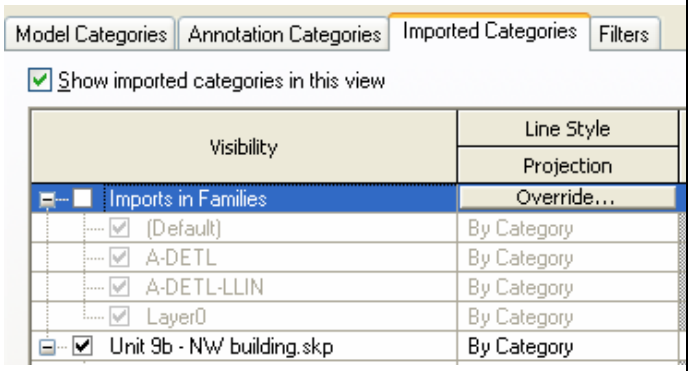
If you need assistance with this review, see the previous exercise for step-by-step instructions on applying walls, floors, and roof to faces of the mass (Building Maker functions).

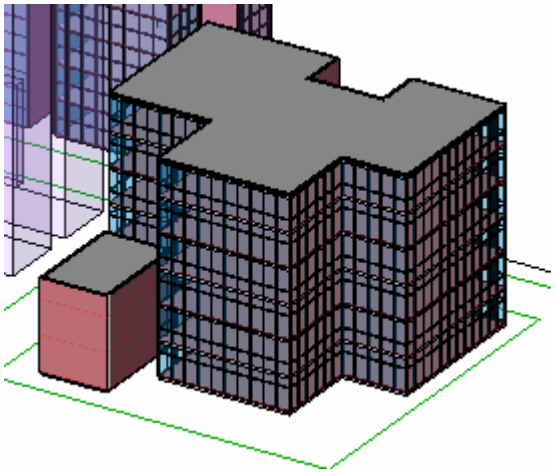
Turn off the SketchUp Model

Like any other imported file, you have control over the visibility of the graphics of the linked file

12. Type VV to access the views graphic overrides.

13. Clear the Imports in Families.





Unit 10

Theory: Component Design

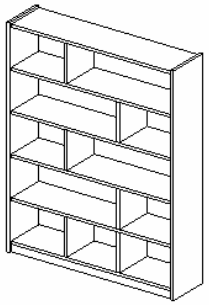
Autodesk Revit Building: Family Editor

This workbook unit is to be used with lecture units 10 and 11. Unit 10 builds a shelf unit as a furniture family using solids. This shelf is the basis for the multiple exercises in Unit 11. This exercise is long, so give yourself enough time to finish it, or save it in a location that you can access later.

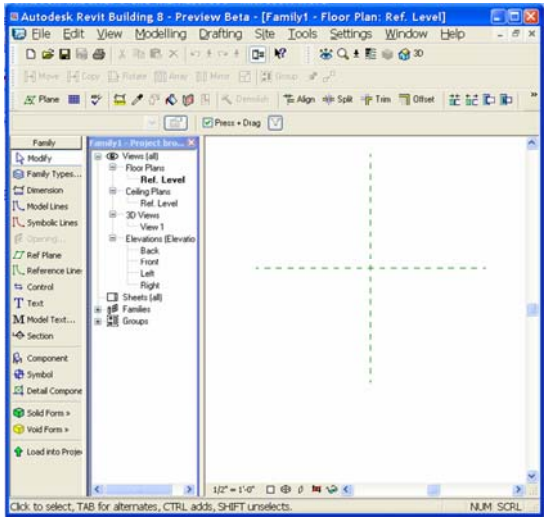
This exercise uses dimensions and align tools extensively. You should be familiar with these tools before you start this exercise.

Creating a Component Family

1. In this unit you create a furniture family, as shown in the image.



2. From File menu, choose New>Family.
3. In the dialog box, open the template called Furniture.rft.



The Family Editor opens: note that the work environment is similar to project mode. The Design Bar provides just one Family Bar. The usual bars are not available (Site, Modeling, Structural, and so forth) because they are not used for family creation. The Project Browser does not differ much: there are plan views, elevations (which are named differently), and 3D views. In the menus, some tools are not accessible (dimmed).

4. From the File menu, choose Save As.
5. Browse to the data set folder that contains the workbook exercise files.
6. Open the *rfa* folder in this location.
7. Save this file as Shelf Unit.

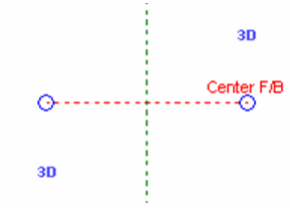
Note: The completed *rfa* files for Units 10 and 11 are in the *Completed rfa* folder.

The other shelf units in this folder are starting points for Unit 11 exercises.

Create Overall Reference Planes

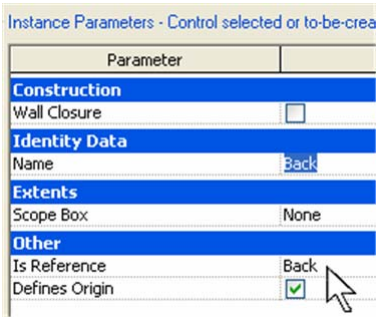
When you are working with families, you are creating reference planes. These reference planes are assigned the parameters that drive the geometry.

8. In the Project Browser, open Floor Plans>Ref Level.
9. Right-click the horizontal reference plane and choose Properties.



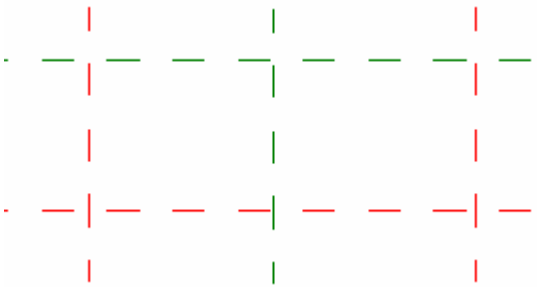
In this view there are two reference planes. The intersection of these two planes represents the insertion point of the family. In this case, this point is the rear (back) and the middle of the piece of furniture. Begin by changing the name of this reference plane.

10. In the Properties dialog box, change the name to Back and verify that Is Reference: Back is selected. Click OK to exit.



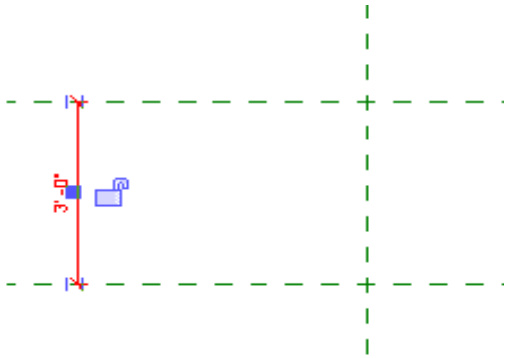
Reference planes are important in the creation of families. It is on these lines that you base the parameters of your family; they are references for the geometry. Adding reference planes is easy. Simply specify a starting point and a final point (just like drawing a line). The length of the line symbol is not important. If necessary, you can resize it using the grips that appear at its ends when it is selected.

11. Click the Reference Plane button on the Design Bar and add three planes, as shown in image (don't worry about the distances between each plane).

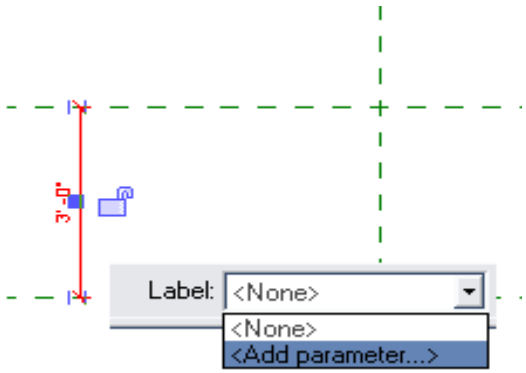


You must be able to vary the width and depth of your piece of furniture, so you add two new parameters to your family. To create a parameter you must add a dimension and assign it a label. The depth of the furniture family corresponds to the distance between the two horizontal reference planes; the width corresponds to the distance between the two vertical reference planes (right and left).

12. Click the Dimension button on the Design Bar, and add a dimension line between the two horizontal reference planes.



13. Click the Modify button on the Design Bar, and select the dimension. On the Options Bar, open the Label list and click Add Parameter.

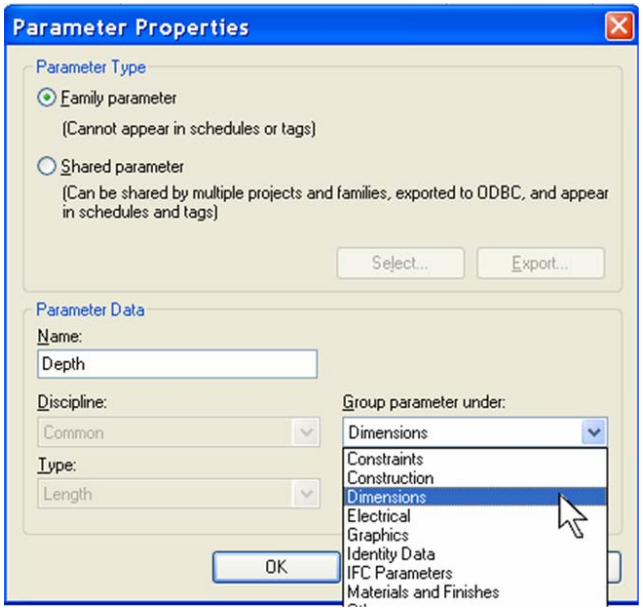


You can also right-click the dimension line and choose Edit Label from the context-sensitive menu.

14. In the Properties dialog box for the parameter, enter Depth as the name. The options suggested by default are that this is a Type parameter.

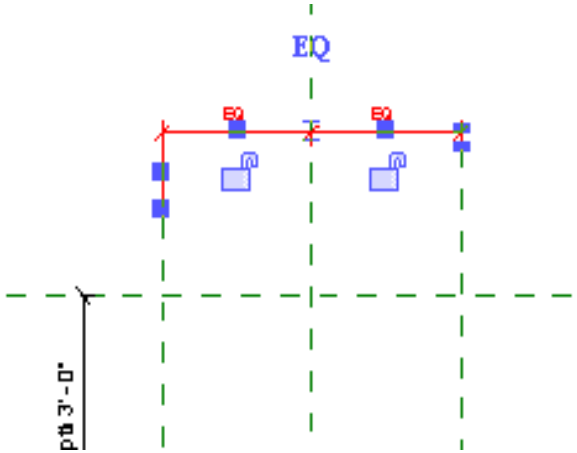
15. Set the Group Parameter Under option to Dimensions.

16. Click OK.



17. Click the Dimension button on the Design Bar and add a dimension between the three vertical reference planes (click each line and position the dimension line with a left mouse-click).

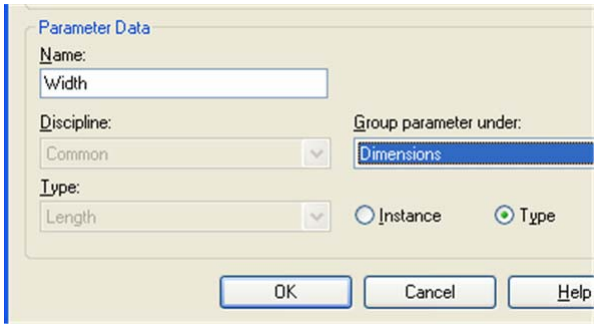
18. Click the EQ symbol that appears.

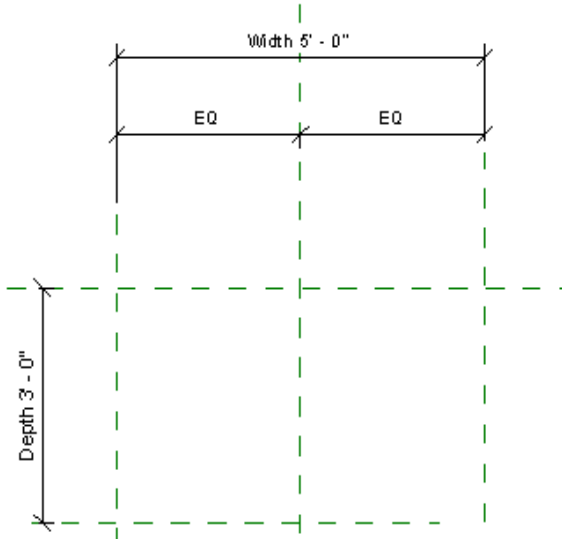


The vertical reference plane between the two other planes is the axis of the furniture. Thus, it must be equidistant between the planes on the right and left. To achieve this and keep it as a constant during the design, you need to add a dimension between the three reference planes and to activate the equality constraint (EQ symbol).

19. Repeat the earlier steps to add the width parameter.

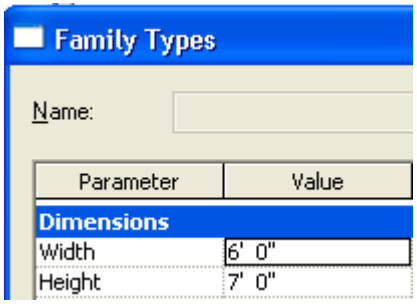
    a. Add a dimension.
    b. Click the dimension, and click Add Label on the Options Bar.
    c. Set the label as follows:
        - Name = Width
        - Group Parameter Under = Dimensions
        - Type parameter





20. Click the Family Types button on the Design Bar, change the Depth and Width values, and then click Apply.

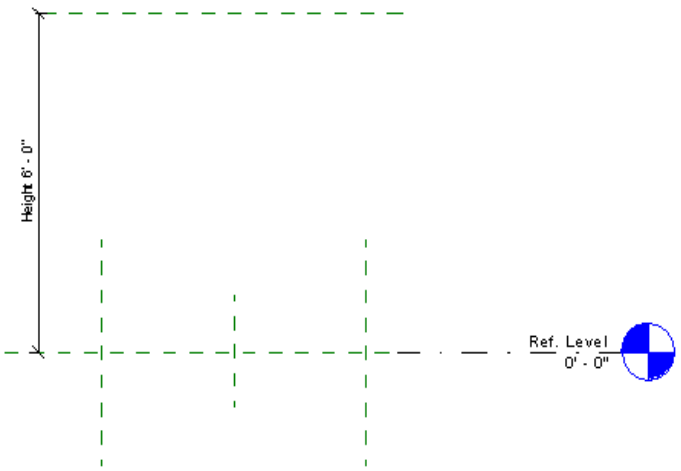
21. Click OK.



During family design, it is important to test the parameters to check that all is working properly. You have just added two parameters in your family. You can test them by changing some of their values. During this test, reposition the reference planes. You should not receive any error message.

This process is referred to as flexing the family parameters.

22. In the Project Browser, click Front View.
23. Add a horizontal reference plane, add a dimension between the reference plane on the ground and the one you have just added, and transform this dimension into a parameter named Height (also a type parameter in the Dimension group).
24. Flex the family by changing parameter values in the Family Types dialog box.
25. Save your project.

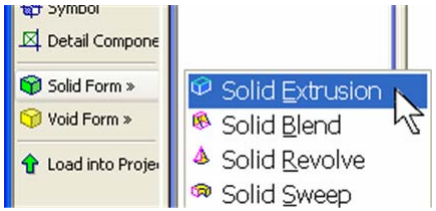


Remember to save your work regularly. You can decide to create a new tree structure of files under the main *Library* folder. It's a good idea to keep your personal libraries separated from the installed library.

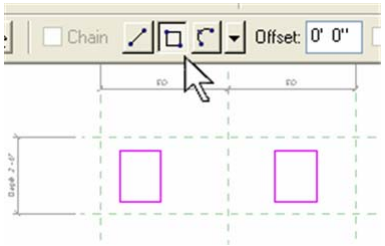
Create the Side Supports

Now that the reference planes are in place, you create the side supports with the Solid Extrusion tool.

26. Activate the view Ref. Level.
27. On the Design Bar, click the Solid tool, and choose Solid Extrusion.

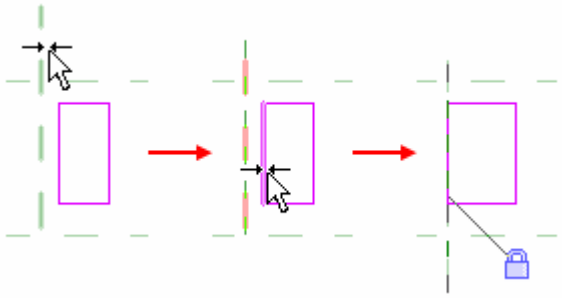


28. On the Design Bar, click the Lines button, and on the Options Bar, click Rectangle. Trace two rectangles, as in the image (the size is not important).



Sketch mode is used for creating forms: the Design Bar displays the tools available to create the sketch, which must be a closed loop.

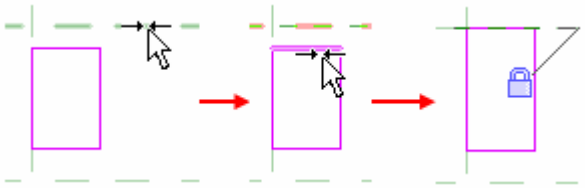
29. Use the Align tool to lock the left sketch line to the left reference plane, as in the image.



   a. Click Align tool.
   b. Click left reference plane.
   c. Click left line of the left rectangle sketch line.
   d. Lock this alignment by closing the small lock that appears (click the symbol).

30. Repeat the process for the right rectangle, locking the right edge to the right plane.

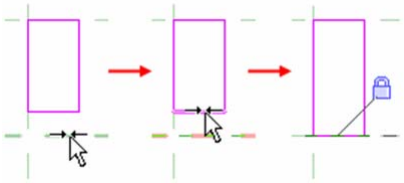
31. Use the Align tool to lock the top sketch lines to the upper reference plane, as in the image.

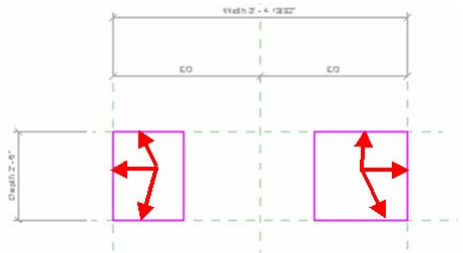


   a. Click Align tool.
   b. Click upper reference plane.
   c. Click top line of the left rectangle sketch line.
   d. Lock this alignment by clicking the lock symbol.

32. Repeat the process for the right rectangle's top sketch line.

33. Repeat this process for the bottom sketch lines, locking them to the lower reference plane.

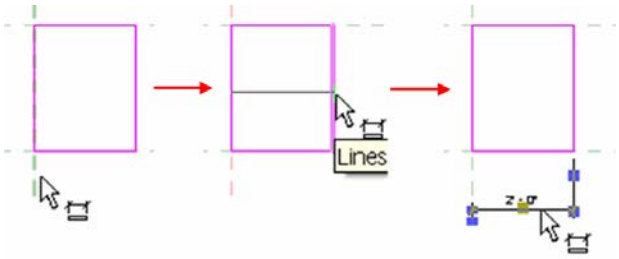




The sketch lines shown here should now be aligned/locked with their respective reference planes.

34. On the Design Bar, click Dimension.

35. Click the left reference plane, then the right line (which is not locked), and then position the dimension.



When you dimension a sketch like this, you want to run the dimension to the reference plane rather than the sketch line. This allows the sketch to flex as you use the dimensioned label parameters to drive the geometry.

36. Click the Modify tool.

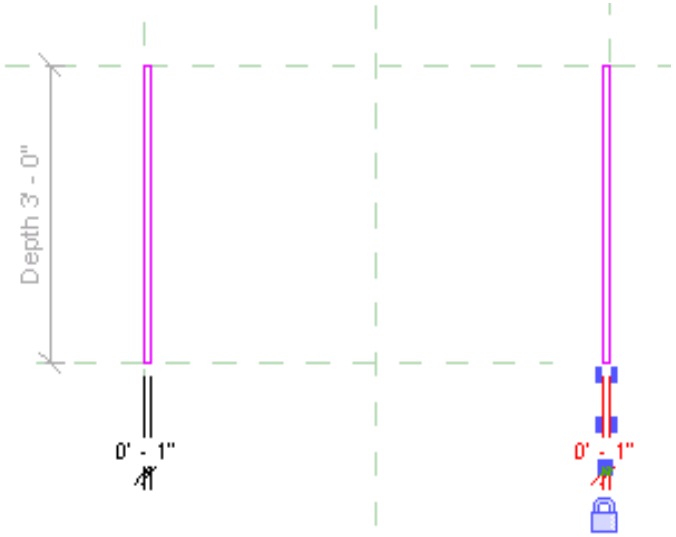
37. Select the sketch line on the right side of the rectangle you just dimensioned.

38. Click the dimension text and change the value to 1”.

39. Lock the dimension by clicking the lock symbol.

40. Repeat the process for the sketch on the right side.

41. Click Finish Sketch.

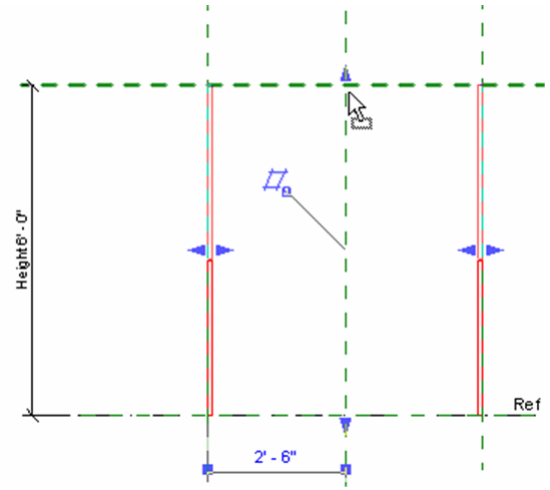


42. In the Project Browser, select Front view.

43. Select the 3D geometry. Blue grips that can be used for dragging the faces appear.

44. Drag the grip that allows changing of the height of the solid element until you reach the top reference plane.

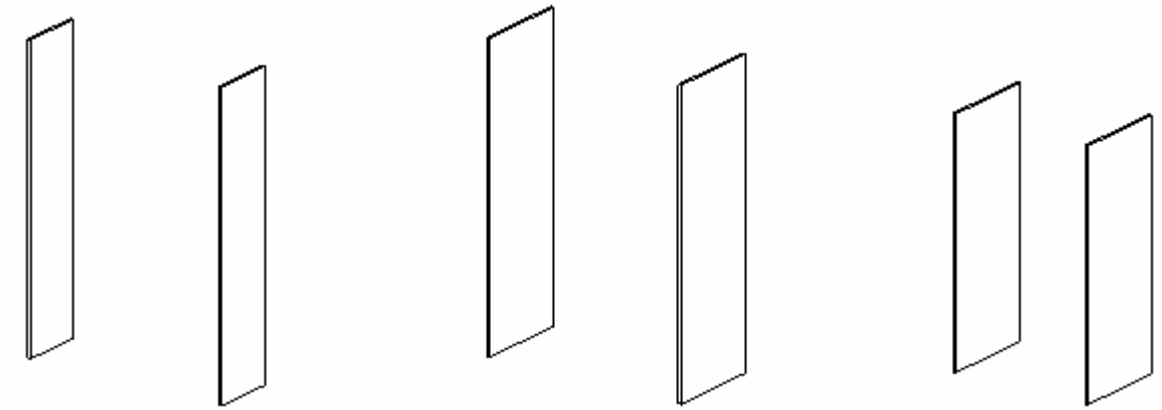
45. Click the lock symbol to lock the alignment.



You can also use the Align tool to accomplish this task.

Because you drew two rectangles in sketch mode, you have only one vertical grip that controls the height of both side frames.

46. The vertical sides are finished. Test your work by varying the parameters of the family (width, height, depth) in the Family Types window (flexing the model). The 3D geometry must update consequently and no error message should appear. To see the effect of the parameters well, open a 3D view.



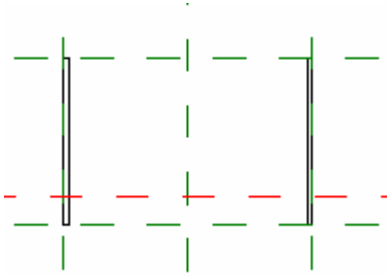
Add the Shelves

Again, like the side supports, draw the reference planes and then the solid extrusions.

47. Create the reference planes for the shelves.

48. Open view Ref. Level in the Project Browser.

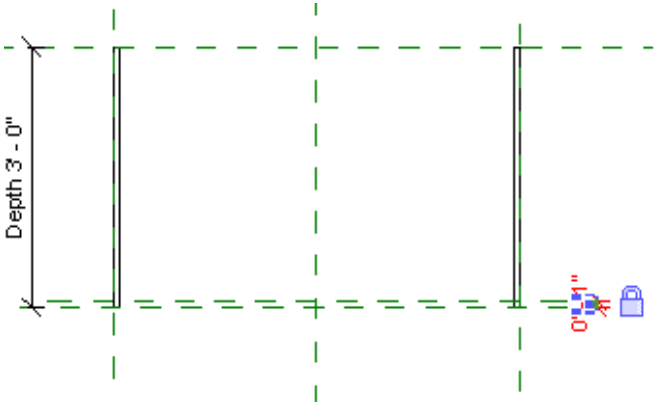
49. Add a horizontal reference plane just above the one that defines the depth of the furniture family.



50. Add a new dimension line between the bottom reference plane and the one you just created.

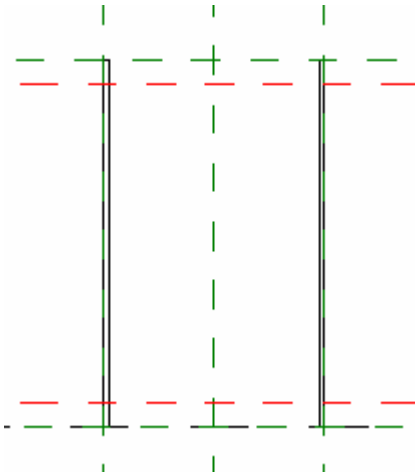
51. Select the reference plane and change the dimension text to 1”.

52. Lock the dimension.



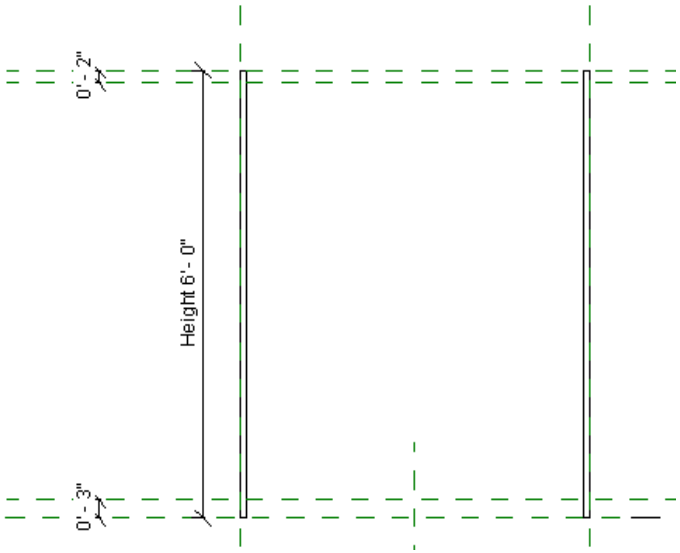
53. Open the front view.

54. Add two horizontal reference planes, as shown in image.

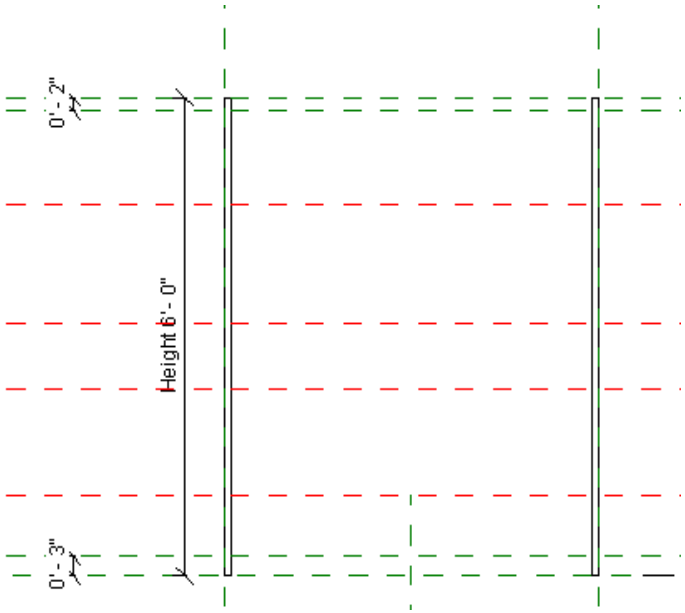


55. Dimension and lock the upper two reference planes to 2”.

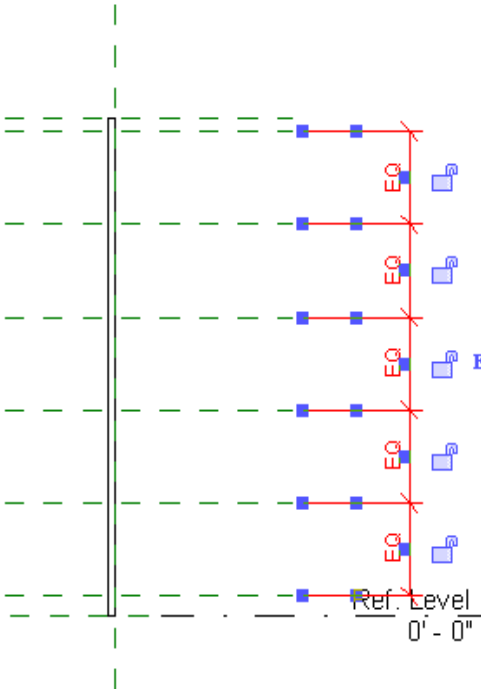
56. Dimension and lock the lower two reference planes to 3”.



57. Add four more reference planes, as shown in image.



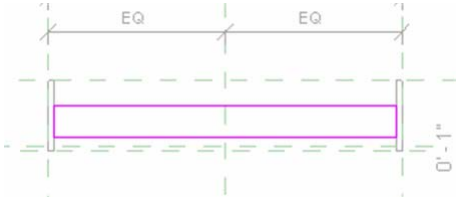
58. Click Dimension, and then click the four reference planes as well as the two created in the previous step.
59. Click the EQ symbol.
60. Flex the model by changing parameter values.
61. Save the file.



A few words to explain these reference planes: two of them cannot move. They are constrained by locked dimensions (50 and 34). The other four are spaced regularly because of the dimension line that constrains the distance between them. Thus, if the height of a piece of furniture is modified, the top and bottom parts are fixed, whereas the distance between the four other planes is adjusted to satisfy the equality constraint.

Add a Base Trim

62. Open view Ref. Level.



63. On the Design Bar, click Solid Form>Solid Extrusion.

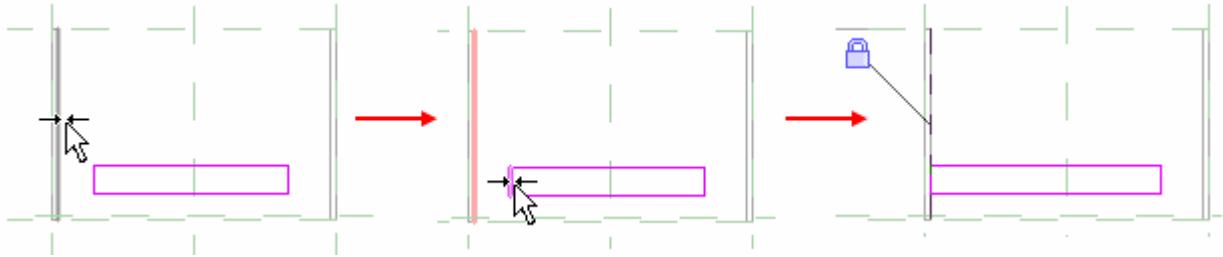
64. On the Design Bar, click Lines, and then click the rectangle template on the Options Bar.

65. Draw a rectangle, as shown in image. The size is not important.

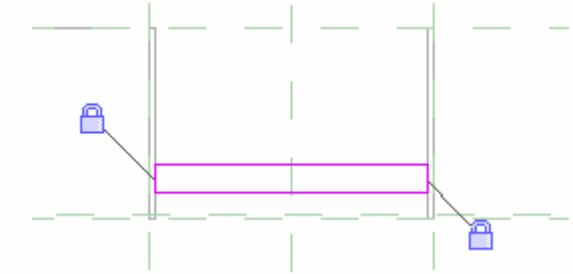
66. Click the Align button on the toolbar.

67. Click the internal face of the upright, and then click the nearest line of the rectangle.

68. Lock this alignment by clicking the lock symbol to close it.

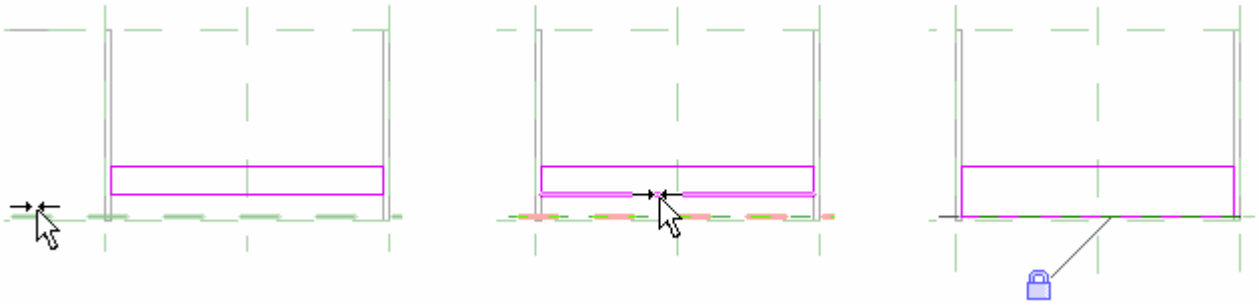


69. Repeat the process on the right side. Don't forget to lock the alignment.



70. With the Align tool, click the horizontal reference plane on the bottom and then click the nearest horizontal line of the sketch.

71. Lock this alignment by clicking the lock symbol to close it.

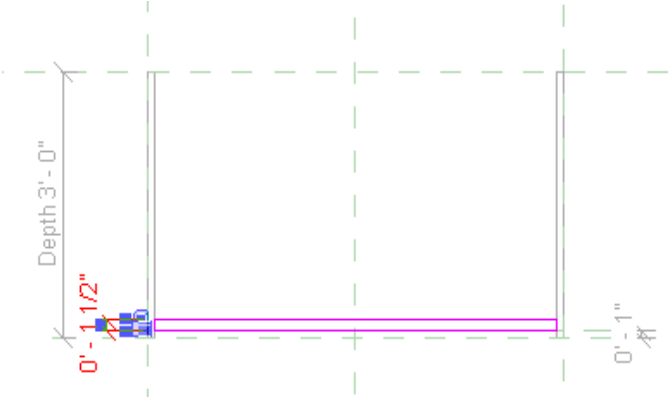


72. Add a dimension between the reference plane immediately above the one that defines the depth, and then click the line that you did not lock.

73. Select the line, and in the dimension text change the value to 1 ½”.

74. Select the dimension and lock it.

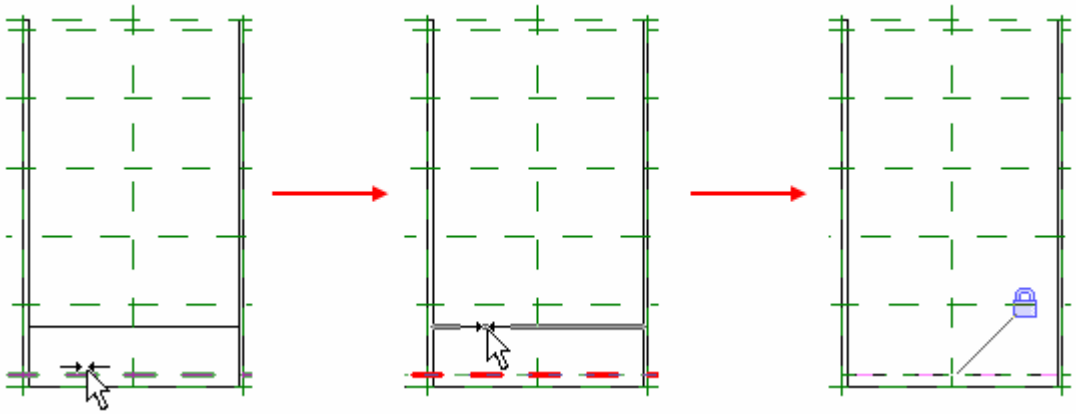
75. Click Finish Sketch.



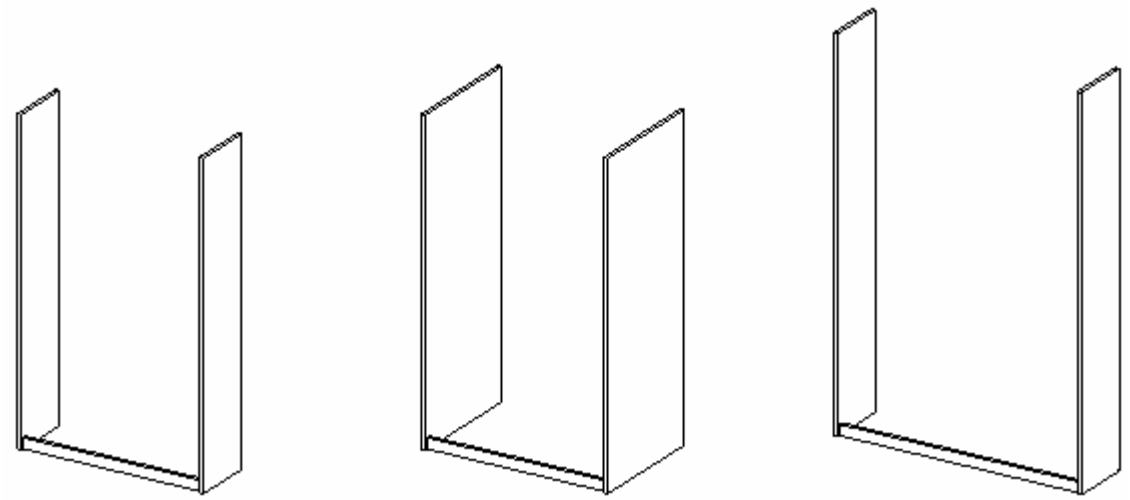
76. Open the front view.

77. Click Align.

78. Click the reference plane that is directly below the top of the solid you just created, and then click the top of the solid. Lock the alignment by clicking the lock symbol.

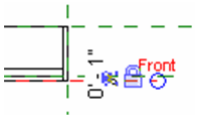


79. Flex the model.
80. Save the family.

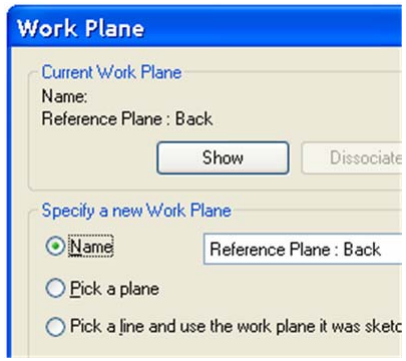


Add Shelves

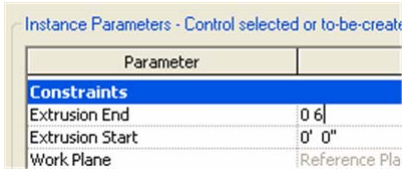
81. Open Ref Level.
82. Right-click the lowest horizontal reference plane, and choose Properties.
83. Rename the reference plane to Front.



84. Open the front view.
85. On the Design Bar, click Solid Form>Solid Extrusion.
86. On the Design Bar, click the Set Work Plane tool.
87. Set the work plane by Name to Back.
88. Click OK.



89. On the Design Bar, click Extrusion Properties.
90. Set the Extrusion end to 6”.



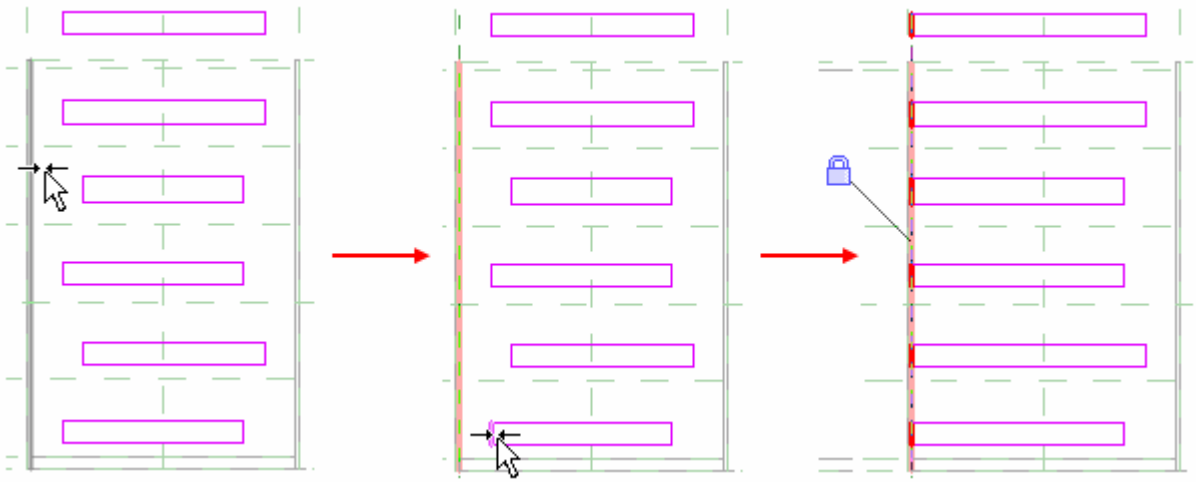
You could set this to 12” here, but you will align and lock this front edge to a reference plane when you are finished with this sketch.

91. Use the Line's rectangle tool to draw six rectangles, as shown in image. The size is not important.

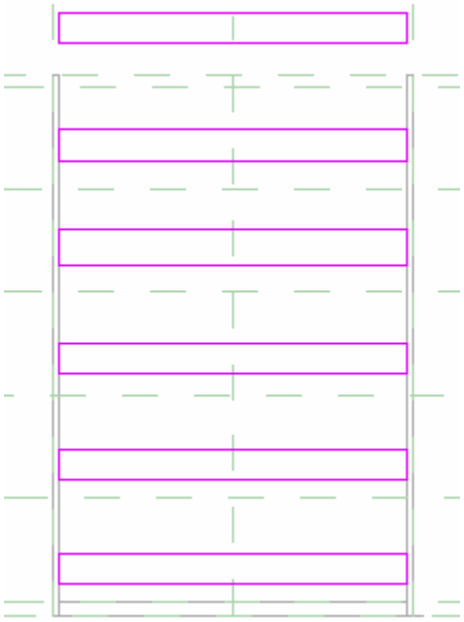
92. Click the Align tool, and on the Options Bar select Multiple Alignment.

93. Click the interior face of the left upright and then click the left vertical lines of the rectangles (one at a time).

94. Lock each alignment (you must lock each line individually after aligning it).



95. Repeat the process for the lines on the right side. Remember to lock the alignments.

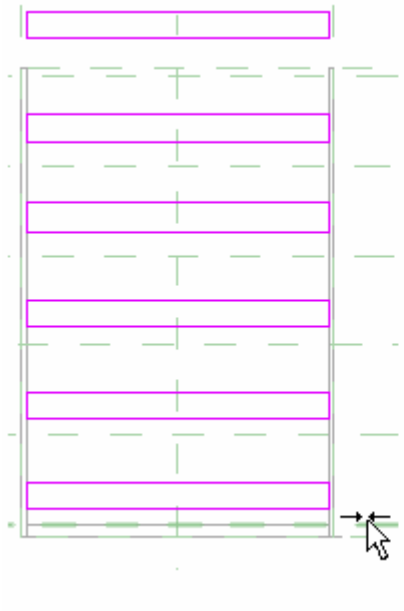


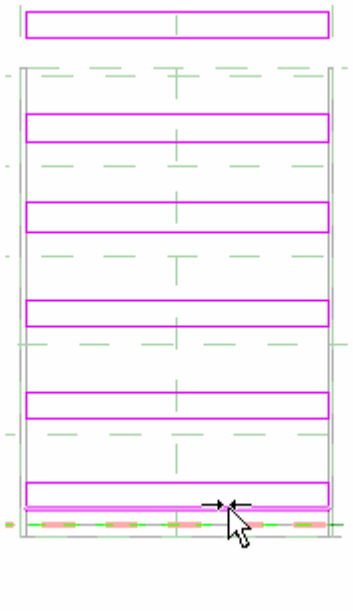
These alignments allow the horizontal racks to remain in contact with the vertical uprights if the furniture family's width is resized. You should now force the horizontal lines of the rectangles; the lines of the bottom of the rectangles must be respectively aligned with the reference planes that are subjected to the equality constraint.

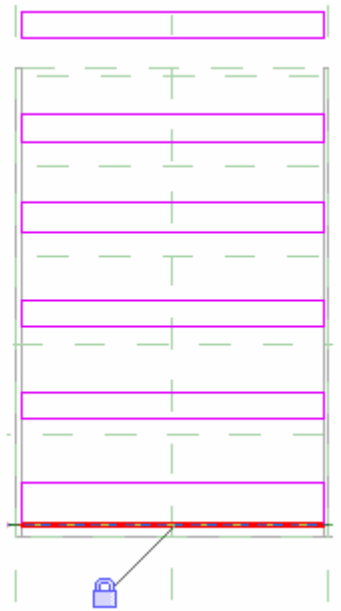
Then you need to place a dimension between each reference plane and the top line of the rectangles: one adjusts dimension and one locks the dimension. Thus, if the height of the furniture changes, the racks cannot vary in thickness. Thanks to the equality constraint, they reposition themselves correctly to divide the obtained space.

96. Click the Align tool, and on the Options Bar, clear the Multiple Alignment option.

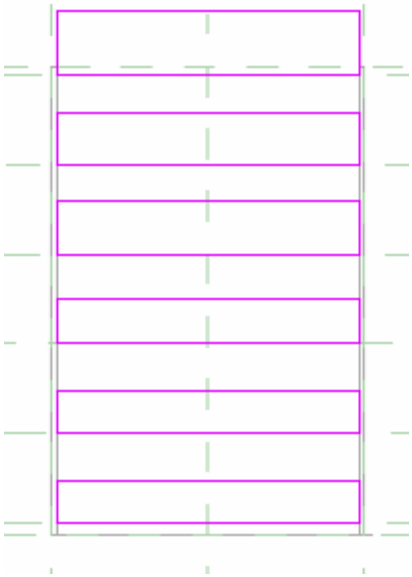
97. Click the reference plane right above ground level and then on the bottom horizontal line of the lowest rectangle. Lock the alignment.







98. Repeat the alignment process with the horizontal reference planes and the bottom lines of the rectangles, as shown in image.



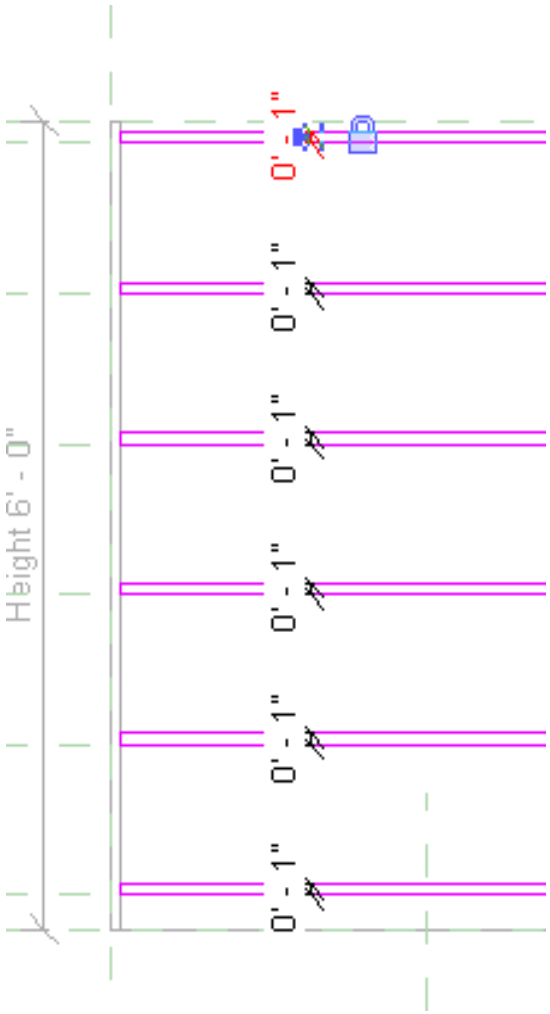
99. Add a dimension line between the reference plane and the top line of the rectangle located on the bottom, as shown in image.

100. Select the line and change the dimension text to 1”.

101. Lock the dimension.

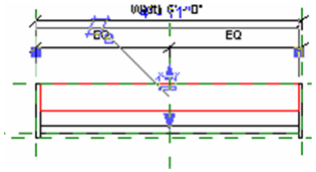
102. Repeat the process for all horizontal lines (located on the top of the rectangles). Remember to lock the dimensions.

103. Click Finish Sketch.

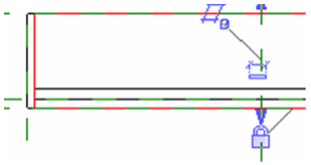


104. Save the family.

105. Open Ref. Level.

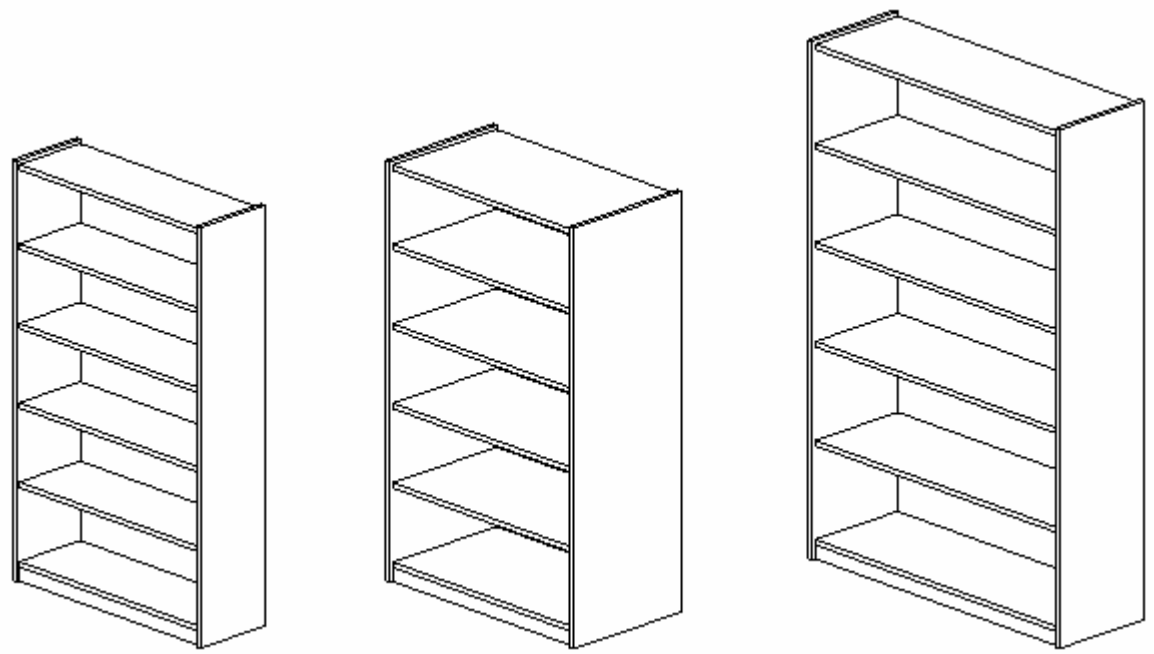


106. Drag the lower blue grip to the horizontal reference plane, as shown in image. Click the lock symbol to lock it. If the lock symbol does not appear, use the Align tool.



107. Flex the model.

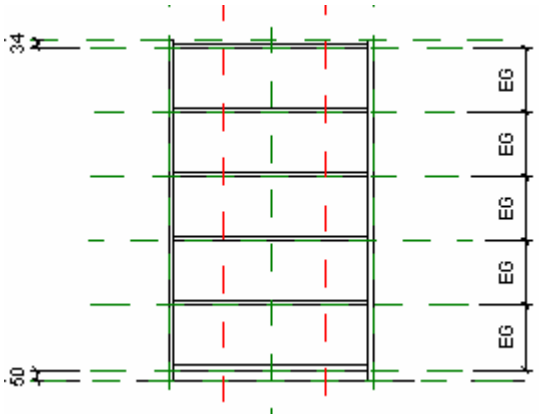
108. Save the family.



Add Vertical Supports

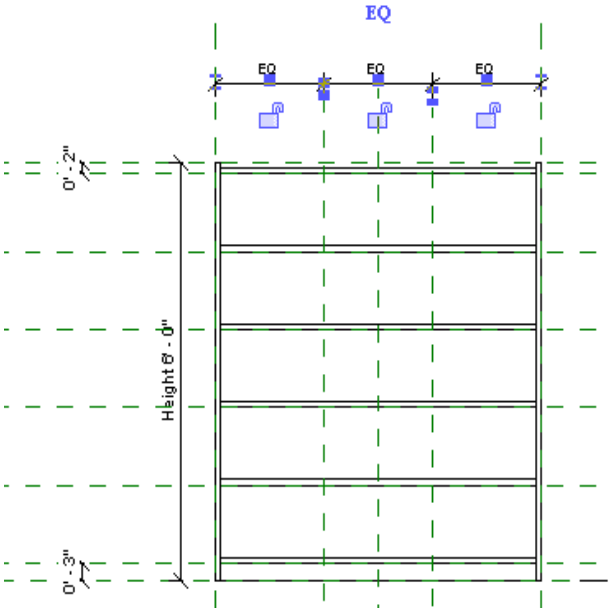
109. Open front view in the Project Browser.

110. Add two vertical reference planes, as shown in image.



111. Add a dimension line between the two reference planes you just added and the external ones, as shown in image.

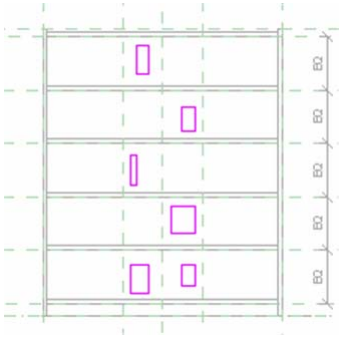
112. Click the EQ symbol.



113. On the Design Bar, click Solid Form>Solid Extrusion.

114. On the Design Bar, click Lines, and then click the rectangle template on the Options Bar.

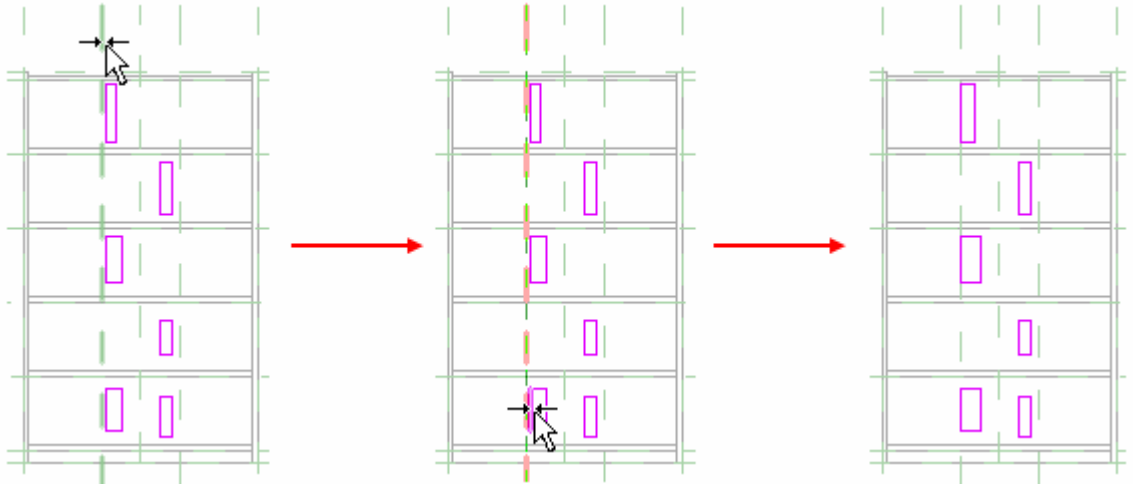
115. Draw six rectangles, as shown in image. The size is not important.



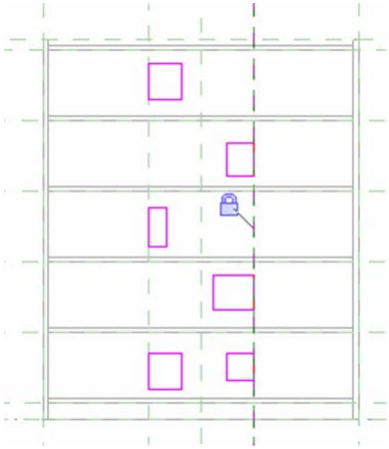
116. Click Align on the toolbar. On the Options Bar, select Multiple Alignments.

117. Click the left reference plane (see image) and align the three rectangle lines, as shown in image.

118. Lock each alignment as you make it.



119. Repeat the process with the remaining rectangles and the right reference plane.

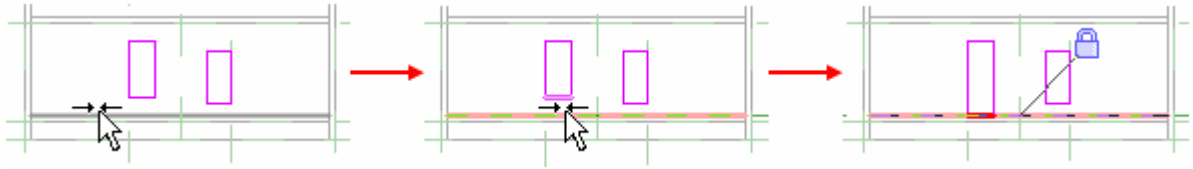


All these alignments are locked to maintain this constraint when you change the value of the furniture family's width parameter.

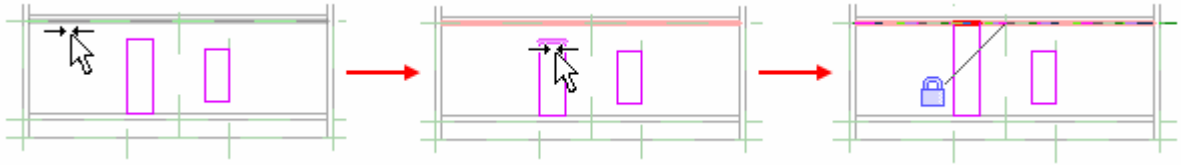
120. Click Align. On the Options Bar, clear the Multiple Alignment option.

121. Align the bottom line of the bottom rectangles, as shown in image.

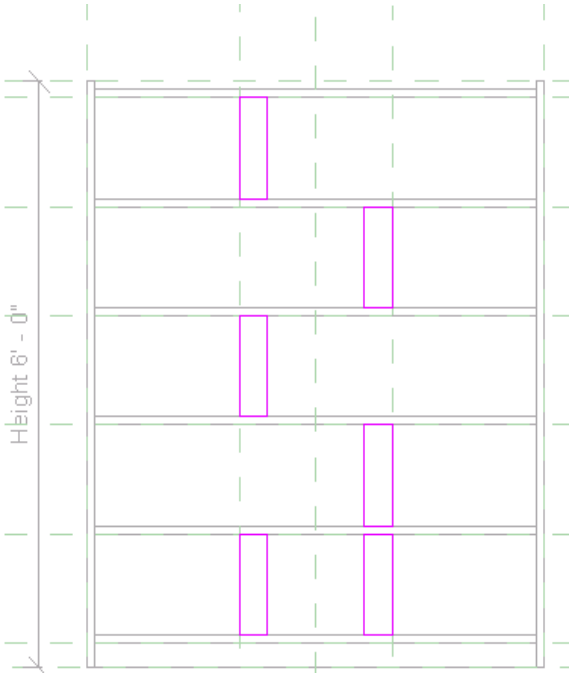
122. Lock the alignment.



123. Repeat the process with the top lines (see image).



124. Repeat the process for all the rectangles.



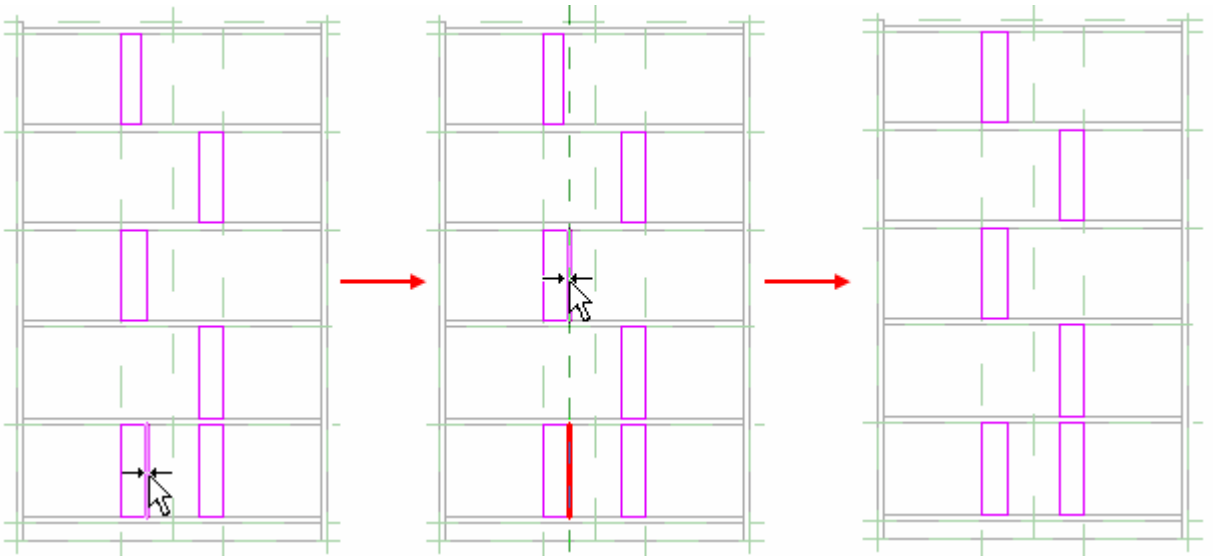
It is now necessary to manage the thickness of vertical separations. You operate in a way identical to the preceding stages, namely, a dimension locked between the reference plane and the unconstrained line of the rectangle. But before that you align the sides of the rectangles between them (on the left and right).

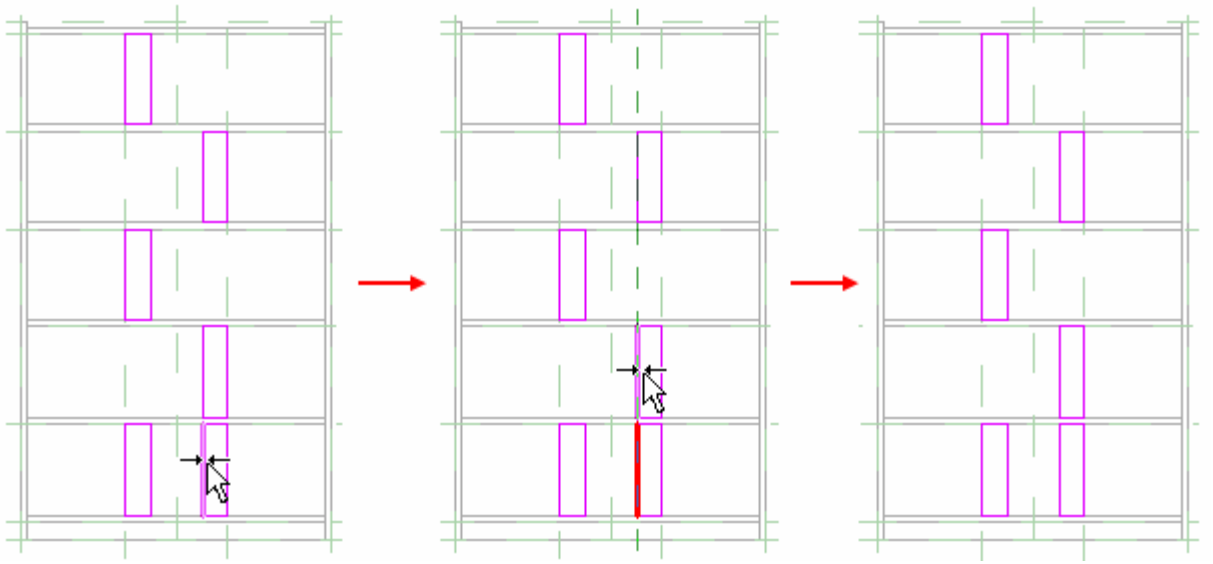
125. Click Align on the toolbar. On the Options Bar, select Multiple Alignment.

126. Click the right vertical line of the bottom left rectangle and then click the right vertical lines of the rectangles on top of it (see image).

127. Lock each alignment as you make it.

128. Repeat the process for the rectangles on the right side.

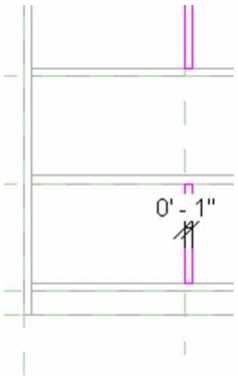




129. Place a dimension line between the vertical lines of the bottom left rectangle (see image).

130. Select the line, and in the dimension text change the value to 1”.

131. Select the dimension and lock it.



Because the right sides of this set of rectangles are locked together, you need to place only one dimension to control all rectangles in that set.

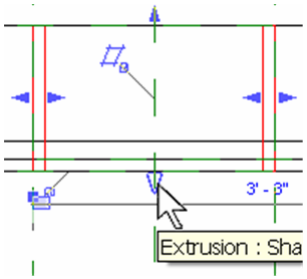
132. Repeat the process for the right rectangle.

133. Click Finish Sketch.

134. Open Ref. Level view.

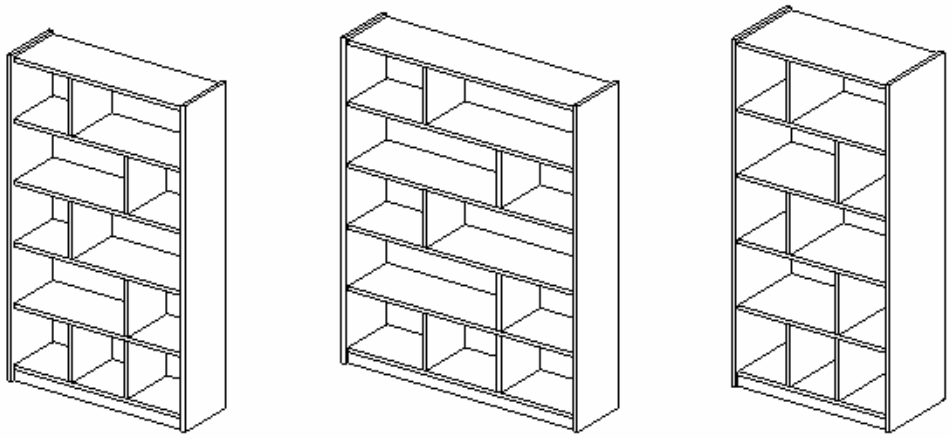
135. If the vertical supports are too narrow, select the 3D geometry and use the blue grips to align the bottom face, as shown in image.

136. Lock the alignment.



137. Flex the model.

138. Save the family.

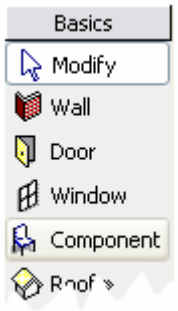


139. Start a new project to insert this family.

140. From the File menu, choose Load from Library>Load Family.

141. Navigate to where you saved the family and open it.

142. On the Design Bar (Basic), click the Component button. You can now place your family.



To test your new family in a project, you load it in a project. You can then insert it from the Component tool. Do not forget that your family is parametric! To find the Width, Height, and Depth parameters, open the Type properties of the family.

Unit 11

Theory: Propagation of Constraints

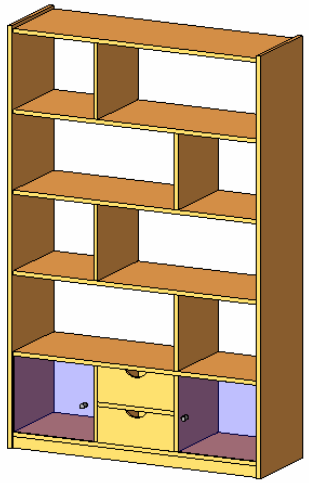
Autodesk Revit Building: Alignment, Locking, and Constraints

This unit is to be used with Lecture Units 10 and 11. Unit 11 builds on the family created in Unit 10. This unit has several exercises designed to illustrate various capabilities of the family within Autodesk Revit Building.

- Exercise A: Add the symbolic line representation to create the coarse, medium, and fine detail views. In addition, this exercise works with in-place family editing from the project environment.
- Exercise B: Add a material parameter to control the materials assigned to shelf unit.
- Exercise C: Add a glass door and assign a visibility parameter to control the display of the glass element.
- Exercise D: Work with nested families to add a drawer unit to the family, using the parent shelf parameters to drive the geometry of the nested family.
- Exercise E: Fine-tune the family, adding control of family elements through the use of subcategories.

In this unit you complete the furniture family created in the previous unit by adding components to it. See image.

The family that you created in the first part of the exercise requires more work so you can use it properly. You need to generate its 2D representation, associate all necessary materials, and define the levels of detail. Later in the exercise, you can experiment with nested families and formulas—an enormously powerful part of the Family Editor.

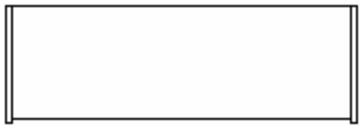


Exercise 11a: In-Place Family Editing and Symbolic Line Representation

In Unit 10 you worked with the Family Editor. In-place family editing provides access to the family definition directly from the project environment.

Symbolic Lines and View Detail Level

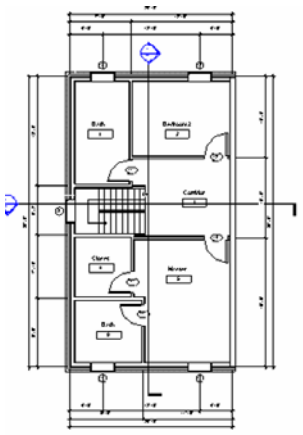
When you create a family, you need to define how that family behaves in different views (plan, section, elevation, 3D). The first important decision is its 2D representations: will the display of the family in plan view simply result from a cut 3D view, or should it be represented with a simple 2D sketch? In this case, it is not generated from the 3D model but is represented with a 2D sketch that you create. After you have defined the way your family (object) is displayed in different views, you need to define its representation in different scales (coarse, medium, fine) for all views. So, this is our objective:

	Coarse	Medium	Fine
Plan View			
Section, Elevation, 3D view	Display representation is generated from the 3D model		

You need to add two new sketch drawings to your family—one for its Coarse-Medium representation and one for the Fine representation. You use the symbolic lines for these sketches. You set the visibility of the objects in the family such that only the sketch lines display in the project and not the 3D elements of the shelf.

Open a Project and Load the Shelf

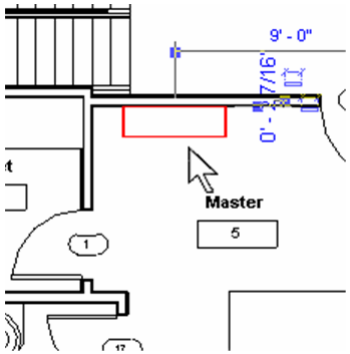
1. Open Unit 11a – Start.rvt.
2. Verify that the file opens to the view Floor Plans: Level 2.
3. From the File menu, choose Load from Library>Load Family to launch the Browse dialog box.
4. Browse to the *Workbook Data Set* folder, and open the *rfa* folder within it.
5. Select the Shelf Unit 11a.rfa.
6. Click Open.



Place an Instance of the Shelf and Create a Cropped 3D View to Make It Visible

7. Click Component tool on the Basic menu. The type should be set to Shelf Unit 11a. By default, the last loaded component is set when you use the Component tool.

8. Place an instance on the north wall of the master bedroom.



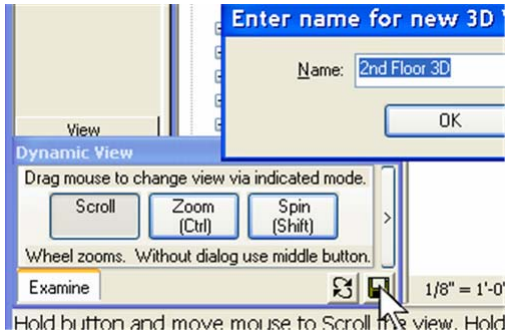
9. Set the 3D view current.

10. Press the F8 key to bring up the Dynamic View dialog box.

11. Click the disk icon in the Dynamic View dialog box.

12. Enter 2nd Floor 3D for the name.

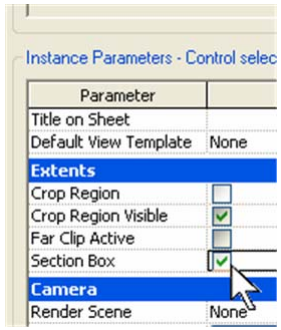
13. Click OK.



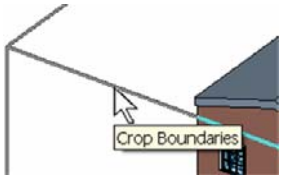
This creates a new view in the Project Browser under 3D views.

14. Right-click in the drawing window, and choose View Properties.

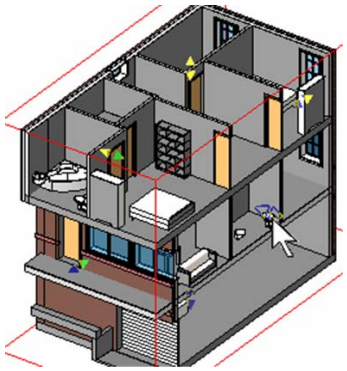
15. In the view properties, select Section Box.



16. Select the section box that appears in the drawing window.

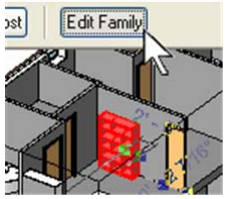


17. Use the face grips to cut away the roof, south walls, and east walls.



18. Select the shelf unit.

19. On the Options Bar, click Edit Family.



20. Click Yes to open the family for editing.

Set up Duplicate Views of the Reference Level Plan

To facilitate the creation of the 2D sketch, you are going to duplicate this view. Revit Building lets you associate different levels of detail to different views: one for Fine and another for Coarse-Medium.

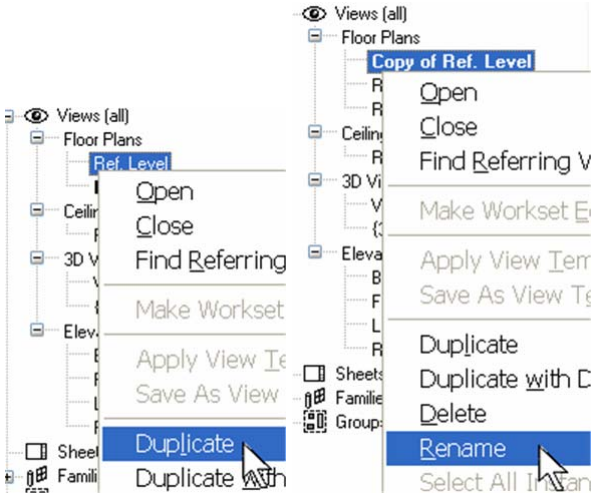
You make only one for both Coarse and Medium because the 2D geometry for these two representations is the same.

21. In the Project Browser, under Floor Plans, activate the view Ref. Level.

22. Right-click Ref. Level, and choose Duplicate.

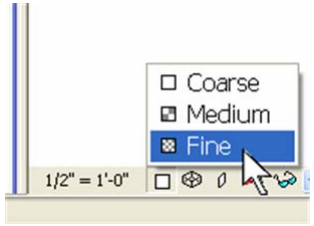
23. Right-click the newly created Copy of Ref. Level, choose Rename, and change the name to Ref. Level (Coarse - Medium). Click OK.

24. Repeat the operation and create a new duplicate named Ref. Level (Fine). When you click OK, Revit Building asks if you want to rename the corresponding view and level. Confirm with OK.



25. Set Ref. Level (Fine) current.

26. Use the Drawing window view toolbar to set the Detail Level to Fine. Using the same method, assure that Ref. Level (Coarse - Medium) has Coarse set as detail level in its properties.



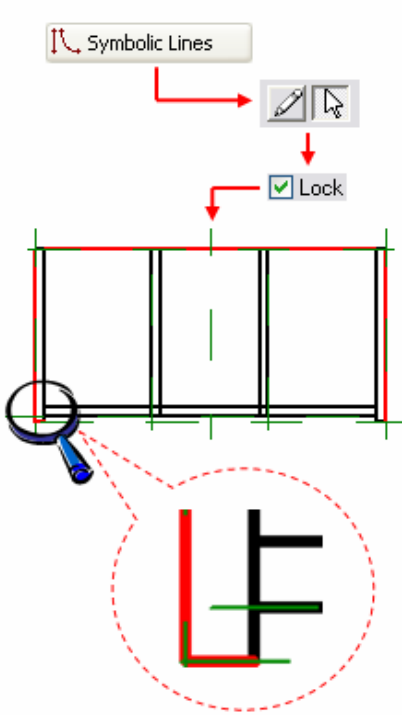
27. Make sure that Ref. Level (Coarse - Medium) is the active view (if not, double-click it).

28. On the Design Bar, click Symbolic Lines.

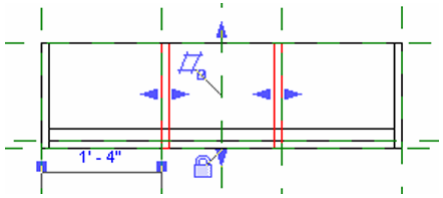
29. On the Options Bar:

    a. Click the Arrow button (Select).
    b. Select the Lock item.

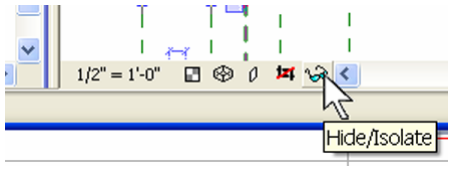
30. Select the lines by clicking them, as shown in the image.



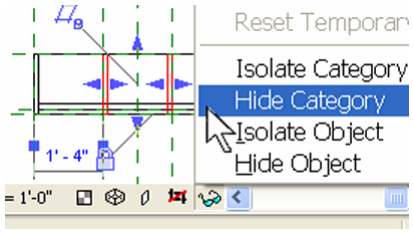
31. Click the Modify tool, and select the vertical separations as shown.



32. From the drawing window view toolbar, select the Hide/Isolate icon.



33. Choose Hide Category from the context-sensitive menu.



A check in the Lock box means that the selected lines automatically lock to the geometry from which they have been generated.

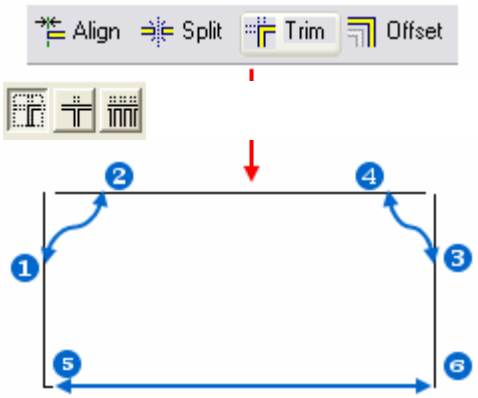
You need to trim the symbolic lines you have just created. But because there is a lot of overlapping geometry, this can be a tedious task. To simplify it, Autodesk Revit Building offers a temporary Hide/Isolate option to hide all 3D geometry, as well as the reference plane. You then have a pure 2D sketch drawing on which it is much easier to work.

34. Select a reference plane and again choose Hide Category.

Note the lower-right corner does *not* return.

35. On the Tools toolbar, click Trim. Verify that the Options Bar mode is set to Trim/Extend to Corner.

36. Trim the lines to close the rectangle.



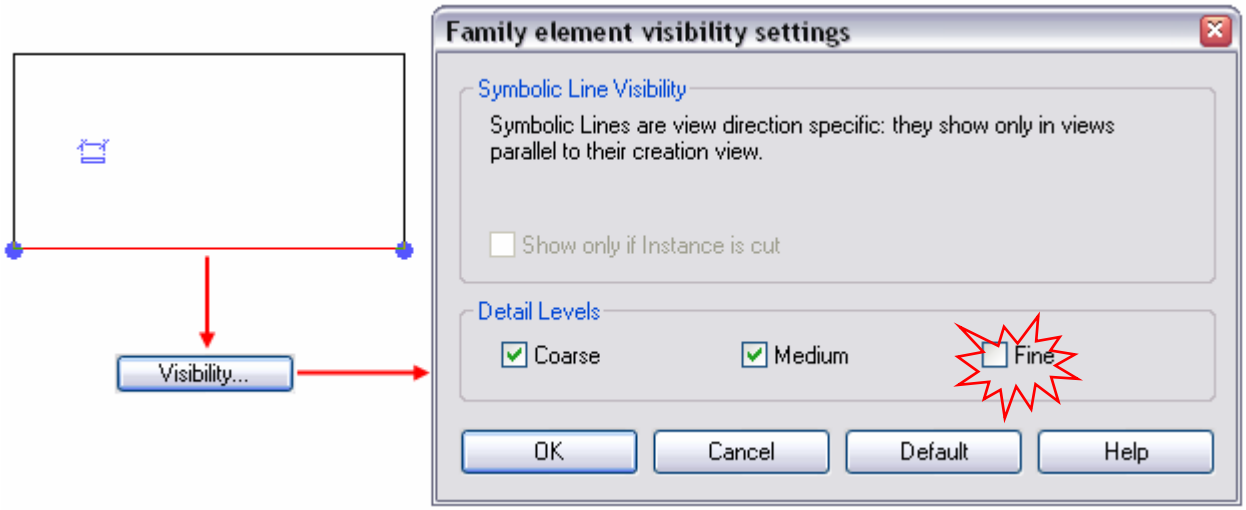
You have just finished defining the 2D sketch for the Coarse – Medium level of detail. What remains is to tell Revit Building which lines should *not* be associated to the Fine level of detail.

37. On the Design Bar, click Modify, and then select the line that represents the front of the furniture.

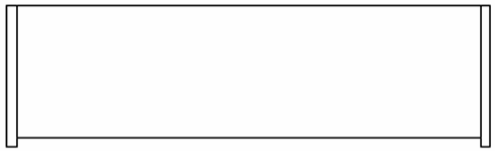
38. On the Options Bar, click the Visibility button.

39. Clear Fine in the Family Element Visibility Settings dialog box. Thus the selected line is invisible in views set to this level of detail.

40. Click OK to confirm.

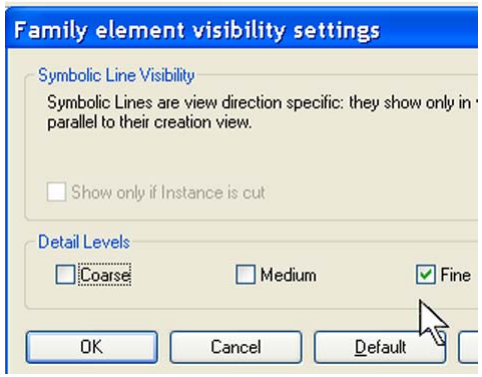


41. Activate the Ref. Level (Fine).
42. Right-click in the drawing window and choose Zoom Fit.
43. Use the same methods to:
44. Hide the Reference Plane category.
45. Use Symbolic Lines – Pick Lines – Lock.
46. Hide the solid geometry category.
47. Clean up the symbolic lines as shown.



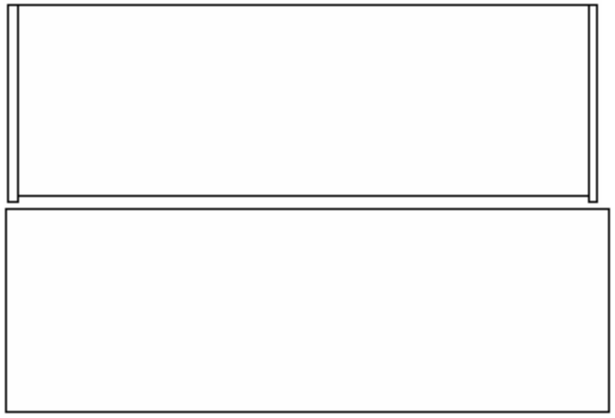
Remember to use the Symbolic Lines Pick tool with the lock so the symbolic lines are related to the solid geometry. The solid geometry is driven by the family type parameters. If you just hide everything and draw the lines, they do not flex with the model.

48. Set the visibility of the newly created lines to Fine.
49. Click OK.



Flex the Family

50. Tile the screen so you have both views next to each other.
51. Try modifying the Width or Depth parameter. Note that the 2D geometry follows the change and updates.

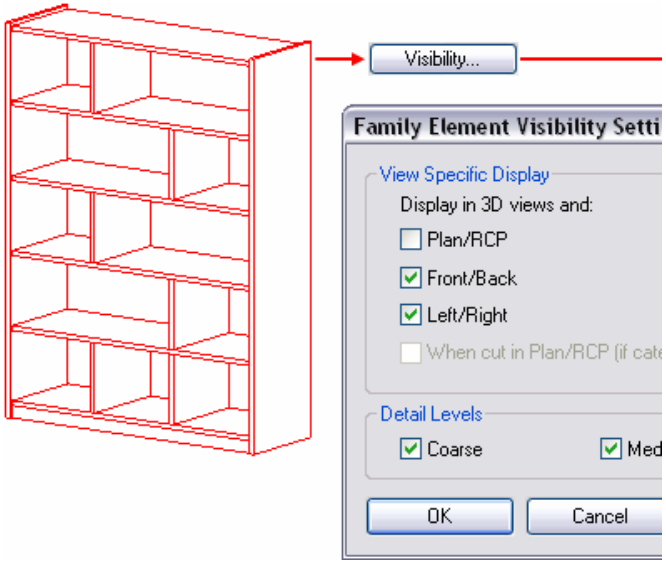


Use Window>Close Hidden Windows before you use Window>Tile. This keeps all the open windows (which is often quite a few) from cluttering up the view. Leave the project that you started open for the next step.

52. Activate the 3D view, and select the entire geometry.

53. On the Options Bar, click the Visibility button and clear the Plan/RCP check box.

54. Click OK.

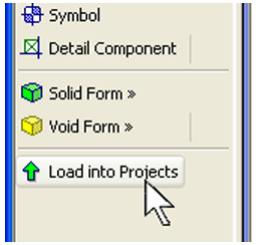


In Plan/RCP views you are going to use the 2D geometry you just created as representations. For all other ways, the representation is generated from the 3D model and in all levels of detail.

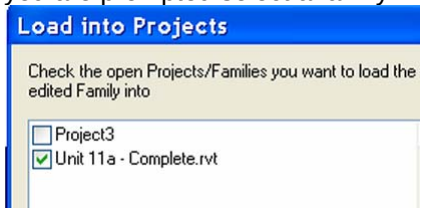
Reload the Family into the Project

At this point you can either load the family back into the project or save the family out and overwrite the original *.rfa* file. Or use Save As and create a new family based on these modifications.

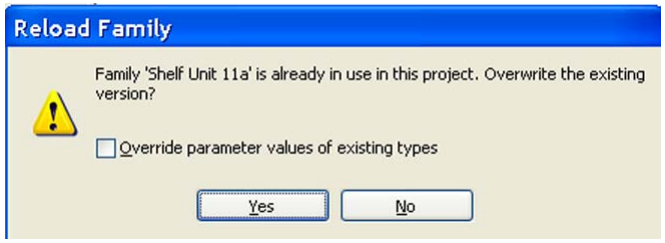
55. On the Design Bar, click Load into Projects.



This loads the family into any projects you have open. If you have more than one project open, you are prompted select a family.

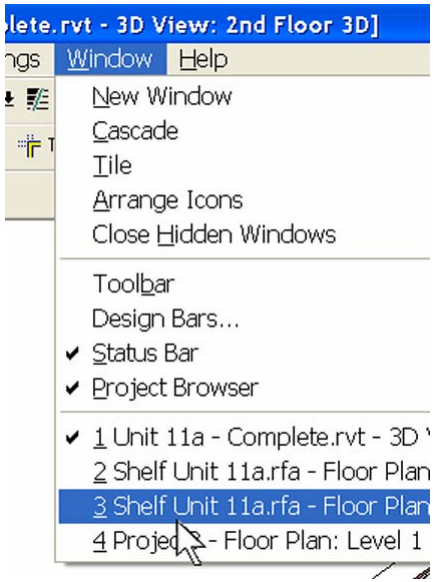


56. Click Yes to overwrite the existing version.



At this point your work has been transferred into the current project. You do not need to save the family you are working on, but you do need to save the project file.

57. Use the Window menu to change back to the shelf project.



58. From the File menu, choose Close to close the family file.

59. Do not save changes. They are already transferred to the project.

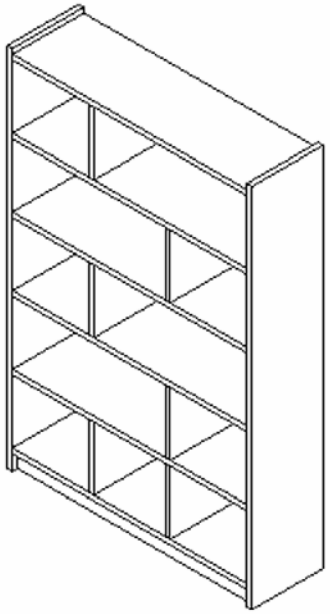
60. Save the project.

Unit 11, Exercise B: Material Parameters

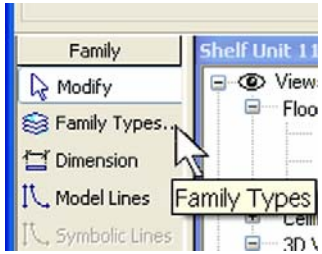
In this exercise you add materials to the shelf.

Although you could assign material directly to the solid extrusions as part of their properties, this definition would be static, lacking the ability to control the materials in the project. Autodesk Revit Building provides a parameter type that enables you to apply materials once the object is in a project. This can be either a type or an instance parameter.

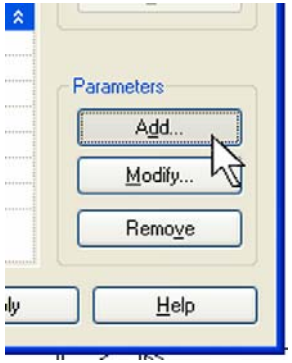
1. Open …\ Data \ rfa \ Unit 11b Shelf - Start.rfa.



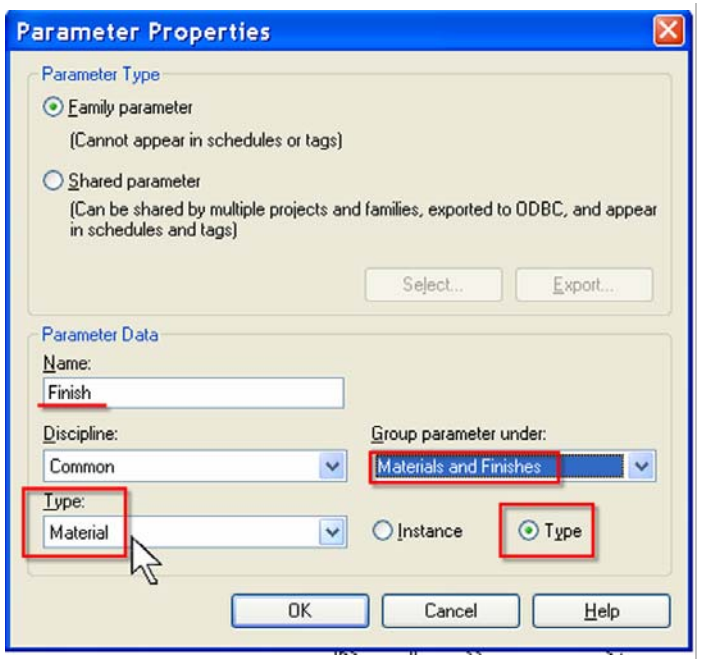
2. On the Design Bar, click the Family Types.

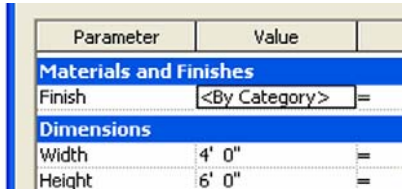


3. Under Parameters, click Add.
4. In the Parameter Properties dialog box, set the following:
   - Name = Finish
   - Type = Material
   - Group Parameter Under = Materials and Finishes
   - Type button
5. Click OK.



For the moment, your family is fully parametric in respect to its dimensions, but you will add a new type of a parameter that allows the user to parametrically change the material associated with the furniture as well. For now, you create just one material parameter to apply to the entire 3D geometry.

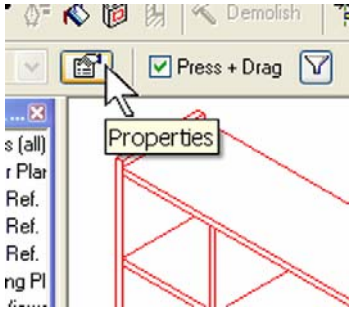




The Finish parameter is now part of the family definition. At this point it is not assigned to any particular element.
If you did not make the Finish parameter, then you would not have access to this control once the family was in a project. Only those parameters appearing in the Family Types dialog box are open for editing in a project.
You need to assign this parameter to the solid extrusions.

Assign the Material to the Solid Extrusions of the Shelf

6. Select all 3D geometry, and click Properties.

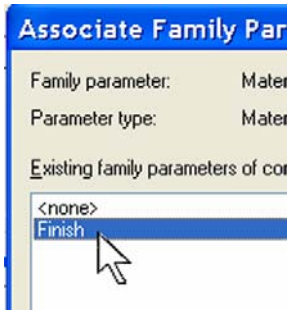


The material parameter is a hard-coded property of a solid extrusion. You need to assign the Finish parameters you just created to this property.

7. In the Element properties, click the small button to the right of Material.

8. In the Associate Family Parameters dialog box, click the Finish parameter.

9. Click OK in all open dialog boxes.

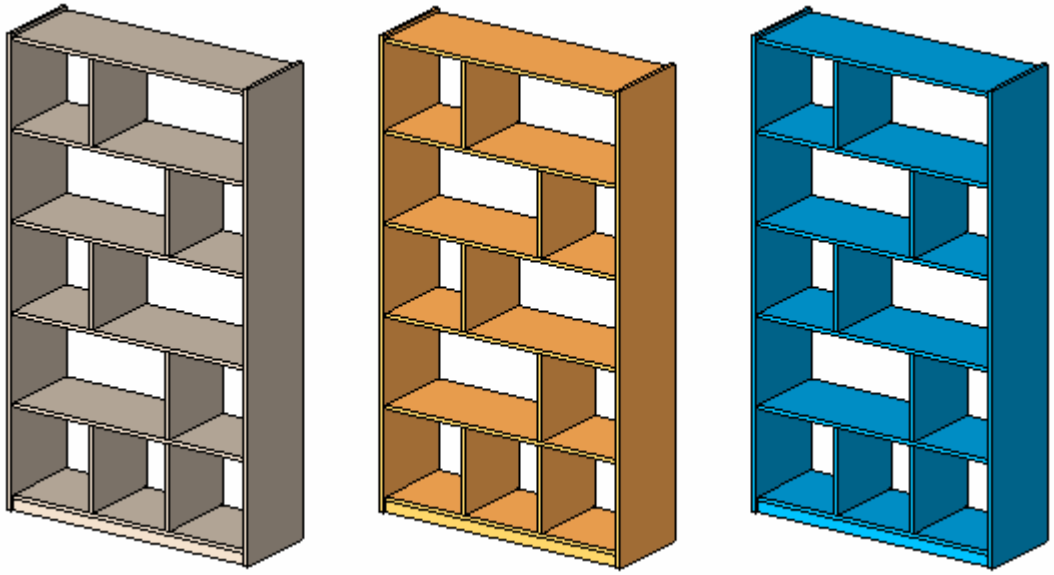


If you want, you could create a new material within the Family Editor and associate it as default material of the family. All materials created in the family are going to be automatically created in every project where this family is loaded. If an existing material has the same name, the family material is overwritten. That is why it is advisable to give your materials specific names.

10. From the File menu, choose Save.

11. Close the family.

12. Start a new project and load your family. Insert a few instances of this family in the project and try changing the parameters. Note that all modifications are propagated in all instances of this family. This is because you have defined all family parameters as Type parameters.



Unit 11, Exercise C: Visibility Parameters

In this exercise you add glass doors to the shelf unit. You have now worked with two types of parameters.

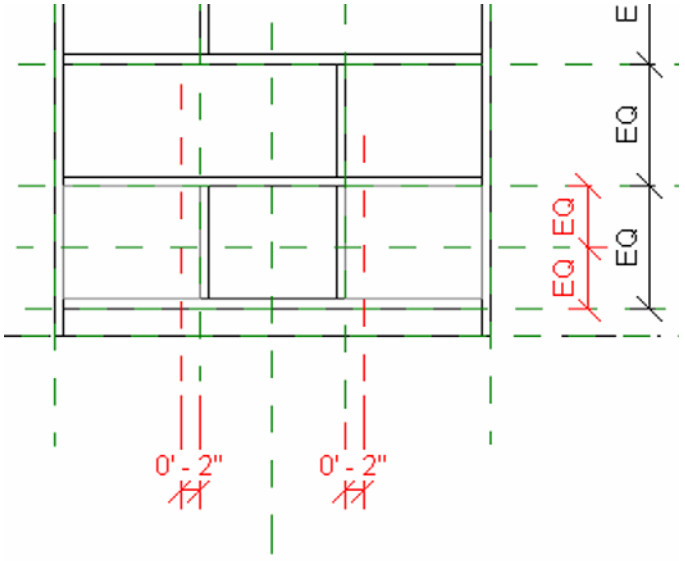
Parameter Type	Name	Assigned to	Controls
Length	Width, Depth, Height	Dimension	Geometry
Material	Finish	Solid extrusion properties	Material assigned to the solid

In this exercise you create two glass doors for the shelf unit. You create a new parameter in the family that is a Yes/No parameter type. Yes/No parameters have several uses. In this exercise you assign the Yes/No parameter to the visibility of the glass doors. This enables you to turn them off in a project if you do not want to see them. They are still defined in the family but are not visible.

This exercise continues from the last exercise. If you worked through Exercise 11 B, and were successful in both applying materials and manipulating the dimensions parameters, you can continue working on your family in this exercise.

In this exercise you add and constrain new references as well as create solid extrusions and voids. Go back to Unit 10 if you need to review these tasks.

1. Open …\ Data \ rfa \ Unit 11c Shelf - Start.rfa.
2. Activate the front view.
3. Add the reference planes and dimensions shown in the image.



Families recognize logical conditions like Yes/No. You use that to control the visibility of the glass doors within the shelf unit. The next task is to create the geometry of the glass doors.

4. Activate the view Ref. Level (Fine).

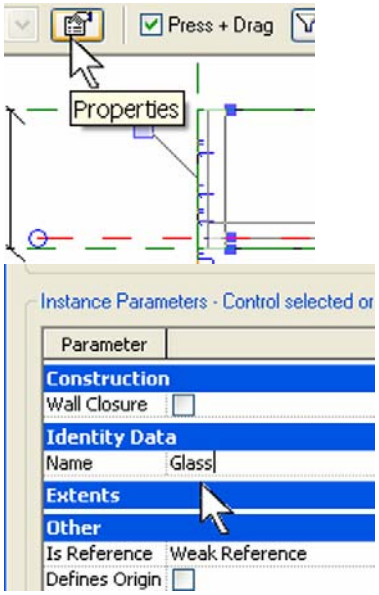
5. If the view shows a red background to the Hide/Isolate tool, click the Hide/Isolate button and click Reset Temporary Hide/Isolate.

6. Click Reset to see everything.

7. Activate the Ref. Level.

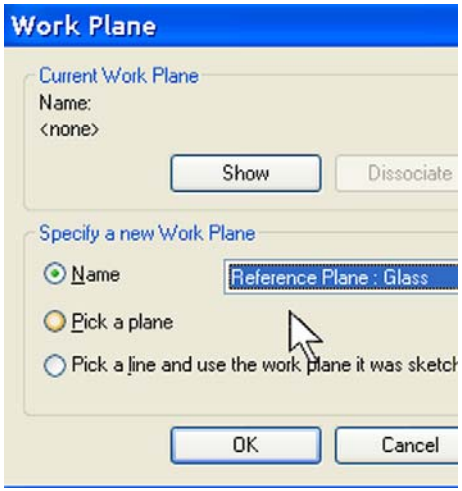
8. Select the horizontal reference plane that is second from the bottom, and click the Properties button on the Options Bar.

9. In the Properties dialog box, change the name to Glass, and click OK.

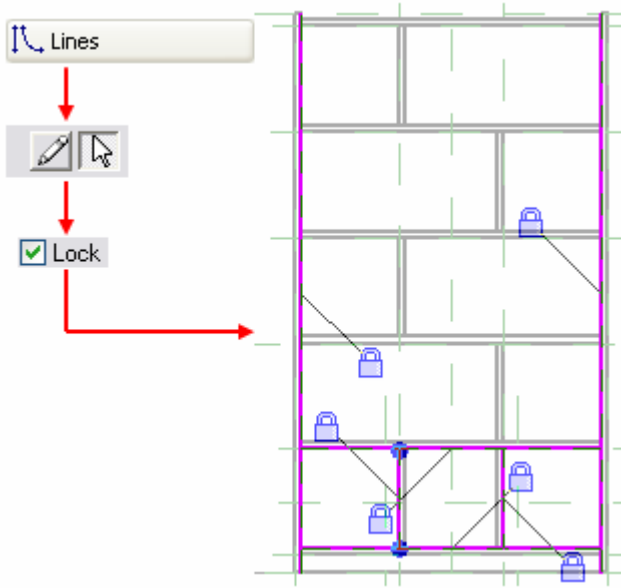


To facilitate the creation of the glass doors, name one of the reference planes. The effect is to create a work plane on which you can trace your sketch of the doors. Just imagine you are inserting a sheet of paper on which you are simply drawing a sketch.

10. Activate the front view.
11. On the Design Bar, click Solid>Solid Extrusion.
12. On the Design Bar, click Set Work Plane.
13. In the Work Plane dialog box, select Glass from the Name list.
14. Click OK.

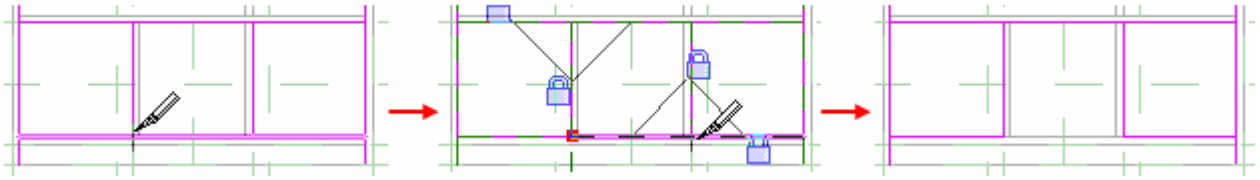


15. On Design Bar, click Lines.
16. On the Options Bar, click Select and select the Lock check box.
17. Click the lines that form the first shelf, as shown.

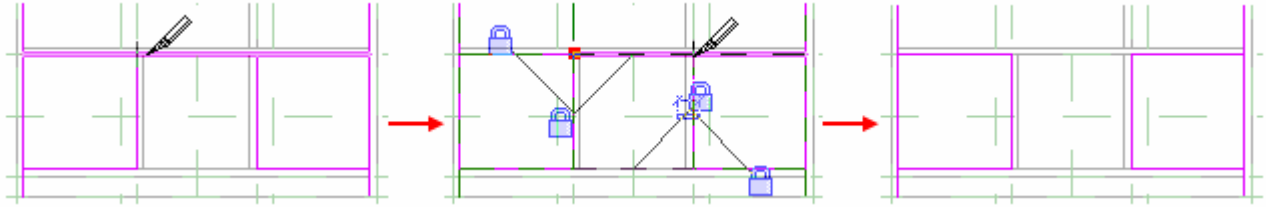


For a sketch to be valid for an extrusion, it should not have T intersections and its lines must be in a closed loop. Since this is not the case for your sketch, you need to fix it.

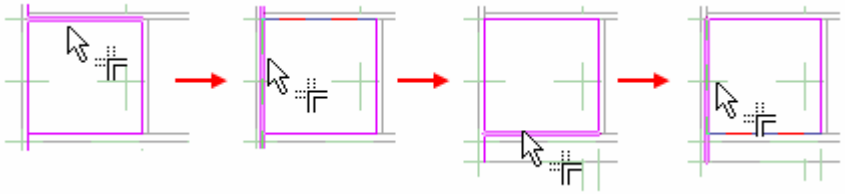
18. On the Tools toolbar, click the Split tool.
19. On the Options Bar, select Delete Inner Segment and select the two middle vertical lines as well as the bottom one.



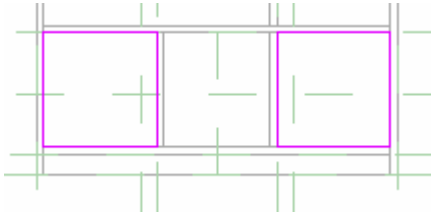
20. Repeat for the line above.



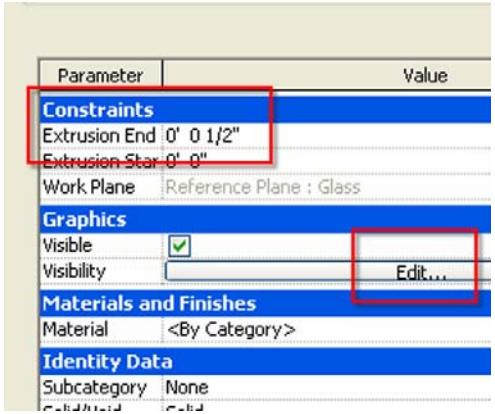
21. Click Trim.
22. Set the trim mode to Trim/Extend to Corner.



23. Repeat for the other side.



24. On the Design Bar, click Extrusion Properties.
25. Set 1/2” for the Extrusion End.
26. Click the Edit button next to Visibility.

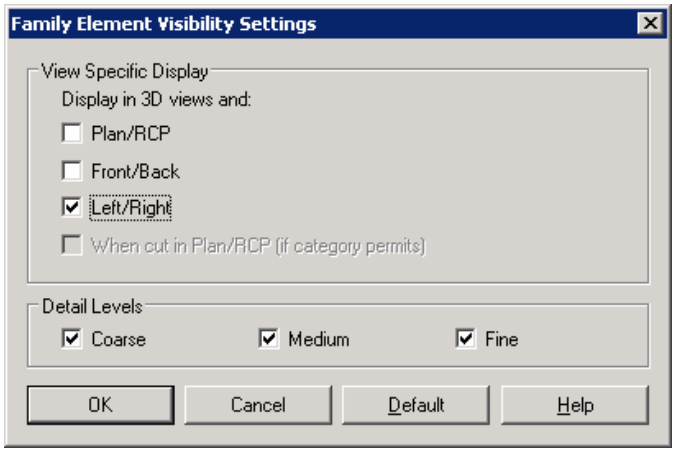


The value positive or negative when drawing an extrusion from a reference plane depends on the direction you first drew the reference plane (right to left or left to right).

If you get it wrong here, you can always change it after you are finished with the sketch, by looking at the extrusion properties.

27. Clear the Plan/RCP check box, as well as Front/Back (this means that these doors are *not* displayed in the plan or elevation view).

28. Click OK to return to the Element Properties dialog box.



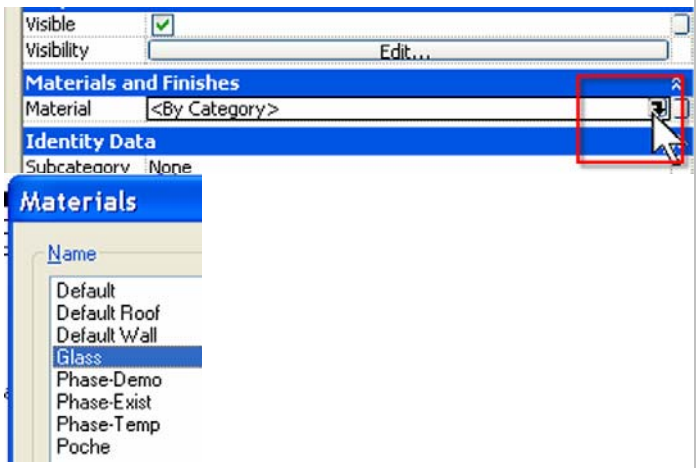
29. Click the button next to Material and select Glass.

30. Click OK to return to the Element Properties dialog box.

31. Click OK again to close the Element Properties dialog box.

32. On the Design Bar, click Finish Sketch.

33. Save the file (File>Save).



When you assign a material in this way, the material is static. You cannot assign a different material to the element placed in a project.

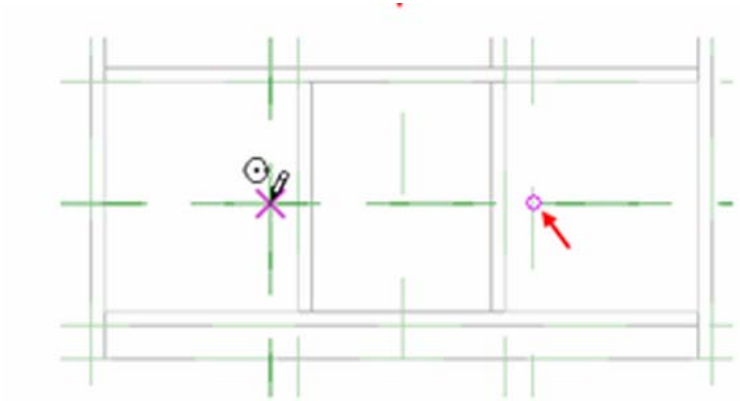
Create Pulls for the Glass Doors

34. Select the Solid Form>Solid Extrusion.

35. On the Design Bar, click Set Work Plane. In the dialog box make sure that the active work plane is set to Glass.

36. Select Lines and click the circular shape on the Options Bar. Activate the Radius and set it to 1/2”.

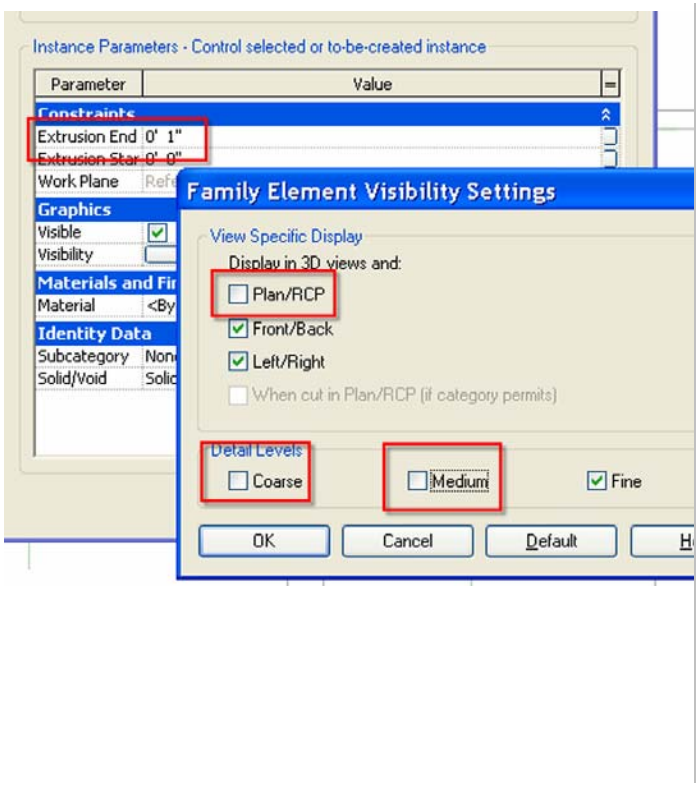
37. Add two circles, as shown on the right. Note that the center of insertion is the intersection point of the reference planes.



38. On the Design Bar, click Extrusion Properties and set 0 1” as an extrusion end.

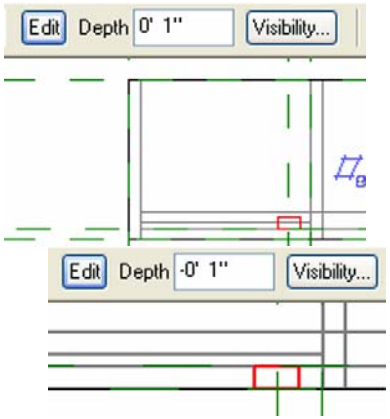
39. Click the Edit button next to Visibility and clear Plan/RCP. Under Detail Levels, select only Fine. (This means that knobs are visible only in a Fine level of detail.)

40. Click OK to close all open dialog boxes.



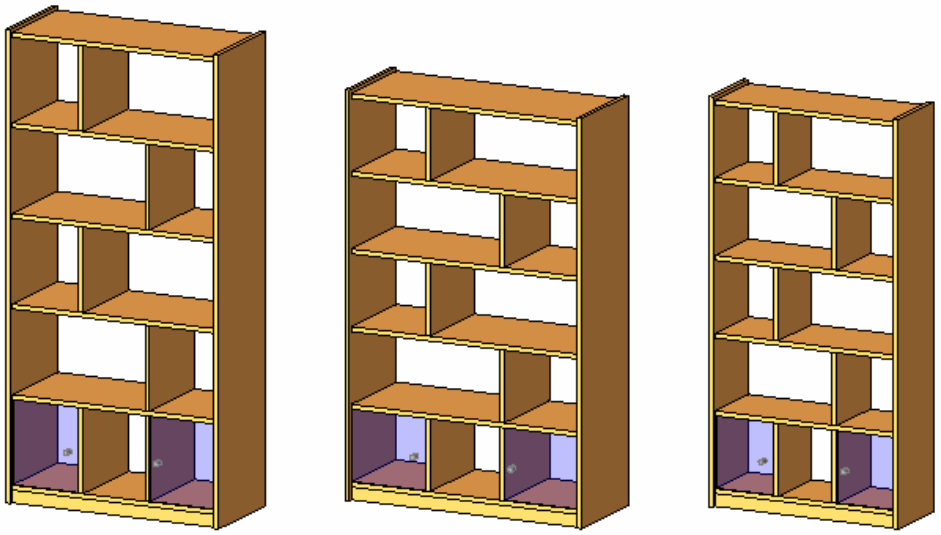
41. On the Design Bar, click Finish Sketch. Thus you are exiting sketch mode, and you have finished creating the 3D object.

42. Set current Floor Plans: Ref Level.
43. Select pulls.
44. Set Depth = -0 1” (negative).

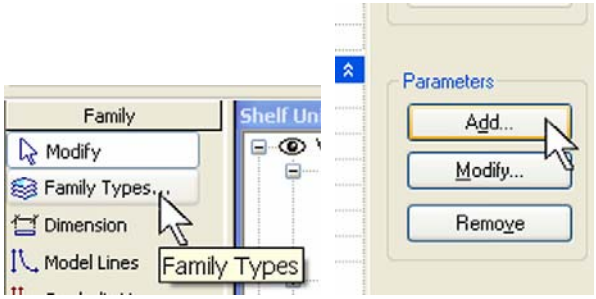


The pull switches to the other side of the reference plane.

45. From the File menu, choose Save (make it a habit to save your work often).
46. Flex your family to test it.

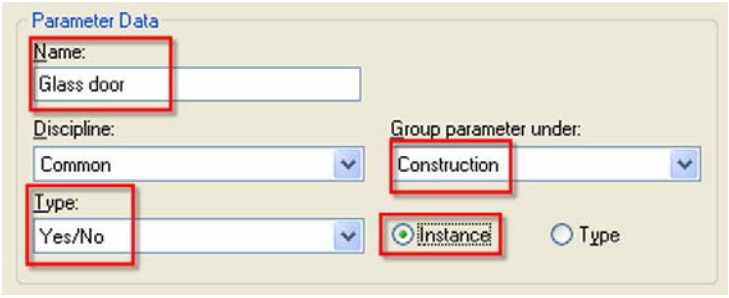


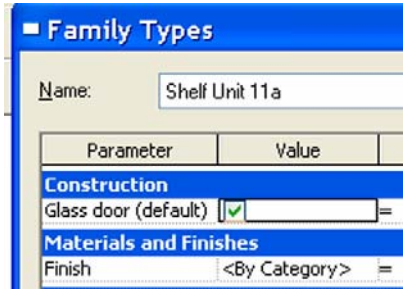
47. On the Design Bar, click Family Types.
48. In the dialog box, under Parameters, click Add.
49. In the Parameter Properties dialog box, set the following:
    a. Under Name, enter Glass Door.
    b. Group Parameter Under: Construction.
    c. Under Type, select Yes/No.
    d. Click Instance (This means that this parameter can vary from one piece of



furniture to another.)

50. Click OK to return to the Family Types dialog box.

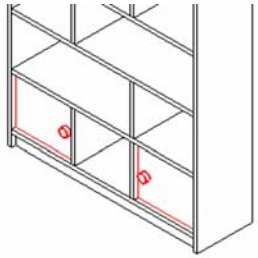




The glass door parameter appears, ready to be assigned to the visibility of an element.

A checked box means show, and a cleared box means hide.

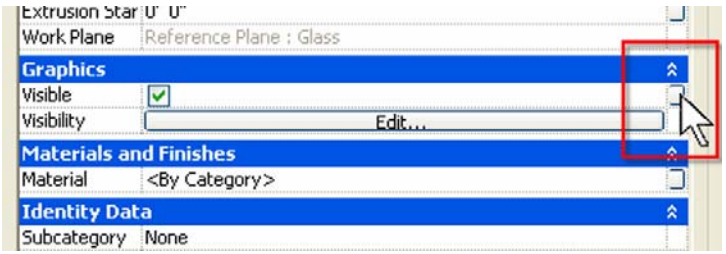
51. Select the glass doors and doorknobs and click Properties.

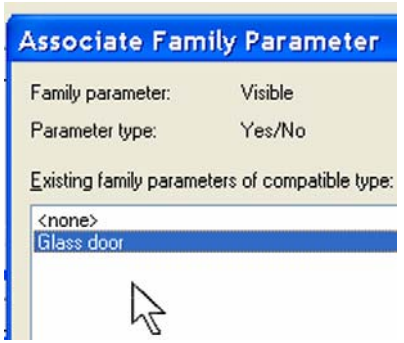


52. In the Element Properties dialog box, click the gray button at the right end of the Visible line. This button enables you to link one parameter to one property.

53. In the Associate Family Parameter dialog box, select Glass Door.

54. Click OK twice.

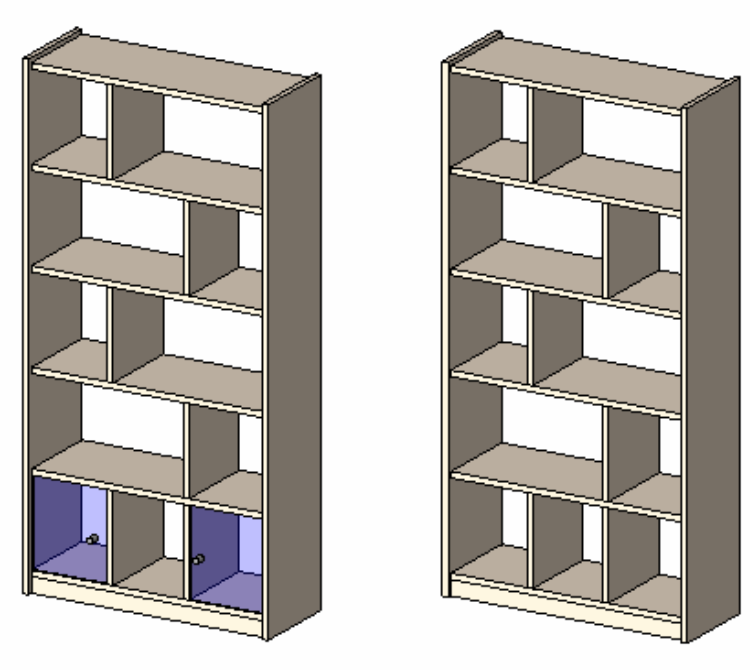




55. To verify functioning of this parameter, load the family in a project.

56. Save your work again.

57. Start a new project, load your family, insert a few instances of the family in the project, and try modifying the parameters. The new, added parameter lets you control visibility of the glass doors and the doorknobs per instance. Try changing to different levels of detail in 3D view. The doors and the knobs should display only in a Fine level of detail. Try also changing the level of detail in plan view. There, regardless of the level of detail, the doors and the knobs should *not* display.



Unit 11, Exercise D: Nested Families

In this exercise you add drawers to the shelf unit. To create the drawers you first create a new furniture family and build a single drawer in it. You load this drawer family into the shelf unit family, “nesting” the drawer family in the shelf unit file.

To finalize your family, you add two drawers in the opening between the glass doors. Instead of modeling it in the shelf unit family, you create a new family for the drawer and then insert it in this one as a nested family. The width of this interior space is determined by the overall width of the family type—or the width parameter. You create formula-type parameters that are based on the depth, width, and height parameters of the shelves and pass these parameters through to the nested drawer family.

However, first things first: let’s create the drawer family.

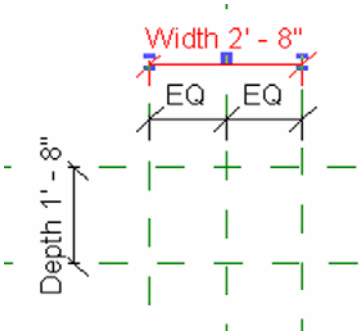
Note that the description for creating the drawer is less detailed than the previous one. If necessary, refer to the initial creation of the shelf unit to review the processes.

Roughly, this exercise breaks down into the following sections:

- Create a drawer family: This is a new family you will create.
- Create a drawer shelf: This takes place in the shelf unit family and is a review of the Unit 10 exercise.
- Create drawer parameters in shelf unit family. These drive the geometry of the nested drawer family.
- Create formulas for the drawer parameters within the shelf unit family. The formulas perform arithmetic operations on other family parameters.
- Load, place, and position a drawer. You can load families to use inside other families as components.
- Link parameters from the shelf unit family to the drawer family.

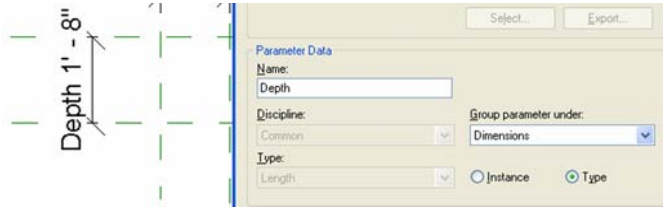
Create a Drawer Family

1. From the File menu, choose New>Family. Select the Furniture.rft family template and click Open.
2. Activate the Ref. Level view (Project Browser, Floor Plans).
3. Add three reference planes, as shown.
4. Add dimensions, as shown.



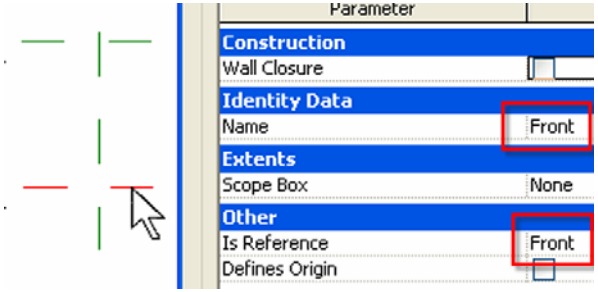
5. Set the dimensions to labels (parameters), as shown. (You need to create two new parameters: Width and Depth.)

   a. Group = Dimensions
   b. Type parameter



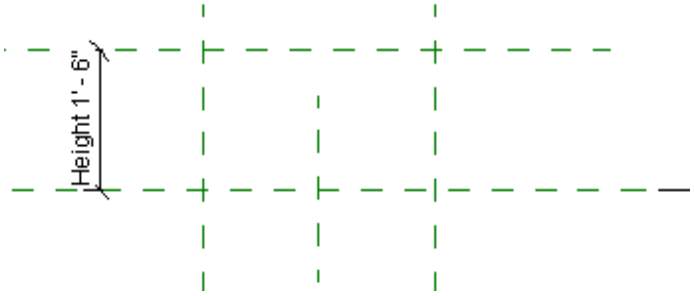
6. Select the horizontal reference plane, and in its properties select:

   a. Name = Front
   b. Is Reference = Front



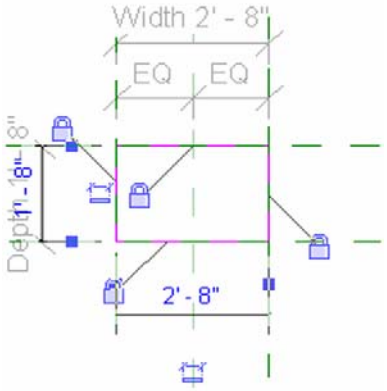
7. Activate the front view, and add another reference plane above the existing one. Create a new parameter Height.

   a. Group = Dimensions
   b. Type parameter



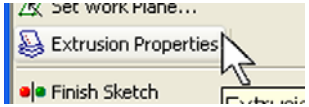
8. Activate the Ref. Level view.

9. Add a solid form using the extrusion method. The sketch of the solid should be a rectangle with sides locked to the reference planes. At this stage do *not* click Finish Sketch.

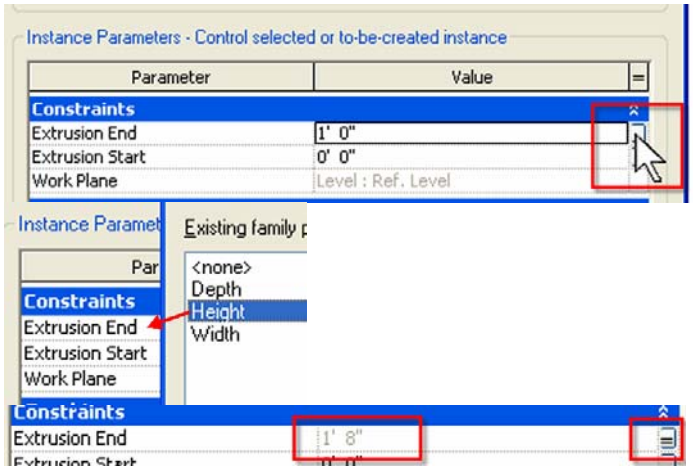


As you hold the cursor over an intersection of two reference planes, notice that one or both of the reference planes highlight. If only one reference plane highlights, move the cursor slightly until both reference planes are highlighted. Then click the intersection. If you do this with both corners of the rectangle, the locks automatically appear as shown.

10. Click Extrusion Properties.



11. In the dialog box, click the gray rectangle on the Extrusion End line.
12. Select the Height parameter.
13. Click OK.



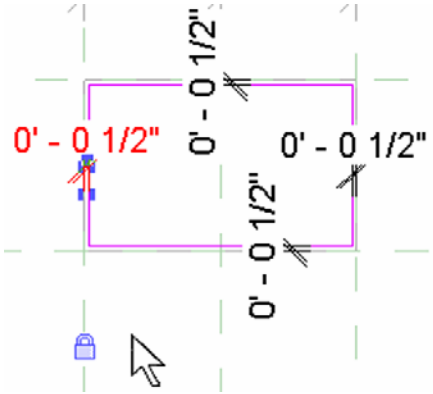
You have just constrained the depth of the solid to the family's height parameter.

The Extrusion End (depth) is now dimmed because it is being driven by the height parameter. There is an equal (=) symbol here to let you know this has been assigned to a different parameter.

14. Click OK to close the dialog boxes.

15. Click the Finish Sketch button.

16. On the Design Bar, this time select Void Form and choose the Extrusion method.
17. Draw a rectangle on the interior side of the existing solid. Using the Dimension tool, lock the edges of the void to the reference planes (fix the distance to 1/2"). At this stage do *not* click Finish Sketch.

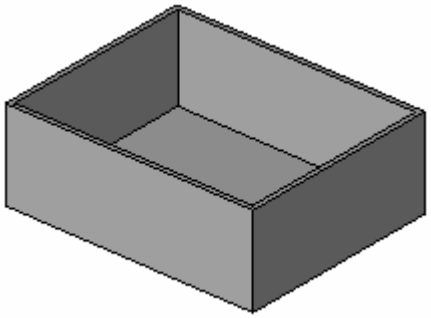


It is a good practice to dimension to the reference plane rather than the geometry of the previous solid form.

18. Just as in the previous case, in the Extrusion Properties dialog box, associate the extrusion end to the height parameter and set the extrusion start to 1/2”.

19. This is the thickness of the bottom of your drawer. You can see this better in the front view.

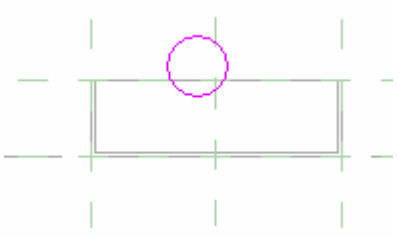
20. Finish the sketch.



21. Activate the front view.

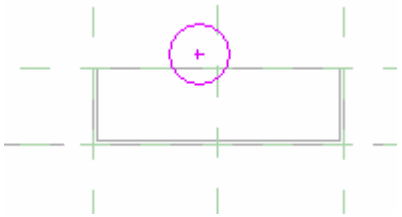
22. On the Design Bar, click Void Form>Void Extrusion.

23. Add a new sketch. This time it is a circle cutting out the opening spot for the drawer. Draw the circle as shown on the right. *Don’t* click Finish Sketch yet.



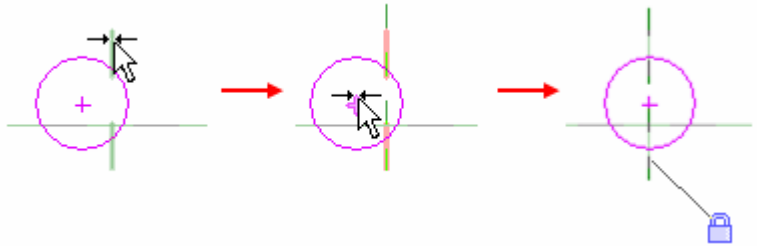
You need to assure that this sketch remains always aligned to the axis of the drawer width and that its vertical position doesn’t change either. To facilitate aligning a circle, it is recommended you activate the Center Mark Visible option and use it as a reference point for constraining.

24. Right-click the circle, choose Properties, and select the Center Mark Visible option. Confirm with OK.

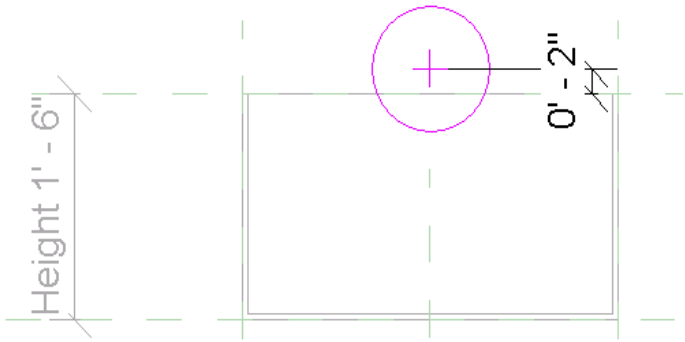


Note the cross in the middle of the circle. It is from this point that you define constraints to the reference planes.

25. Using the Align tool, align and lock the circle to the central reference plane.

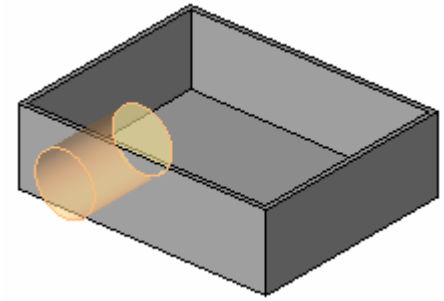


26. Add a dimension between the reference plane that defines the height of the drawer and the center of the circle. Set the distance to 2” and lock it.



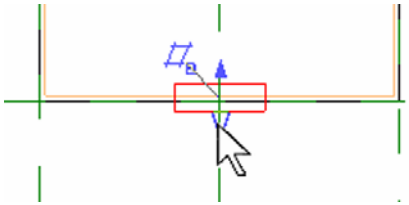
27. In the Extrusion Properties dialog box, set the Extrusion start to 0.

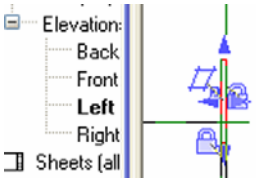
28. Click OK, and then click Finish the Sketch.



The extrusion is heading the wrong direction. You need to fix that little problem.

29. Open the Ref. Level view and select the void. Select the upper blue point and start sliding it toward the interior of the drawer. Lock that position. Lock the bottom triangular grip to the front face of the drawer.





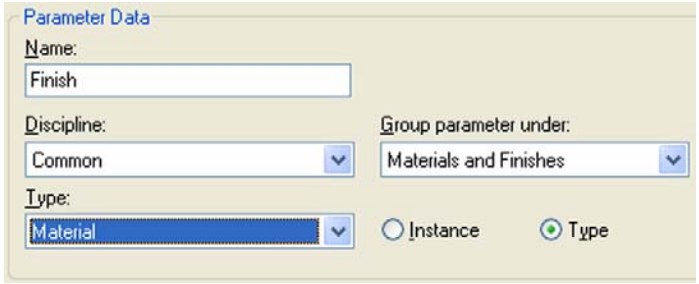
If you have difficulty doing this in plan view, try the right or left.

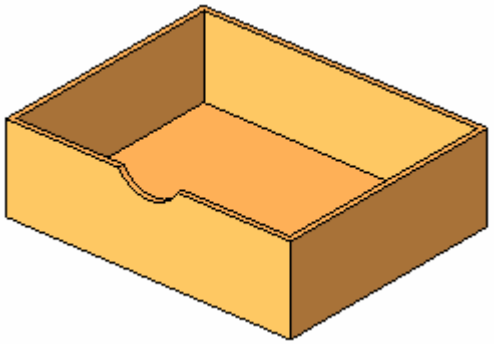
30. Finally, add a new Material parameter. Name it Finish.

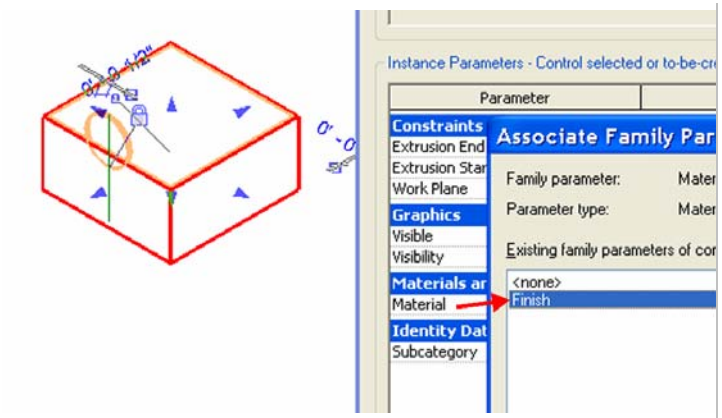
31. Associate the entire 3D geometry to it.

32. Flex the model to test the work you have done. Try out different values for width, height, depth, and so forth.

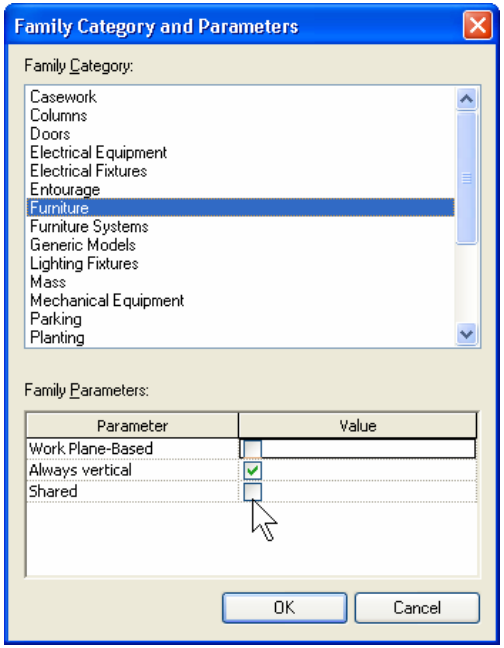
33. From the File menu, choose Save As, and save the family as *Drawer.rfa*. Close this file.







Note that a nested family can also be a shared family. Make a shared family by choosing Family Categories and Parameters from the Settings menu.



By selecting the Shared box, you change the behaviour of the nested family when it is loaded into a project. When a nested family is shared,

- You can load the family directly into a project to update all families that have that nested family.
- You can schedule the nested family even though it resides within a different family.

The drawer family is now ready to be inserted in the furniture family, but you need to make a few adjustments:

- You are missing a small shelf that is positioned between the two drawers when placed in the opening.
- There are no parameters in the big family that define the width, depth, and height of the drawer.

The first problem can be resolved using the same techniques to create the shelf unit as well as the drawer. The second problem requires formulas to help calculate the values of the drawer parameters. You create three new parameters:

- Drawer Width = (total width / 3) – (2 x thickness of the separation panel)
- Drawer Height = ((((total height – 5”) / 5) / 2) – 1 x shelf thickness)
- Drawer Depth = total depth -15

Create Drawer Shelf in Shelf Unit Family

34. Open workbook data set \Unit 11 d Shelf – Start.rfa

The Unit 11 d Shelf – Start.rfa is the end product of Exercise 11c. Use this as a starting point, or continue with a shelf unit you have tested in a project.

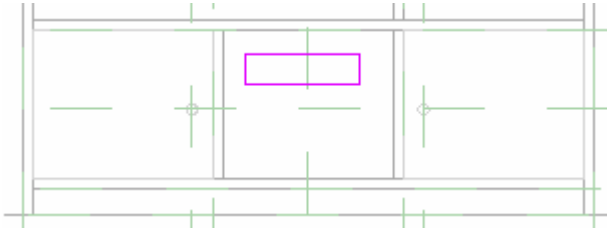
35. Now add the separation shelf between the two drawers. We won't explain in detail, as by now you have already learned how to do that. To review, see Unit 10.

36. Activate the front view.

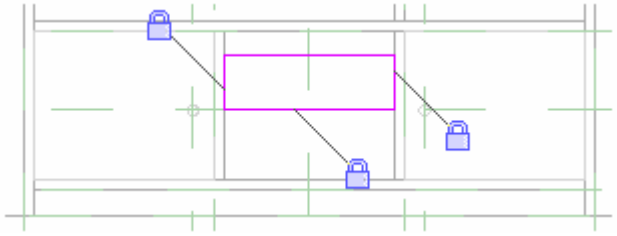
37. Click Solid From>Extrusion.

38. Double-check that the active work plane is set to Back.

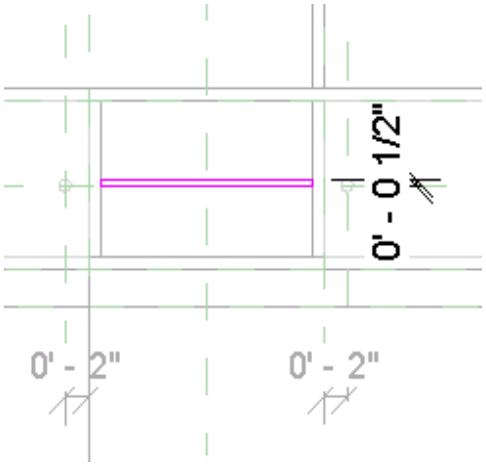
39. Add a rectangular sketch in the upper part of the empty middle shelf, as shown in the drawing on the right.



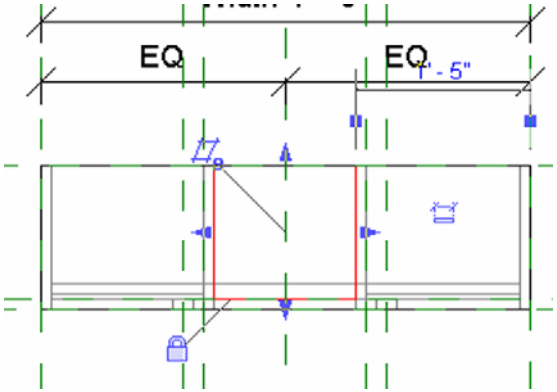
40. Align the sketch and lock, as shown.



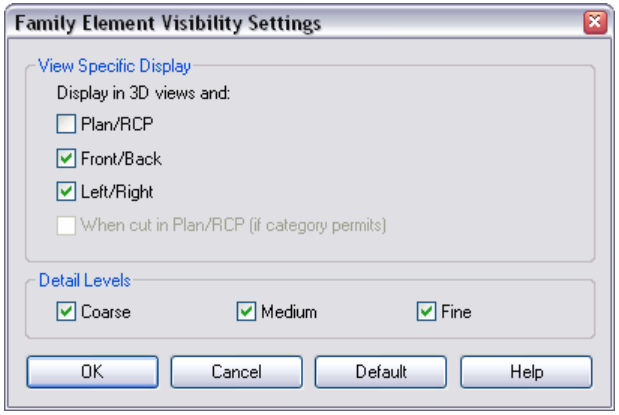
41. Add a dimension for the shelf thickness.
42. Select the dimension chain, set it to 1/2”, and confirm.
43. Lock this dimension.
44. Click Finish Sketch.



45. Open the Ref. Level (Coarse – Medium), select the 3D geometry, and using the blue arrow in the front, align it to the second reference plane from the bottom (see image).
46. Lock it to that position.



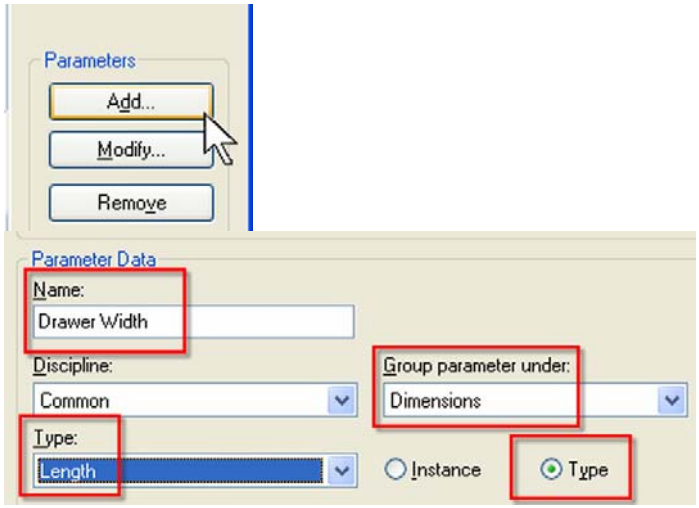
47. In the Properties dialog box of this geometry, associate the Finish parameters to Material.
48. Click the Edit button next to Visible, and clear Plan/RCP.



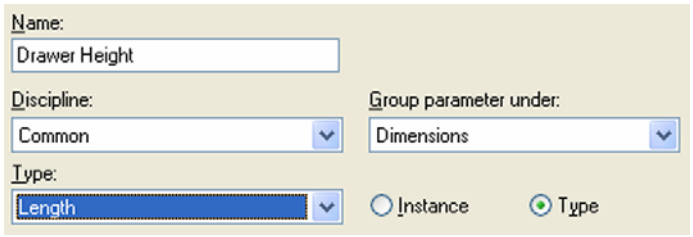
Everything is ready to embrace the new nested family. The next step is to load the family you want to nest and correctly link its parameters to the parameters of the shelf unit.

Create Drawer Parameters in Shelf Unit Family

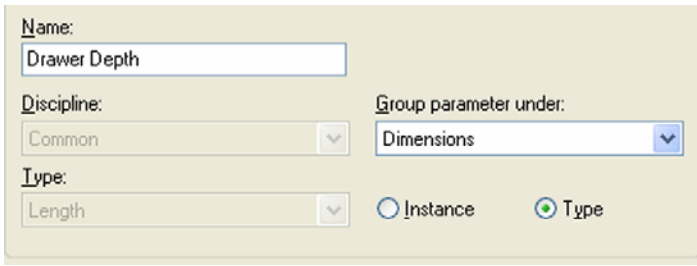
49. On the Design Bar, click Family Types.
50. Under Parameters, click Add and set the following:
    a. Name = Drawer Width
    b. Group Parameter Under = Dimensions
    c. Type = Length
    d. Select Type radio button
51. Click OK.

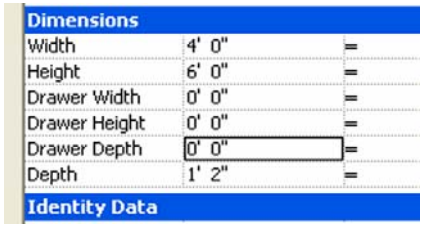


52. Add Drawer Height parameter.
    a. Name = Drawer Height
    b. Group Parameter Under = Dimensions
    c. Type = Length
    d. Select Type radio button



53. Add Drawer Depth parameter.
    a. Name = Drawer Depth
    b. Group Parameter Under = Dimensions
    c. Type = Length
    d. Select Type radio button



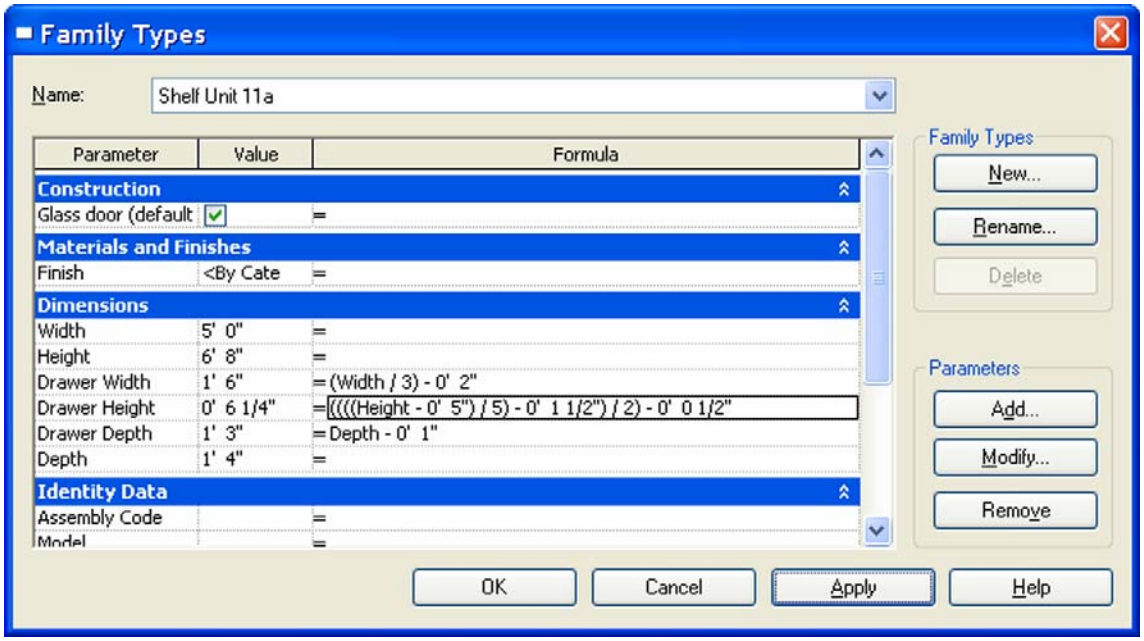


Create Formulas for the Drawer Parameters

54. Now, in the Family Types dialog box, in the lines of Drawer Depth, Drawer Height, and Drawer Width, write the formulas as shown in the image.

55. For Autodesk Revit Building to process the formulas you have just entered, it is necessary to respect case (for Revit Building, width isn't the same as Width). The suffix is automatically added when you confirm your formula, so it's not necessary to write it.

56. Click OK to confirm all.



57. Click Apply to test your formulas as you create them.

Type the formula and click the Apply button. If everything is correct, the calculated Width shows up in the value column. Revit Building alerts you to any errors.

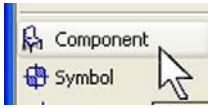
58. Click OK.

59. Save the family.

Load, Place, and Position a Drawer

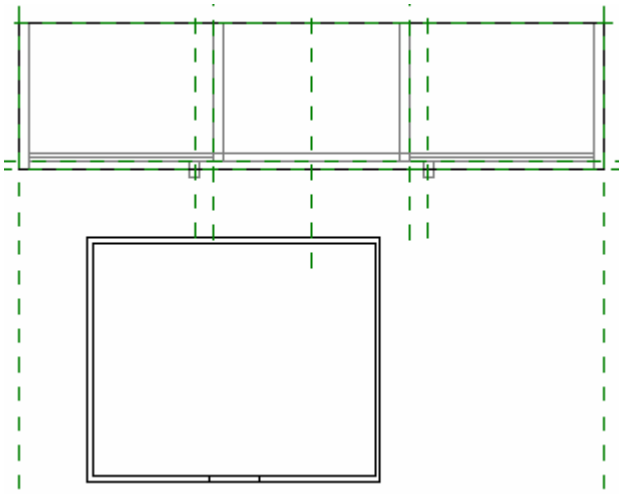
60. From the File menu, choose Load from Library/Load Family.

61. Browse to find the drawer family (you have to remember where you saved it), and click Open.



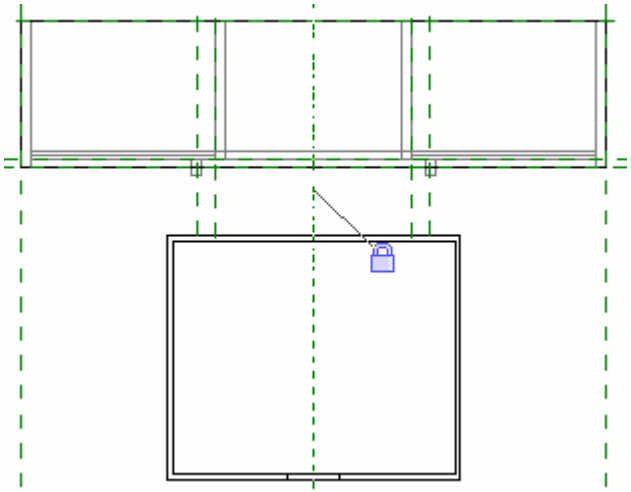
62. Set the Ref Level view current.

63. On the Design Bar, click Component and insert one instance of the drawer family in the shelf unit.



64. Using the Align tool, do the following:

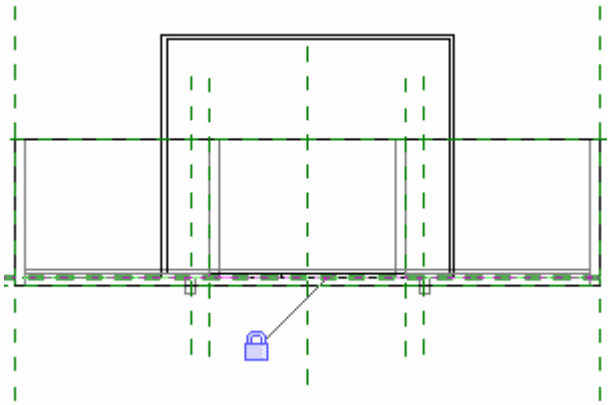
    a. Click the Center Reference plane.
    b. Click the axis of the drawer and lock this alignment.



When you place the cursor in align mode over the axis of the drawer, Autodesk Revit Building displays a thick black line indicating the reference plane of the drawer family.

65. Align the front of the drawer to the second reference plane from the bottom (see image).

66. Lock this alignment as well.

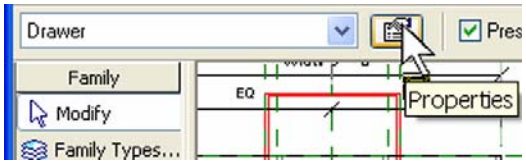


For a perfect match of the drawer family in the shelf unit, you need to link the parameters of both families.

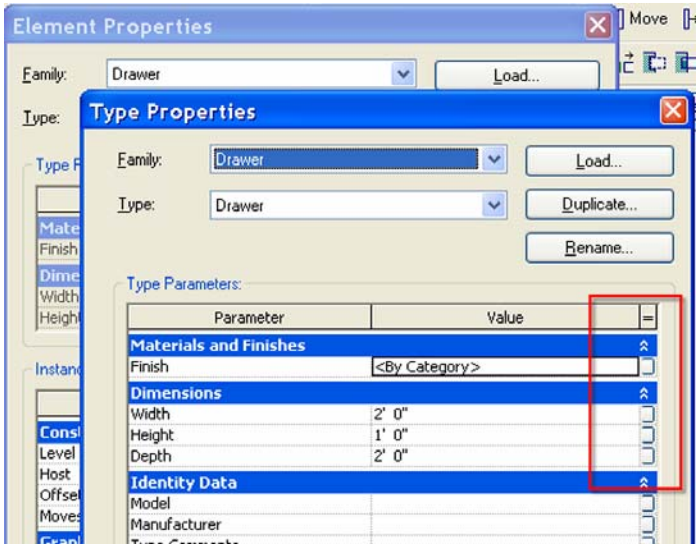
Link Parameters from the Shelf Unit Family to the Drawer Family

67. On the Design Bar, click Modify and select the drawer.

68. On the Options Bar, click Properties.



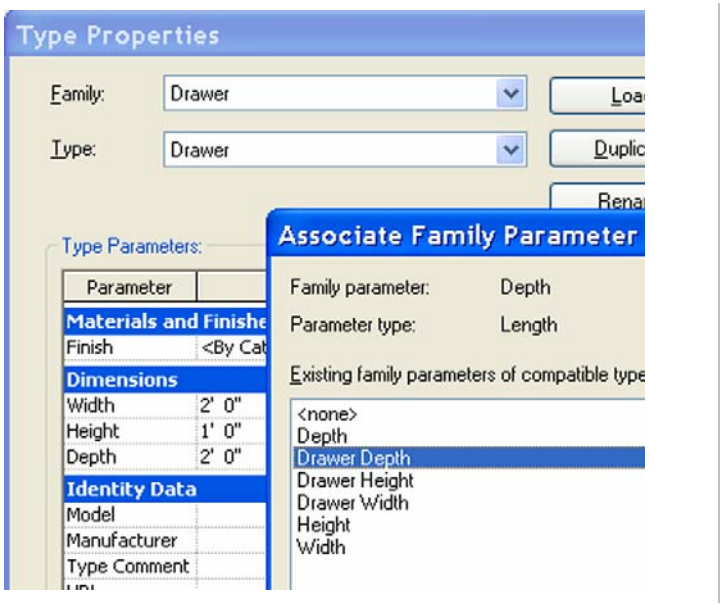
69. In the Element Properties dialog box, click Edit/New to view the type properties of the element and thus the drawer parameters.



The element properties are the same properties you would expect to see if you loaded this family into a project.

You use the small gray boxes at the far right end of the width, depth, height, and finish parameters to make the link between the parameters.

70. Click the small gray box in the Depth line and select Drawer Depth in the Associate Family Parameter dialog box. Click OK.



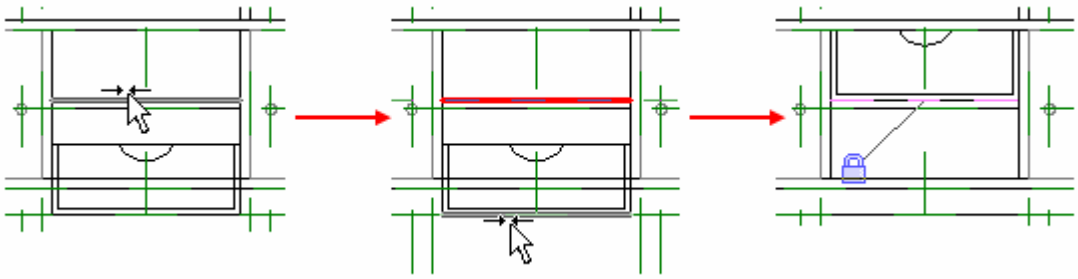
71. Repeat for all three parameters and associate them as follows:

    a. Width → Drawer Width
    b. Height → Drawer Height
    c. Finish → Finish

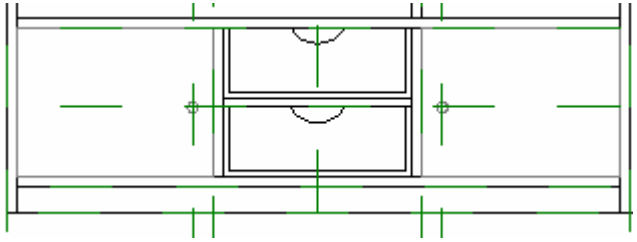
72. Click OK.

73. Activate the front view, and using the Align tool, align and lock the drawer in the upper empty space.

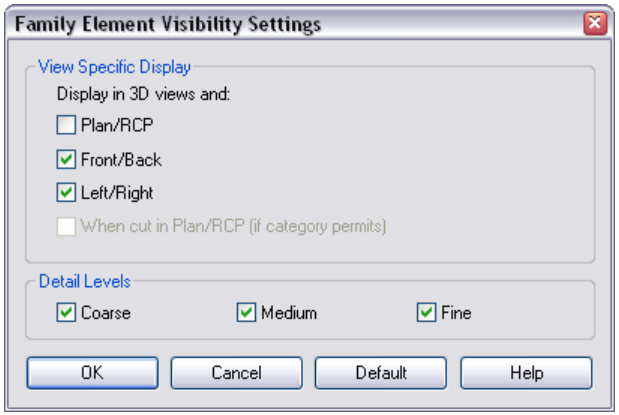
74. If you have trouble selecting the lower line of the drawer, just position your cursor near that line and use the Tab key until that line is activated, and then click to select it. (The Tab key is a great help whenever you have overlapping geometry.)



75. Switch to the Ref Level view.
76. Repeat the same method to insert, align, and lock the second drawer.
77. Switch to the front view, and repeat aligning and locking vertically.
78. Test the family by flexing the model.



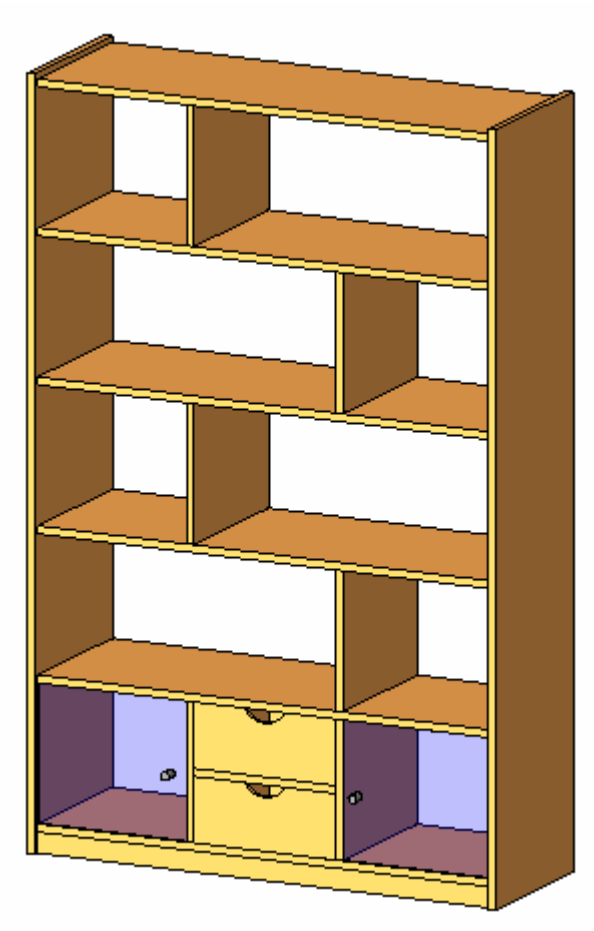
79. Select both drawers, and click Visibility on the Options Bar.
80. Clear Plan/RCP.
81. Click OK.



Because all drawer parameters are type parameters, you do not need to repeat the same for the second drawer. The new drawer instance automatically inherits the instance properties of the existing one. All you need to do is align it in plan view and in elevation.

If you are daring, try copying the drawer in elevation instead of reinserting it in plan view. Can you get all the alignments in this front view?

82. Save your file.



You are almost finished with your family. But before you use it in a project, you might want to add subcategories. With subcategories, you can control the entire display of the family in all views (line thickness, line color, line style, material, and so forth).

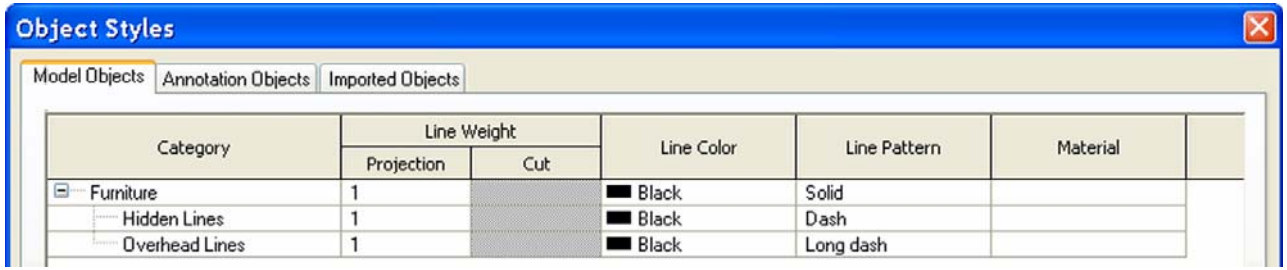
Exercise E: Subcategories and Families

The family category was defined when you selected the template to make it with. You can change this template later, but it is *not* advisable to do so. Always make sure to select the correct template when you create a new family. Next, you set new subcategories within your family.

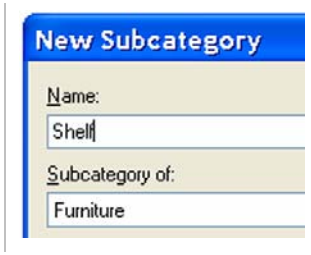
Create Subcategories of the Furniture Category

This exercise builds on work performed in previous exercises. If you have not completed the previous exercises, but want to work through this exercise on subcategories and families, then open Data\rfa\ Unit 11e Shelf – Start.

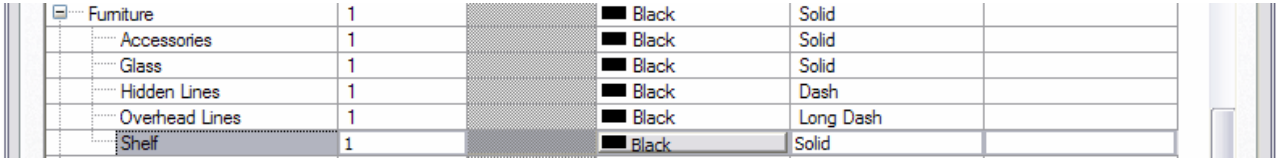
1. From the Options menu, choose Object Styles.
2. Scroll down to the Furniture category. By default there are two predefined subcategories: Hidden Lines and Overhead Lines. You need three new subcategories: Glass, Shelf, and Accessories.



3. Click the New button.
4. Enter Shelf for Name, and select Furniture under Subcategory of. Click OK.



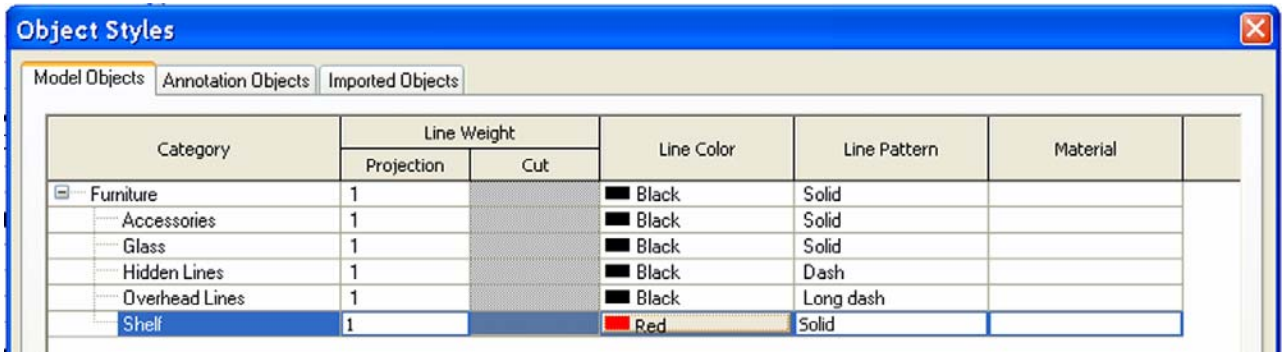
5. Repeat the operation for Glass and Accessories.



For each subcategory, you can set whatever line thickness, color, or material you want. The material is assigned to the family subcategories only if under the Finish parameter the value is set to <by category>. Here, you simply change the color of one of the subcategories.

6. In the Object Styles dialog box, in the Shelf line, click the Line Color button.

7. Select any color from the Color dialog box, and click OK.

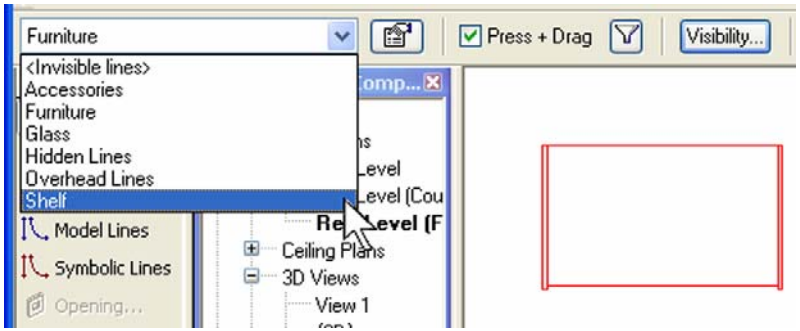


8. To see just the symbolic lines, activate the Ref. Level (Fine) and using the Hide/Isolate tool, hide:

   a. Reference planes
   b. 3D geometry
   c. Nested families

9. Select all these lines and change their subcategory directly to Shelf on the Options Bar.

10. Repeat for the Ref. Level (Coarse – Medium).



In principle, using the same method for both 2D and 3D, here are the associations you need to define:

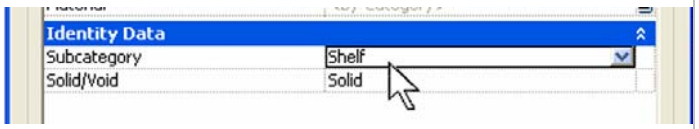
11. For all vertical separations, horizontal shelves, and the plinth, associate the Shelf subcategory.

12. For the Glass doors, choose Glass.

13. For the Door knobs, choose Accessories.

The easiest way to select the geometry when associating the subcategories is to work in a 3D view.

14. Save the family.

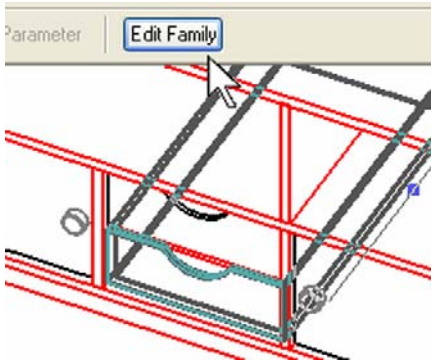


As for the drawers, if you have tried associating a subcategory to them, you will have noticed that there is no subcategory parameter in their properties. The reason is that the drawers are nested families. So, go back to the drawer family to effectuate this.

Use In-Place Family Editing to Modify the Drawer Family

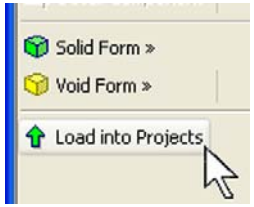
Follow the same process you used in an earlier exercise to access the drawer family and modify the shelf in the project file.

15. Select a drawer, and on the Options Bar, click the Edit Family button.
16. Click Yes to open the family for editing.



17. From the Settings menu, choose Object Styles.
18. Create a new subcategory Shelf.
19. Associate the entire geometry to this subcategory.

20. On the Design Bar, click the Load into Projects tool.
21. Check the current shelf family you are working on.
22. Click OK.
23. Click Yes to overwrite.



In the next step you create a subcategory in the drawer family called Shelf (same as the subcategory in the family file). All geometry uses the existing shelf definition once it is loaded back into the family file.

Alternatively, you could create a subcategory called Bin. In this case, when loaded into the shelf family, it would bring this subcategory with it and you would then have direct control over this subcategory in the shelf unit family file. Likewise, when you load the shelf unit into a project, it brings all the subcategories, including Bin. You would then have access to this subcategory in the project file.

24. Use the Window menu to switch back to the drawer family.

25. Close the drawer family.

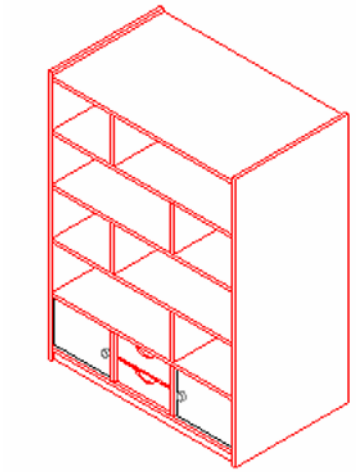
26. Click No to the Save Changes prompt.

You can save the changes if you want. If you do so, the software tries to locate where the original drawer family file came from when it was loaded into the family.

You do not need to save because the changes have already been loaded into the shelf unit family.

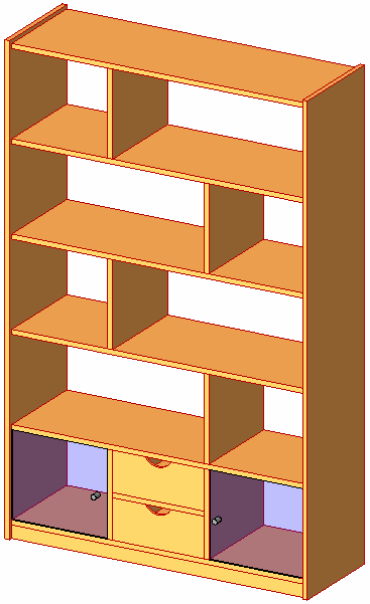
27. You should now be back at the shelf unit family.

28. Save the family.



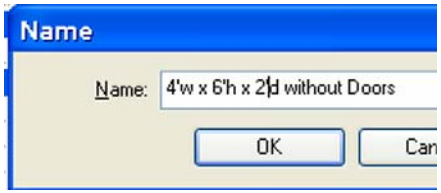
The drawers assume the properties of the shelf subcategory defined in the shelf unit family.

Create Types

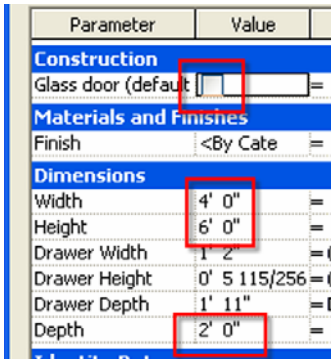


The family is finished and is fully parametric. What you still can do is to create types. In other words, you can preset different types of this family with predefined parameters like width, depth, height, and material so the shelf unit can automatically be inserted in various standard sizes or materials, enabling users to simply select the type from a list. Should the type not be found on that list, the user can always create it on the fly. Let's see how to do that.

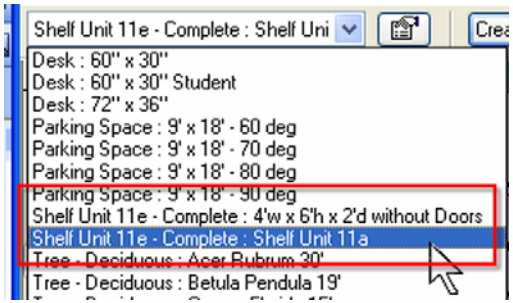
29. On the Design Bar, click Family Types and then click New.
30. As a name for the new type, enter 4'w x 6'h x 2'd without Doors, and click OK.



31. You can now change the corresponding values in the dialog box.
32. Adjust the parameters to Width (4'), Height (6'), Depth (2'), and clear the Glass Door check box.
33. Click OK.
34. From the File menu, choose Save.

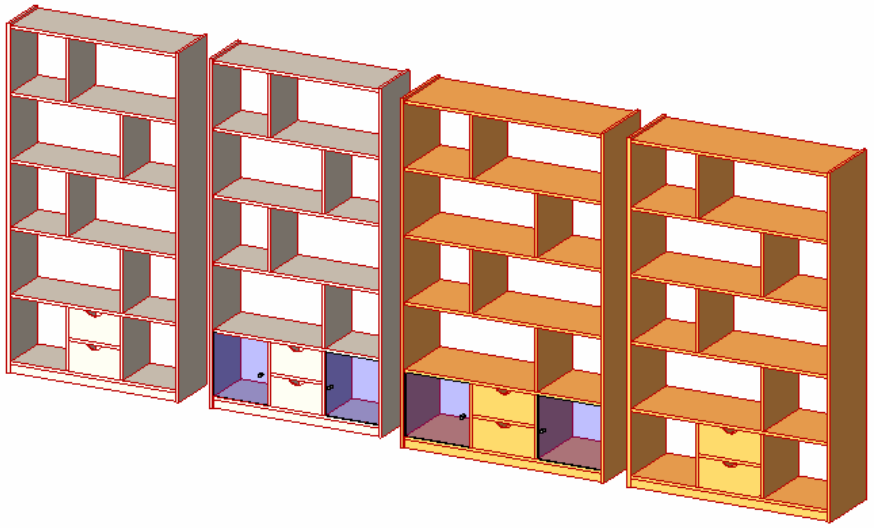


35. Start a new project or open an existing one. Load the newly saved shelf unit family and insert a few instances of it in the project. Note that in the unit's Properties dialog box under Type, you see two different predefined types of this family.



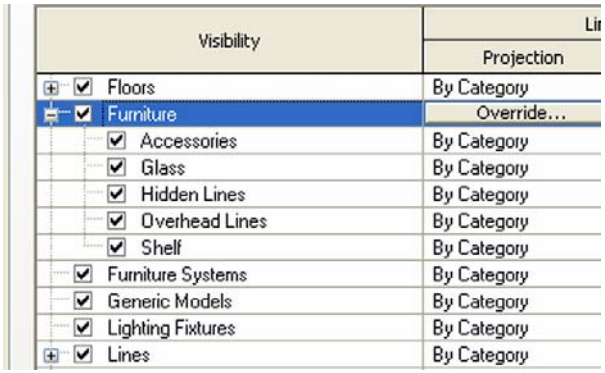
The family name is displayed along with the type name. The family in this case is the name of the RFA file you have been working in.

36. Insert a few instances of each type, and change their parameters to see the differences. Try to change both the instance parameters (Glass Door) as well as the type parameters (width, height, and so forth).



37. Activate plan view, and in the Properties of the view, click the Visibility Edit button.

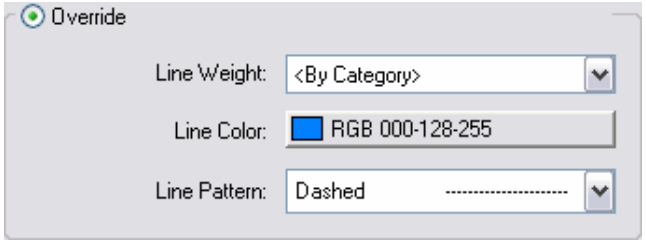
38. Expand the Furniture category.



39. Click Projection in the Shelf line.

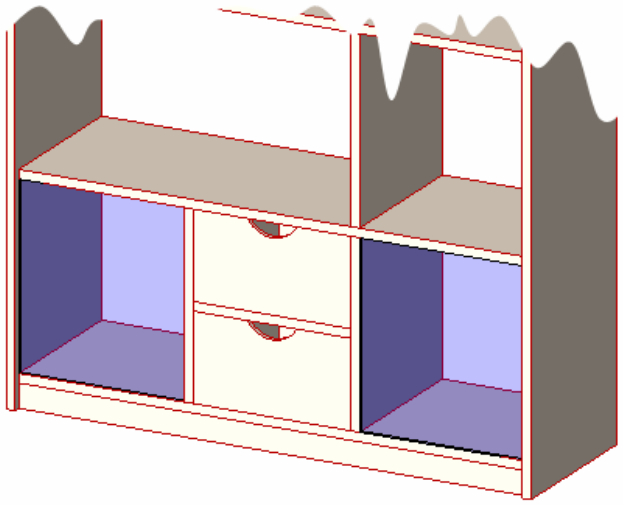
40. Click Override.

41. Change the Line Color and the Line Pattern, and click OK.



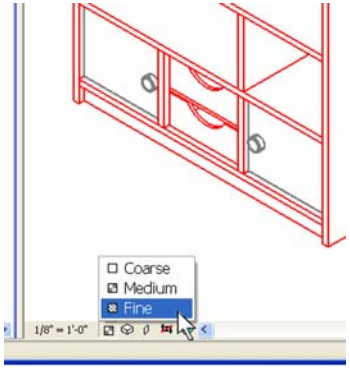
42. Make sure the changes you have just made are propagated correctly.

43. Activate the 3D view, and in the Properties dialog box click Visibility.
44. Expand the Furniture category.
45. Clear Accessories, and click OK.



Again, thanks to the subcategories, you can have an instance of this family in which the doorknobs are simply turned off and thus invisible.

If you do not see the accessories in the view, remember these are set to Fine.



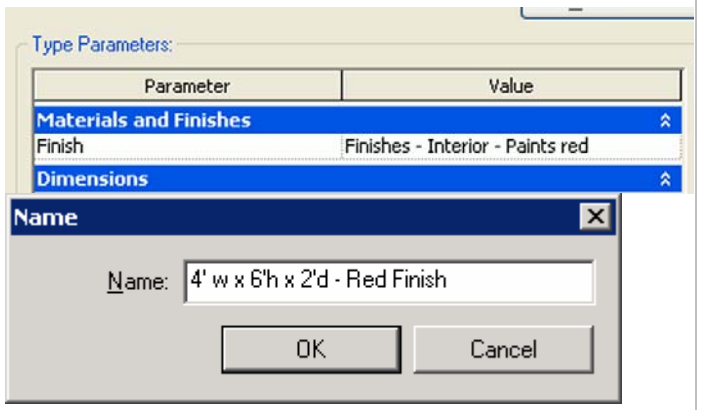
46. Select any instance of the shelf unit, go to its Properties dialog box, and click Edit/New.

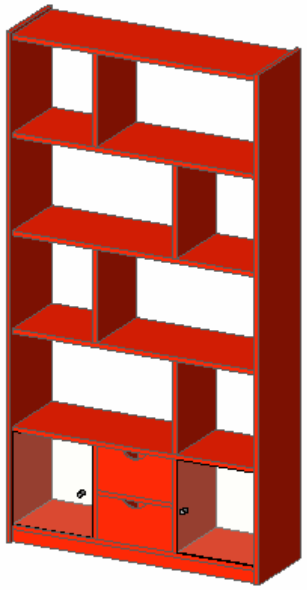
47. In the dialog box that opens, select Duplicate. Autodesk Revit Building prompts you to enter a new name: you are about to create a new type of this family. Name this new type 4'w x 6'h x 2'd – Red Finish.

48. Click the material Finish.

49. Create a red paint, and click OK to close all dialog boxes.

50. You have just created a new type of this family.





As you can gather by now, you can create as many types of a family as you want and use them in any project.

Unit 12

Theory: Interdependencies

Autodesk Revit Building: Site

This unit explains Autodesk Revit Building's Site features and workflow as well as linking files and AutoCAD® drawings. This unit has four exercises:

- 12a takes you through the process of creating importing an AutoCAD drawing
- 12b illustrates how to link a Revit Building project into a current project.
- 12c works with the site tools to develop the model.
- 12d exports a view and sheet into AutoCAD DWG format.

Unit 12, Exercise A: Importing AutoCAD Drawings

In this exercise you start with the workbook template and import an AutoCAD drawing to use as a basis for the site work in the rest of this unit. This AutoCAD site drawing has polylines that are placed at elevation. In a later exercise you convert this geometry to a Revit Building toposurface.

Exercise Setup

1. Start a new project with the workbook template.

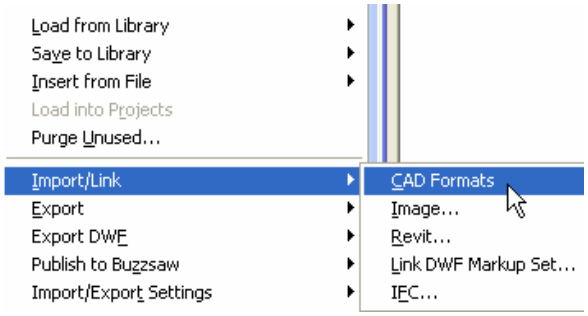
   Refer to Unit 1 if you need help creating a project from the workbook template.

2. From the File menu, choose Save As and save your project as *Unit 12.rvt* in the *Revit Workbook* folder.

3. Set the Site view current.

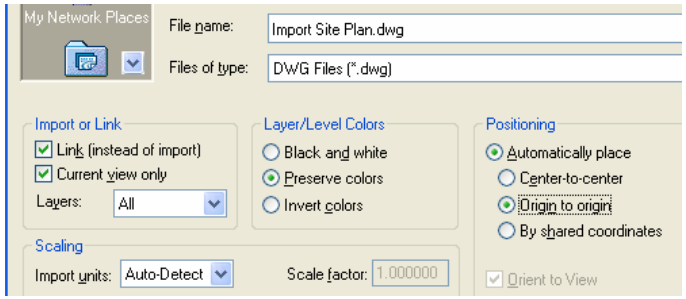
Import an AutoCAD Drawing

4. From the File menu, choose Import/Link>CAD Formats.



5. Browse to and click once on the drawing file *Import Site Plan.dwg* in the *Workbook* folder.

6. Match the settings in the Import dialog box to the settings shown at right:
   a. Link Instead of Import
   b. Current View Only
   c. All layers
   d. Preserve colors
   e. Automatically place: Origin to Origin



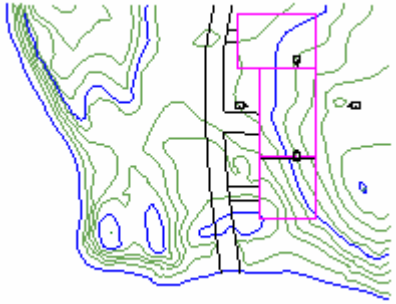
   Link Instead of Import: This option maintains a live link to the drawing. If the drawing changes, you can reload it into the Revit Building project.

   Current View Only: It is a good idea to link drawings to a specific view. This cuts down on the amount of information that must be regenerated as you switch from view to view.

   Origin to Origin. Although you do not have access to the project origin as in AutoCAD, the origin is near the intersection of the elevation marks.

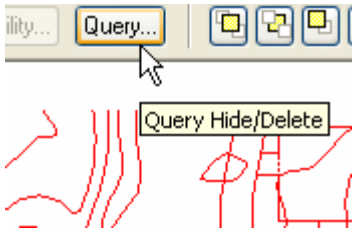
7. Click the Open button to proceed with the import.

8. Right-click in the drawing area and choose Zoom to Fit.

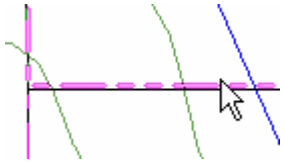


Layer Control of Linked Drawing: Query

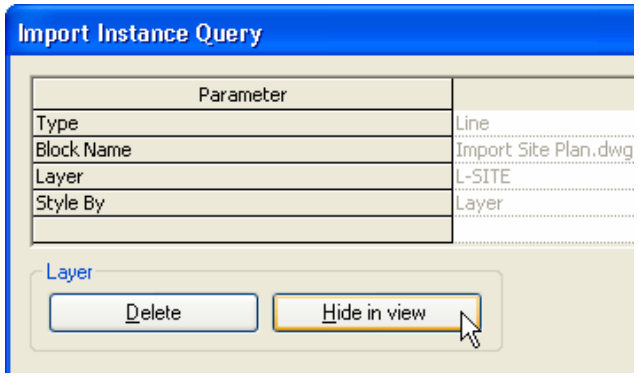
9. Click the imported DWG in the drawing window.
10. On the Options Bar, click the Query button.



11. Click one of the magenta lines in the drawing.



12. Click Hide in View.

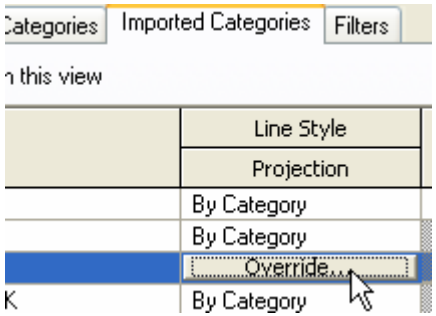


The Query dialog box is a convenient way to find out information about the object you have selected in the linked drawing.

Layer Control of Linked Drawing: Visibility Graphics

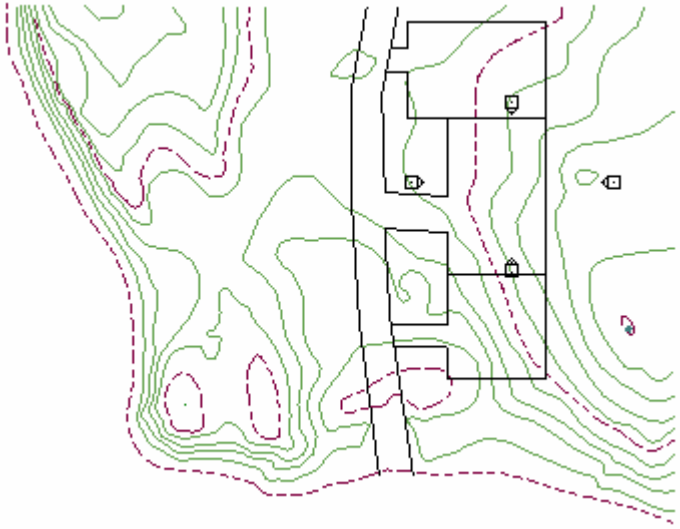
In addition to the on-off control afforded by the query tool, you have complete control over the linework in the linked drawing through the visibility graphics override of the view.

13. Type VG to access the view's visibility graphics override.
14. Click the Imported Categories tab.
15. Click the Line Style for C_CNTR_10 to access the override for this layer in the linked drawing.



16. Set the line color to a purple or dark red and the line pattern to Long Dash.

17. Click OK two times to return to the project's drawing window.



The linked drawing now has overrides for this specific view.

Unit 12, Exercise B: Importing Revit Building Projects

In this exercise you continue from exercise 12a, but import a Revit Building project with a building in it. You then look at some of the display controls you have over the linked Revit Building file.

If you completed the last exercise, you can continue to work in that file. If you choose to work in the provided project file, note for consistency the AutoCAD drawing has been inserted rather than linked.

Exercise Setup

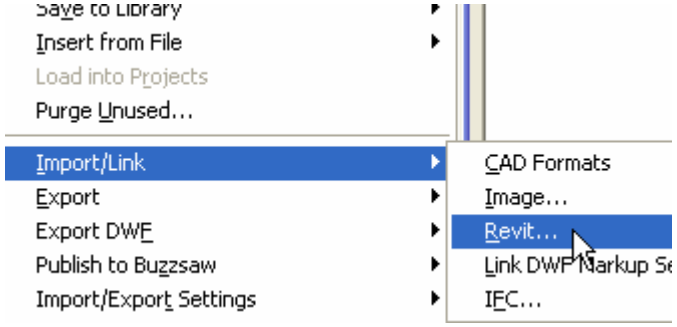
1. Open file Unit 12b – Start. You should be in site view.

Link a Revit Building Project into the Current Project

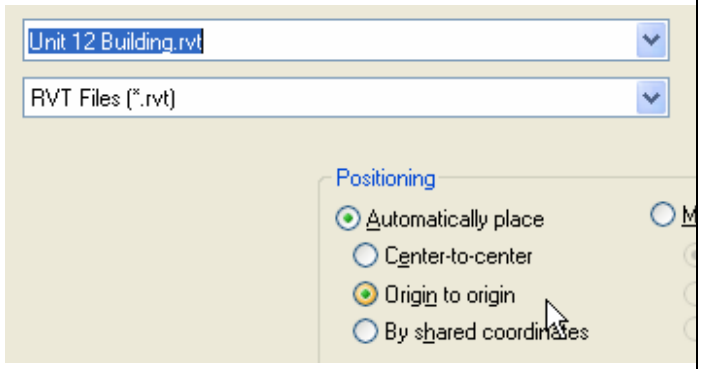
Revit Building files may be linked to one another. Like the linked AutoCAD DWG, as the linked Revit Building file changes, it may be reloaded to update the current project with the new information. Also like the linked DWG file, you have control over how the linked Revit Building file is displayed in the current view.

Unlike the AutoCAD drawing file, there is no way to insert a Revit Building project into another project completely. It will only import as a linked file.

2. From the File menu, choose Import/Link>Revit, and browse to the workbook's data set folder. Click one time on Unit 12 Building.rvt.



3. Under Positioning, select the Origin to Origin option, and click the Open button.

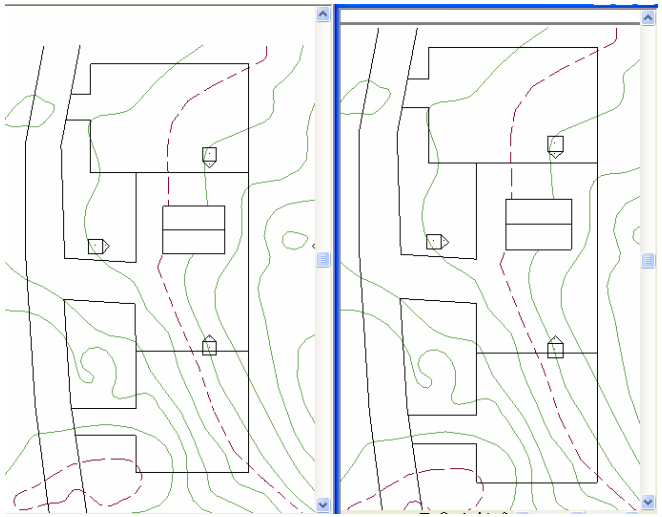


Linked Revit Building Project by View

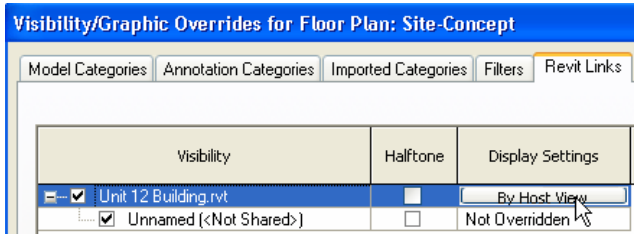
You have several levels of control over the display of the linked Revit Building file. You can view the linked file with the default visibility of the view, or the default settings of a

view within the linked file, or override any of the linked constituent parts.

4. Duplicate with detailing the Site view and rename the new view Site-Concept.
5. Tile the Site and Site-Concept views.

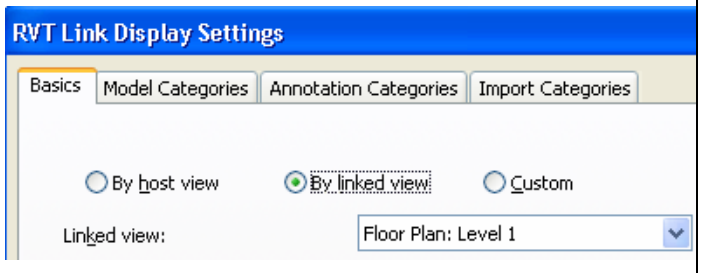


6. Set the Site-Concept view current, and type VG to access the view's visibility graphics override.
7. Click the Revit Links tab, and then click the plus (+) sign to the left of Unit 12 Building.rvt.

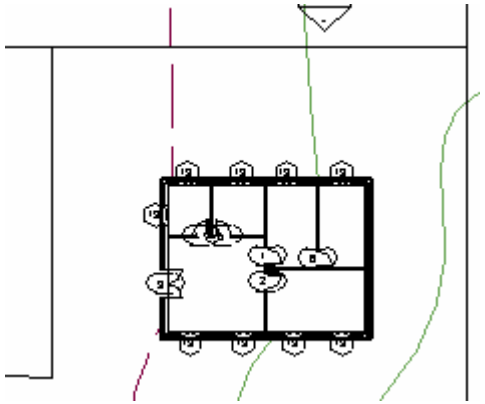


If you have more than one instance of the linked file in your project, each instance is listed in this tree. You control the display of each instance independently.

8. Click the display settings By Host View button to override the default display settings.
9. In the RVT link Display Settings, click the Basics tab, and then click the By Linked View radio button and set the linked view to Floor Plan: Level 1.



10. Click OK two times to return to the drawing window.

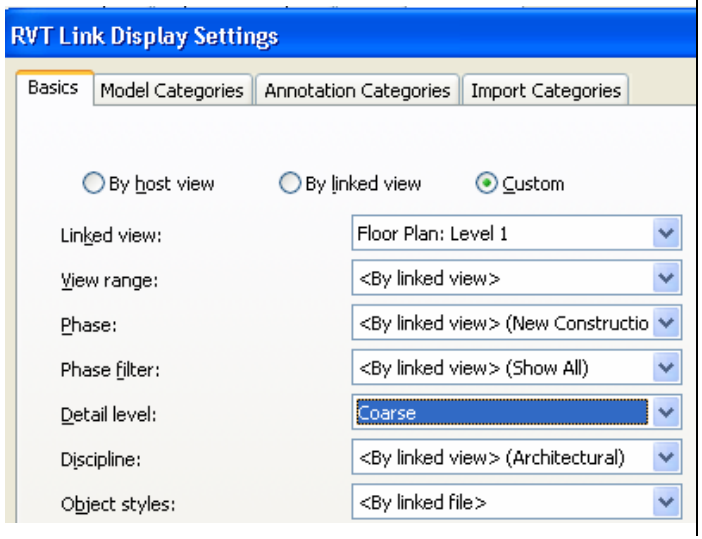


The linked file now uses the current display settings stored by the linked file rather than the host file's current view settings.

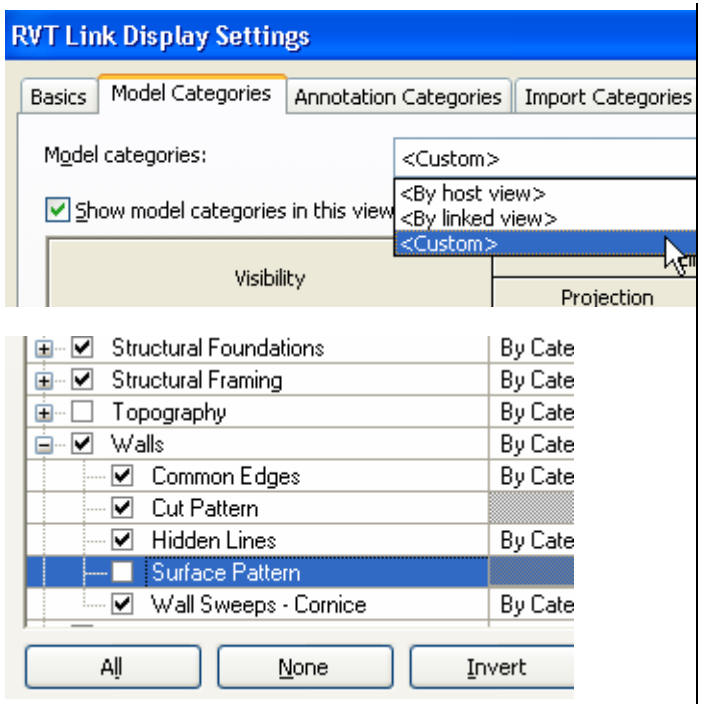
Linked Revit Building Project View Display Override

You can also control each item in the linked file independently of the view settings stored in the linked project files view.

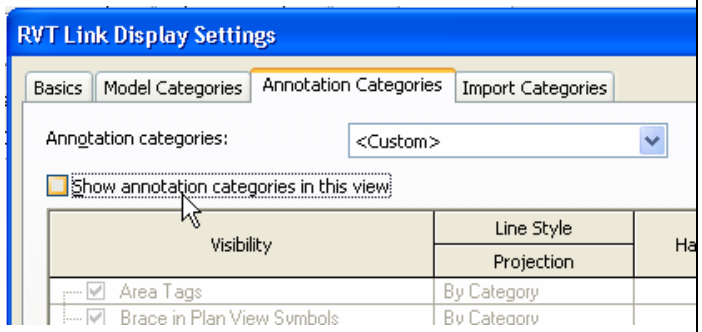
11. With the Site-Concept view current, type VG to access the view's visibility graphics override.
12. In the RVT Link Display Settings dialog box, click the Basics tab then click the Custom radio button.
    a. Verify the Linked View is set to Floor Plan: Level 1.
    b. Change the Detail Level to Coarse.



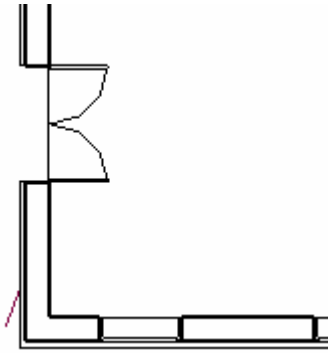
13. Click the Model Categories tab:
    a. Set the Model Categories drop-down to <Custom>.
    b. Under Walls, clear the Surface Pattern check box.



14. Click the Annotation Categories tab:
    a. Set the Annotation Categories drop-down to <Custom>.
    b. Clear the Show Annotation Categories in This View check box.



15. Click OK two times to return to the drawing window.



All of the control you have over the host drawing view visibility can also be applied to a linked Revit Building project.

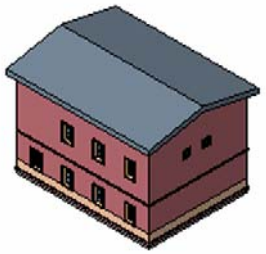
Unit 12, Exercise C: Site Tools

In this exercise you create a site toposurface based on the geometry of the linked AutoCAD site file. You then develop the site using the Revit Building site tools.

1. Open file Unit 12c – Start. You should be in site view.

The site file has an imported DWG instance. The DWG data consists of 2D polylines on different heights.

2. Set the 3D view current.

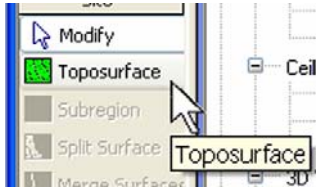


Note that the DWG drawing was imported as "Current View Only," so it displays only in the view where it was positioned—the Floor Plans Site view. It does not appear in the 3D view.

3. Set the Floor Plans Site view current.

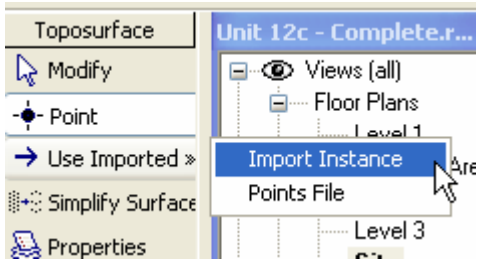
4. Right-click the Design Bar and activate the Site Design Bar if it's not already visible.

5. On the Design Bar, click Toposurface. You enter sketch mode.



6. Set the Floor Plans Site view current.

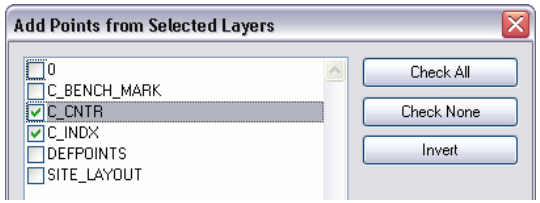
7. On the Design Bar, click Use Imported>Import Instance, and click the imported DWG file.



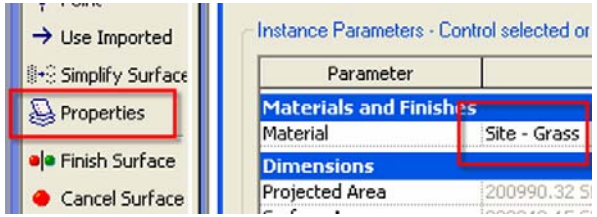
You can also create toposurfaces directly by clicking the Point command and positioning points (the height can be set on the Options Bar) in the workspace.

Site information is usually imported from DWG files. Once the DWG instance is selected, Autodesk Revit Building recognizes the layers contained within it and lets you pick which ones you want to use to create the surface.

8. Use image on the right to select the layers to use for creating the surface. Click OK.



9. On the Design Bar, click Properties and change the surface material to Site – Grass. Click OK to close the dialog box.

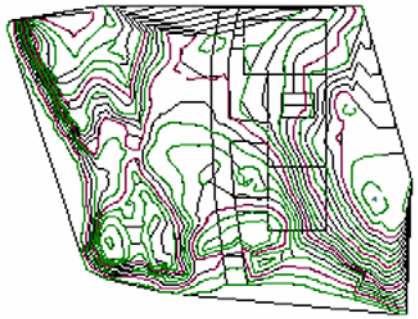


You can change surface material later by opening its Properties window.

10. On the Design Bar, click Finish Surface.

11. Open a 3D view. Note that the building is sunk inside the topographic surface.

12. Open site view again.



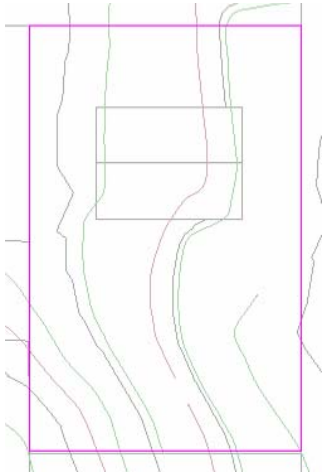
Note that the DWG drawing was imported as "Current View Only," so it displays only in the view where it was positioned.

Create a Pad

13. On the Design Bar, click Pad. You are once

again in sketch mode.

14. Use the Lines tool to draw a rectangle around the building, as shown in the image. You can follow the property lines for the sketch.



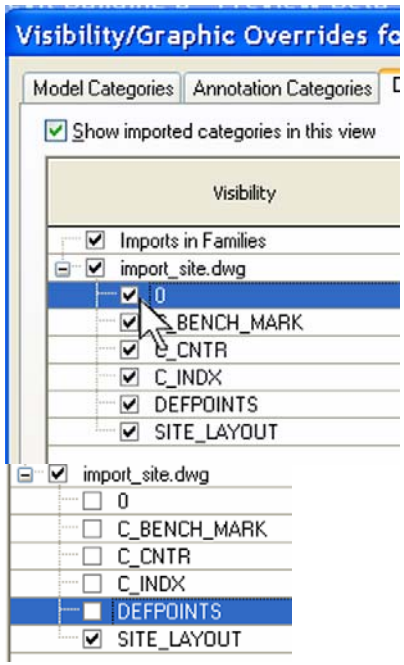
These property lines were sketched, but you can enter their coordinates directly in a table and the sketch is automatically generated.

15. On the Design Bar, click Pad Properties, and change the Pad Level to Level 1.

Change this property at any time.

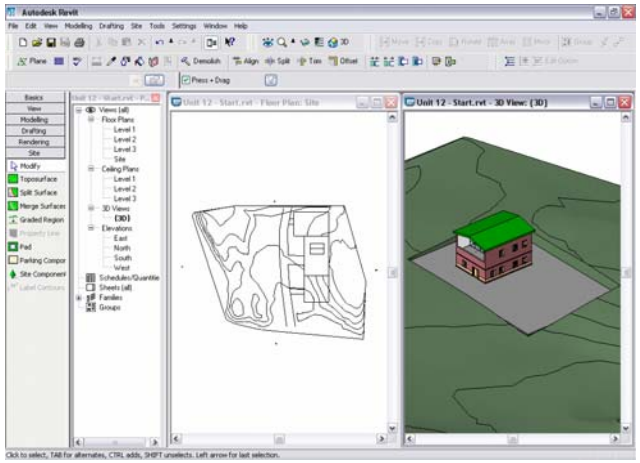
16. Click Finish Sketch.

17. Open the visibility settings for the view, go to the DWG/DXF/DGN Categories tab and turn off visibility for all the DWG layers except Site Layout.
18. Click OK to exit the Visibility/Graphic Overrides dialog box.
19. Click OK to exit the View Properties dialog box.



Turn off the unnecessary DWG data in your view.

20. Open the 3D view to see the pad. Tile windows (choose Tile from the Window menu).

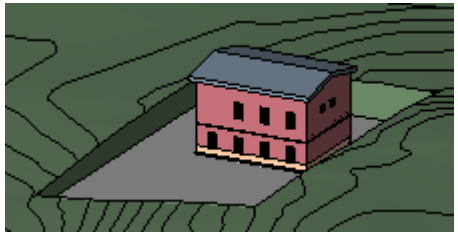


Working with side-by-side windows is helpful in many situations.

Before you tile the windows, choose Close Hidden Windows from the Window menu, and then open just the views you want to tile.

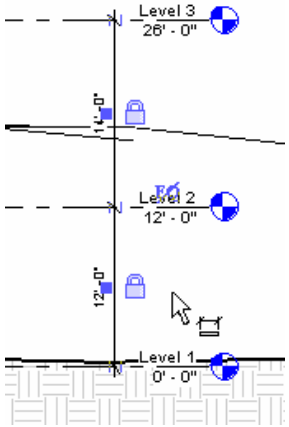
If you minimize a view, it does not tile with the other open views.

Adjust the Building Levels to the Site Topography

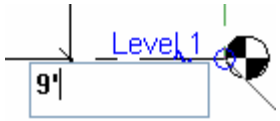


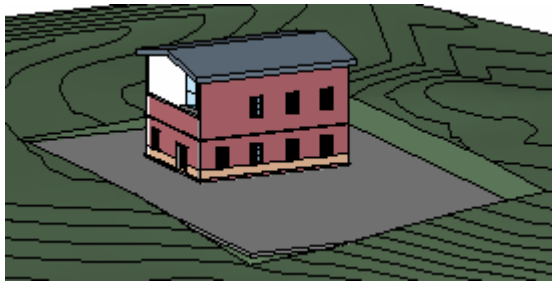
The building pad is well below the average grade of the topography. Lock the levels together, and then adjust the level heights relative to the topography.

21. In the west elevation view, add a string of dimensions from level line to level line. Lock each of the dimensions.



22. Change the value of Level 1 to 9'.



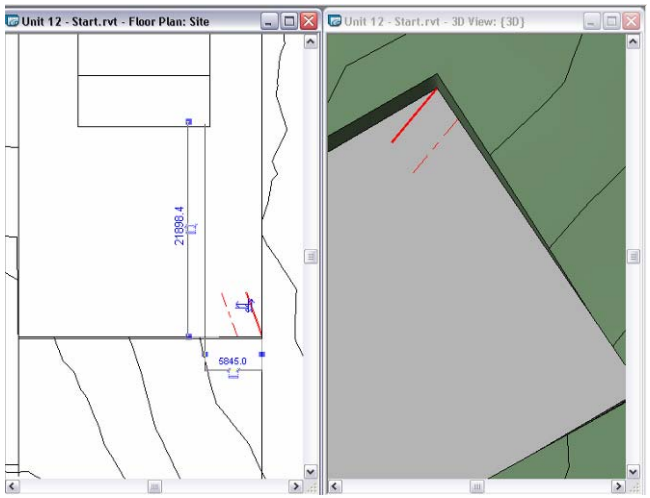


Because all the building components are constrained to the levels, as you move the levels the entire building moves accordingly.

Add Site Components

23. Set the Floor Plans : Site Plan current.

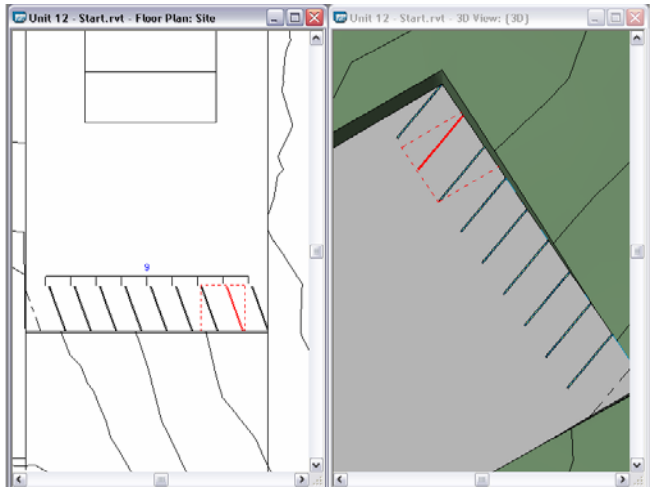
24. On the Design Bar, click the Parking component, and add a 9’ x 18’ - 70 deg, as shown in image.



Parking components, as site components, automatically recognize the height of their host during positioning.

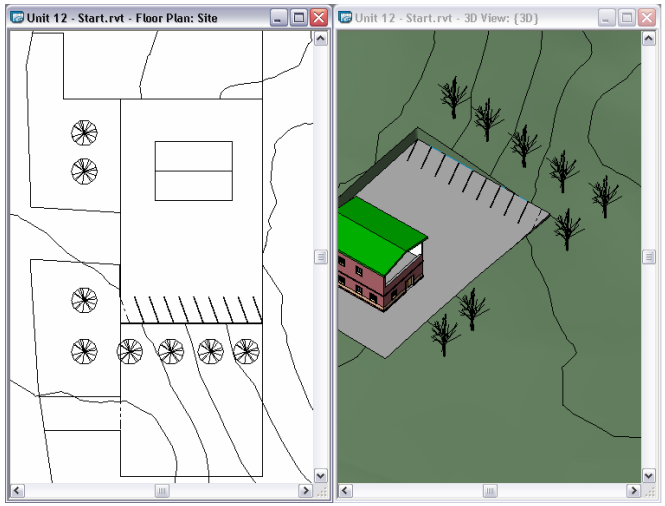
Use the blue arrows to flip the parking space.

25. Select the parking component and array eight instances of it to the left (west).



Parametric arrays are helpful when positioning this kind of component.

26. Click Site component, and add a few tree components, as shown in image.



Trees are specific site components that have their own editor and can be customized, though Autodesk Revit Building comes with an extensive tree library.

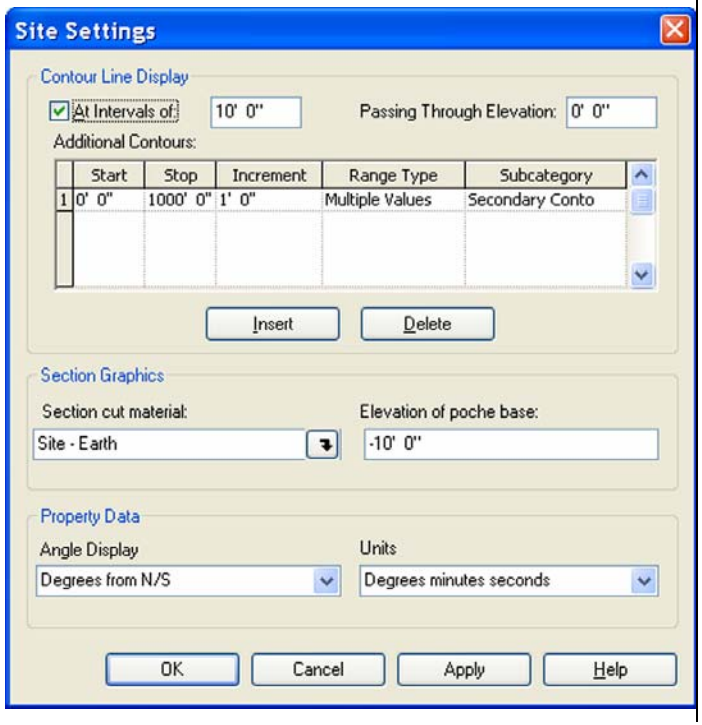
To navigate through the library, create a new planting family and open the Family Types dialog box. Clicking the Plant Name parameter opens an AccuRender dialog box with the tree library.

The symbol used for plans, elevations, sections, and normal 3D is a simple stick symbol.

27. Change the site settings.

28. Maximize the site view. From the Settings menu, choose Site Settings.

29. Contours are set to show up every 10 feet as primary contours, and every foot as secondary contours.



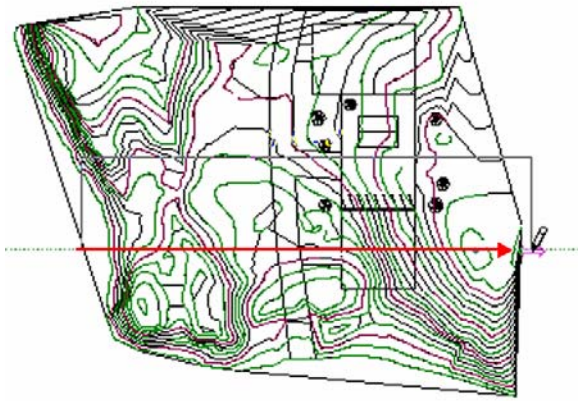
You can add as many contour lines as you want.

The Poche base elevation setting in the bottom left defines how thick the surface displays in section views. The Cut material defines what type of hatching the poche has.

Once finished, if you zoom into the drawing, you see that primary and secondary contours display with different lineweights, which are set in the Object Styles dialog box under the Topography category.

Add Contour Labels

30. On the Design Bar, click Label Contours and draw a straight horizontal line, approximately as shown in image.

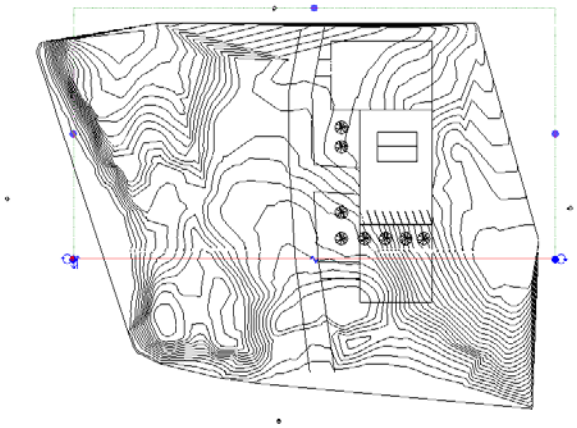


You can draw the contour label line in any direction.

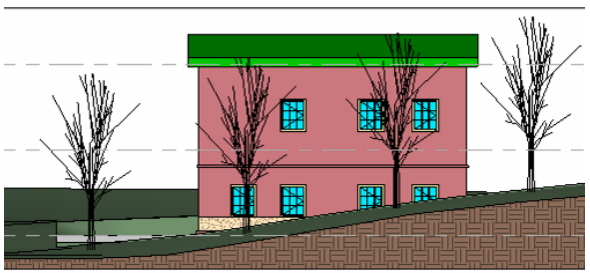
31. Zoom in to see the labels.

Add a Site Section

32. Go to View Design Bar. Click Section, and draw a section on the same line as the contour label line.



33. Open the section. From the View menu, choose Apply View Template>Site Section.



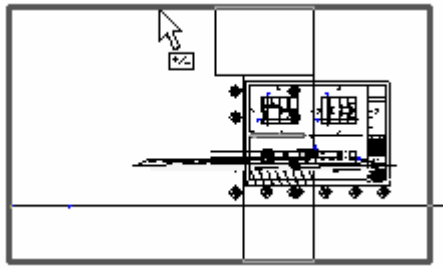
34. Shade the view if desired.

Unit 12, Exercise D: Exporting AutoCAD Drawings

In this exercise you export the site model and a sheet for use with AutoCAD software.

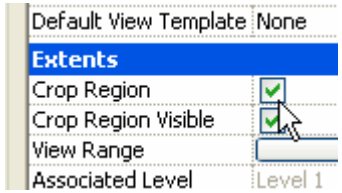
Exercise Setup

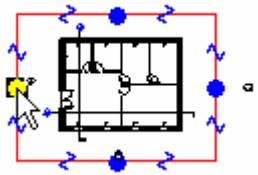
1. Open file Unit 12d – Start. You should be in site view.
2. Open the Sheet A101 and zoom out to see the extents of the views.



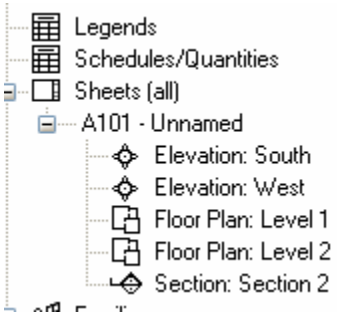
The views that were placed on the sheet have grown because the site work makes the extents of the views much larger than when the views were originally placed on the sheet. This is typical behavior if a view does not have its crop region active.

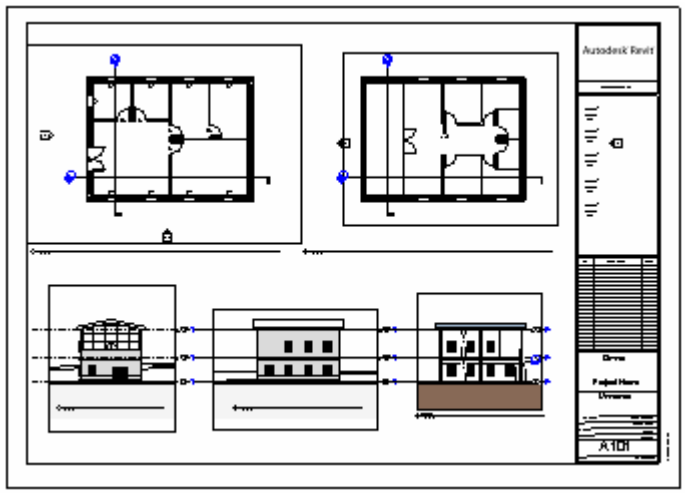
3. For each of the views on the sheet:
    a. Open the view properties and select the Crop Region check box.
    b. Select and left-drag the crop region in to a more sensible boundary for the view.





You can also access the view properties from the sheet by selecting a view on the sheet and choosing Activate View from the context-sensitive menu.



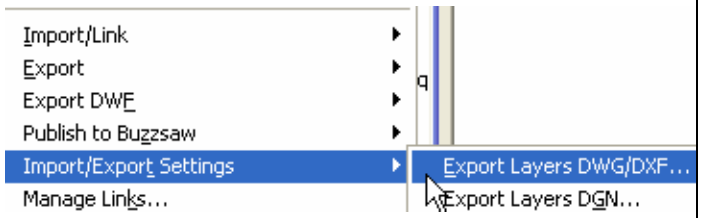


The finished sheet is now ready to export to AutoCAD software.

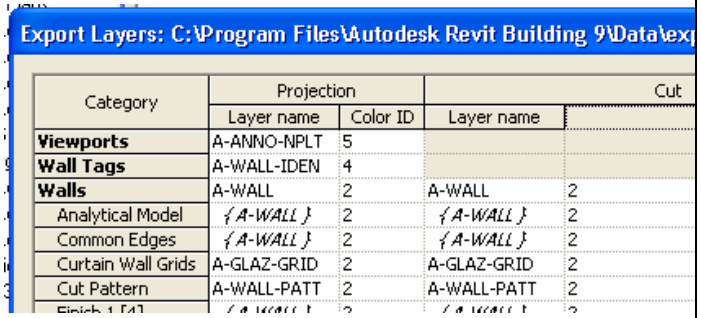
Export a Sheet to AutoCAD Drawing Format

Before you export to AutoCAD, verify that the export settings are correct.

4. From the File menu, choose Import/Export Settings>Export Layers DWG/DXF.



5. Make any changes needed to the export settings.

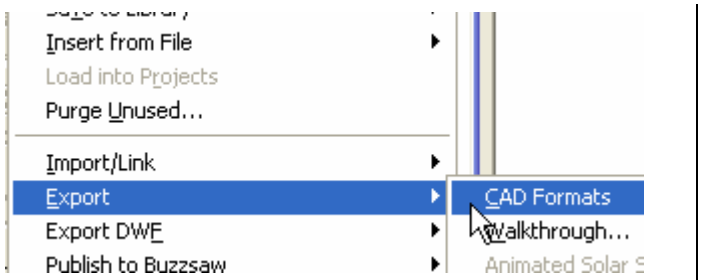


Category	Projection		Cut	
	Layer name	Color ID	Layer name	
Viewports	A-ANNO-NPLT	5		
Wall Tags	A-WALL-IDEN	4		
Walls	A-WALL	2	A-WALL	2
Analytical Model	*{A-WALL}*	2	*{A-WALL}*	2
Common Edges	*{A-WALL}*	2	*{A-WALL}*	2
Curtain Wall Grids	A-GLAZ-GRID	2	A-GLAZ-GRID	2
Cut Pattern	A-WALL-PATT	2	A-WALL-PATT	2

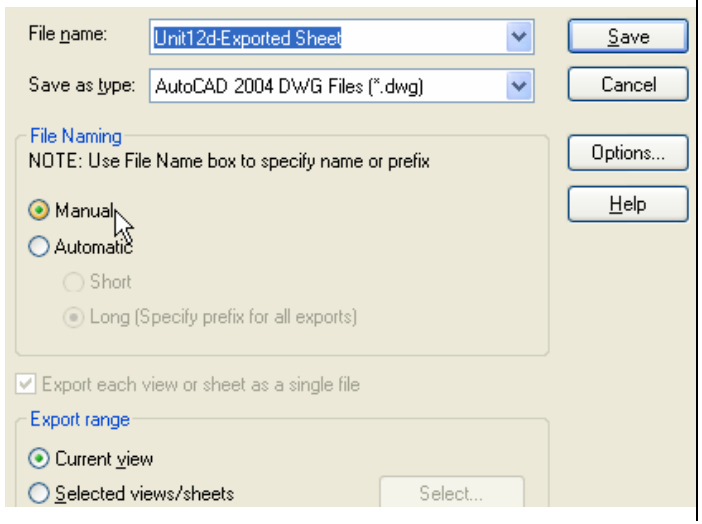
Each of the Revit Building objects is assigned a layer and color ID for instances where the object is cut (such as a wall in plan view) or used as projection (a wall in elevation). The layer names are created automatically in the new drawing file. The color IDs are the standard AutoCAD ACI colors that are assigned to the layers as they are created.

6. Click OK to return to the drawing window.

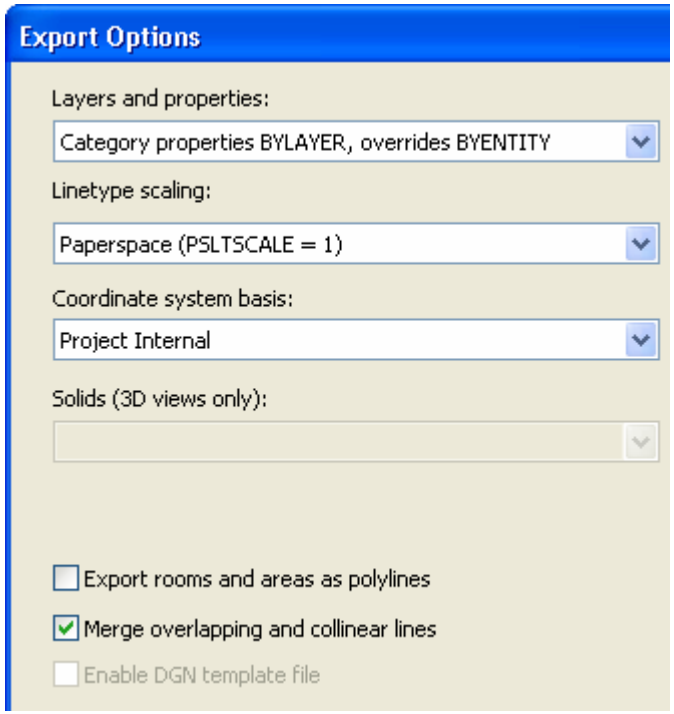
7. From the File menu, choose Export>CAD Formats.



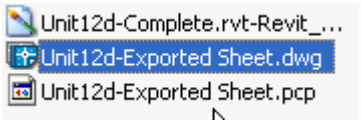
8. In the Export dialog box:
    a. Click the Manual radio button under File Naming.
    b. Type a file name for the drawing.
    c. Set Save as type to AutoCAD 2004 is the format.
    d. Click the Options button.



9. The Export Options dialog box gives you several options as to how the drawing will be created. Verify that the settings are as shown, and click OK to return to the Export dialog box.



10. Click the Save button to create the new drawing file.



The new drawing is created along with a PCP file for the pen settings that AutoCAD can use to plot this file.

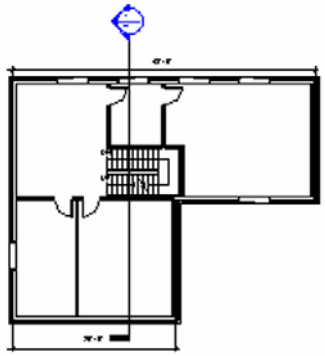
Unit 14

Theory: Detail

Autodesk Revit Building: Drafting and Linework

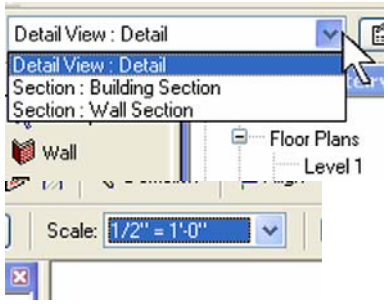
This unit explains how to accomplish detailed drawings using Autodesk Revit Building.

1. Open the file Unit 14 – Start.rvt in the training files directory. The project should open up to the view Floor Plans: Level 2.



2. On the Basics Design Bar, click Section.
3. On the Options Bar, set:

- Section Type = Detail View
- Scale = 1/2" = 1'-0"

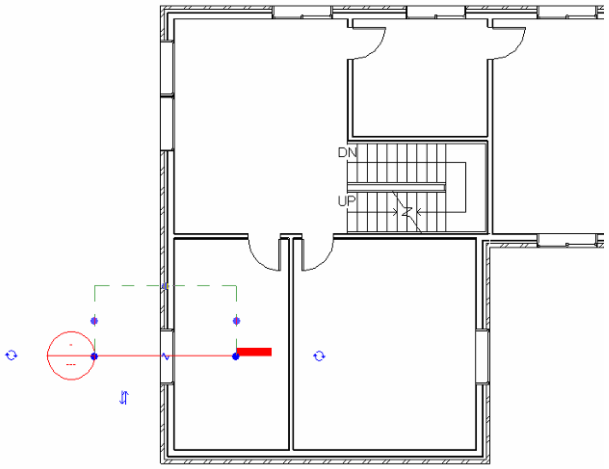


You can create as many section types as you want by duplicating them.

In the Project Browser, details (including sections) appear under the category called Detail Views, while other section types have their own category.

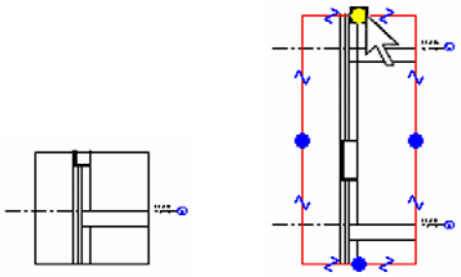
The scale affects the detail level of the newly created view. Normally, all views 1 1/2" = 1'=0" and bigger have detail level set to Fine, but it is possible to change the settings by choosing Detail Level from the Settings menu.

4. Draw a section mark over the window, as shown in image.



5. Open the section by double-clicking the section bubble or the detail view in the Project Browser.

6. If needed, resize section on top to display Levels 2 and 3, as shown in image.



You may need to resize section views, or maybe even turn off the crop region if it disturbs your drawing: Right-click, choose View Properties, and clear Crop Region Visible.

7. Right-click in the section detail view , and choose View Properties. Under Model Categories, turn off visibility of windows.
8. Click OK to exit dialog box. Click OK again to close view properties.

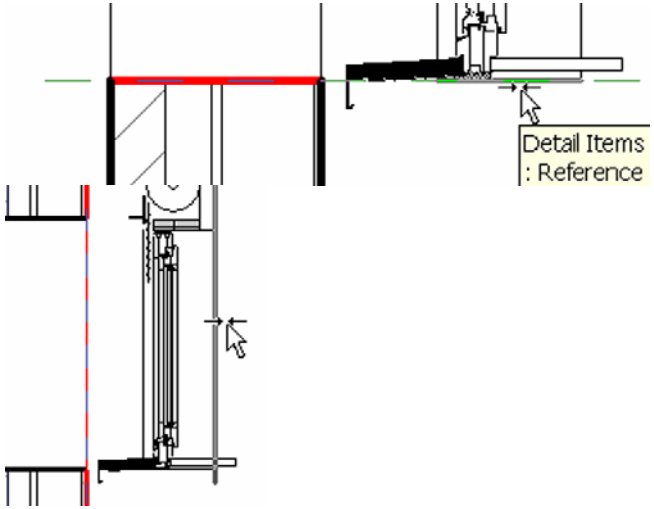
The keyboard shortcut for displaying the visibility settings for the view is VV. It provides a quick way to jump directly to the dialog box.

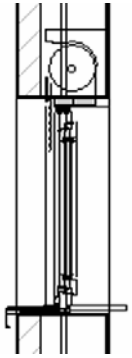
9. From the File menu, choose Load from Library>Load Family. Navigate to the *RFA* folder in the *Training Files* folder and select the file called *Window Section.rfa*. This detail component was generated from a DWG file.

Detail components can be created by drawing directly or by importing a DWG, DXF™, or DGN file if you already have the detail in one of these file formats.

10. On the Drafting Design Bar, click Detail Component. The loaded Window section detail component should be ready to be placed on the drawing.

11. Place the window detail component as shown in image. Use the Align tool to help align it correctly to the sill and the wall finish.

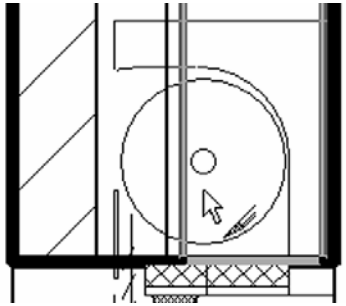




Edit Cut Profile

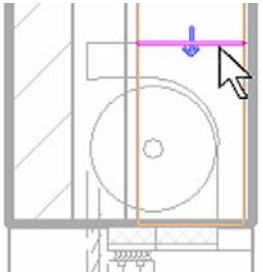
12. Select the Edit Cut Profile icon on the toolbar.

13. Click the hatch or boundary of the subcomponent you want to modify.

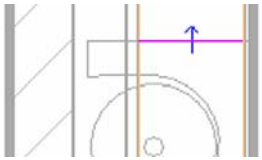


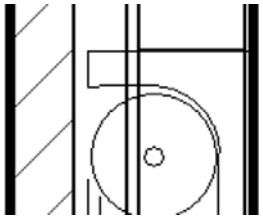
This takes you into sketch mode, where you draw the linework for the new cut profile of the component.

14. Draw the linework where you want the component to be cut.

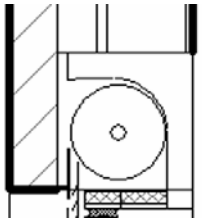


15. Click the blue arrow toward the side you want to keep.
16. Click Finish Sketch.





17. Repeat for the other three components in the wall.

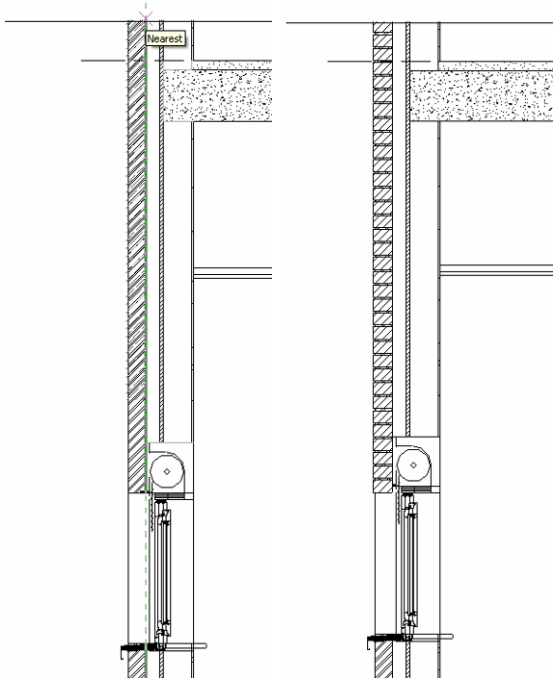


The profile of each material must be edited separately because the tool works on one boundary or wall layer at a time.

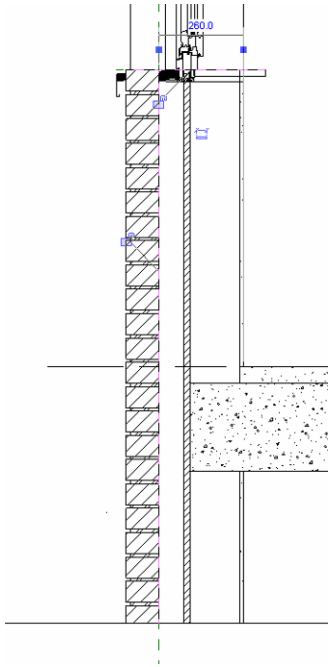
18. On the Drafting Design Bar, click Repeating Detail, and on the Options Bar, click Brick – Section.

Use detail components in arrays to create a repeating detail. A simple example is a series of bricks in section view. There are various ways to assemble the detail component in a repeating detail.

19. Draw a line on the exterior part of the wall, as shown in image. Don't worry about correct positioning. Move it into the correct position after placing it.

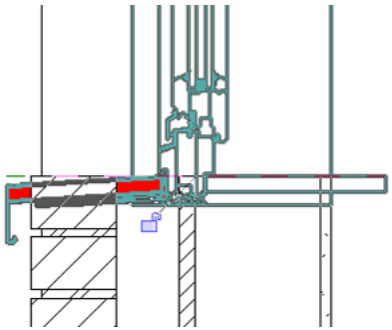


20. Add another Brick – Section repeating detail below the window.



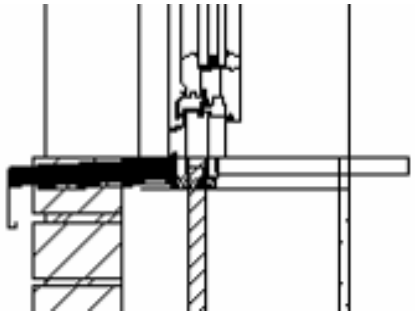
Note that this brick detail component contains an invisible line that defines the width of the mortar. You could add a hatch in the detail component so it displays the mortar in the repeating detail.

21. If the brick repeating detail is in front of the window detail, select the former and click the Bring to Front icon on the Options Bar.



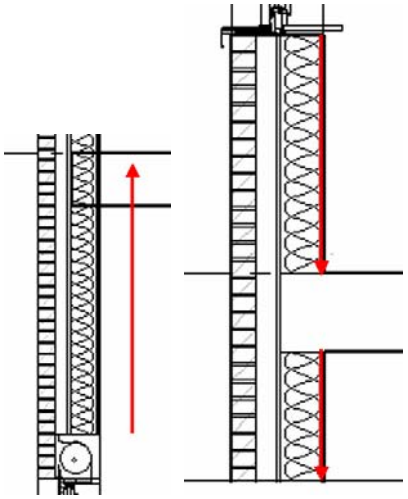
Annotations and detail components are view specific: they are visible only in the view they were created in.

It is possible to define the order of their appearance by using the toolbar displayed on the left. This toolbar appears on the Options Bar when a detail component is selected.



22. On the Drafting Design Bar, click Insulation, and set the size in the Options Bar to 5 ½”.

23. Draw the insulation in the exterior wall, as shown in image, both above and below the window detail.



Change the insulation width after designing it by right-clicking and choosing Properties>Width Field, or by simply changing the Width value on the Options Bar.

Unit 16

Theory: Is Architecture Engineering?

Autodesk Revit Building: Formulas

This exercise starts with a data set that is a window family. The window family is already complete; you add some formulas to control the geometry and visibility of some of the solid elements that compose the window family. In particular, you create

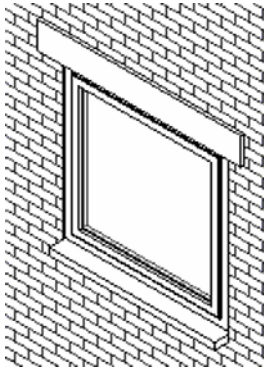
- Formulas that control the relative height of the frames (and the glass), depending on the sill thickness
- A formula that controls visibility of the crown, to be displayed only if the window width is equal to or larger than 5'

Parameter values should always be changed in the Family Types window to verify if the model flexes correctly.

In Unit 11 you added formula parameters to control the width of the drawer of the shelf unit. You also added a visibility parameter.
In this exercise you create formulas and tie the display of the crown or lintel of the window to the result of the formula.

This exercise assumes you have worked through the exercises in Units 10 and 11. If you have questions about terminology or processes, you can go back to those exercises for review.

1. Open file Unit 16 – Start.
2. Set Current 3D Views:{3D}.

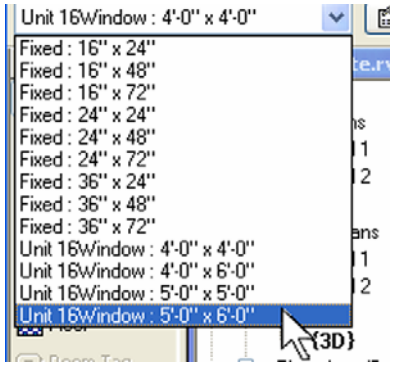


3. Click the window in the view.

Families are created using family template files that contain different parameters according to the category. In this window family a crown subcategory was added in the Object Styles dialog box (Settings menu, Object Styles command).

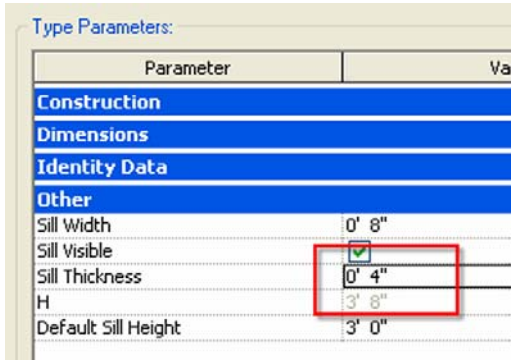
The window family is already complete, but you will add formulas to control the geometry and visibility of some of the solid elements that compose the window family. In particular, you create formulas that control the relative height of the frames (and the glass), depending on the sill thickness and whether it is visible. Another formula controls visibility of the crown, to be displayed only if the window width is equal to or larger than 5 feet.

4. Note that there are already a few types in the family. Select them from the drop-down menu. Return to the type named 4’-0” x 4’-0”.
5. On the Design Bar, click the Family Types button.

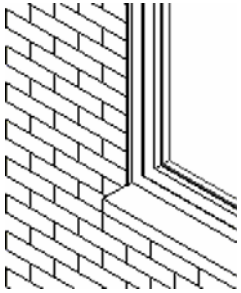


As you flex the types in the project, note that for the different heights the relationship between the sill and the window frame remains constant.

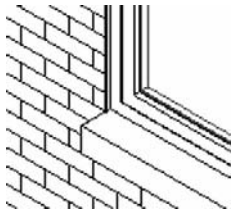
6. Open the type parameters for the 4’ – 0” x 4’ – 0” window type.
7. Change the sill thickness to 4”.
8. Click OK to return to the drawing window.



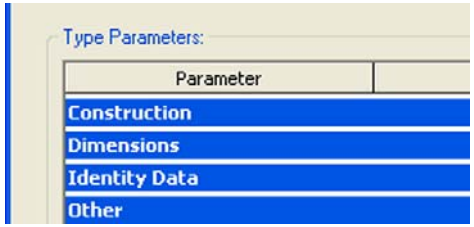
Note that when you do this, the H parameter changes as well. The current definition of the H parameter is height (of the window opening) less the sill thickness.

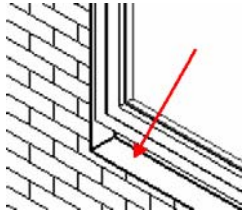


The relationship between the sill and the window frame is constant.



9. Return to the window type properties and clear Sill Visible.
10. Click OK to return to the drawing window.





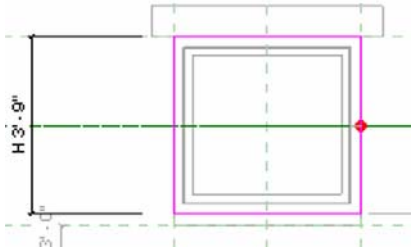
The window has a gap where the sill is still taken into consideration, but is not displayed.

Edit the Window Family

11. Click the window.
12. On the Options Bar, click Edit Family.
13. Click Yes to edit the family.

14. You add a formula to control the relative frame height according the sill visibility.

Formulate the H Parameter



The H parameter was specifically created and assigned to the frame height. To see how it is defined, select the outer frame and click Edit on the Options Bar. On the Design Bar, click Sketch 2D Path, and go to the exterior elevation view.

Note the gap from the bottom of the sketch line to allow for the sill.

If you see a parameter in a family definition that is not immediately evident when the family is opened, there is a good chance that it is nested into a solid part of the family.

If you have opened this solid for editing, quit back to the standard family editor window.

15. In the Family Types properties dialog box, click the H parameter row, and under the Formulas column write the IF formula: if (Sill Visible, Height - Sill Thickness, Height).

Other		
Sill Width	0' 8"	=
Sill Visible	☑	=
Sill Thickness	0' 2"	=
H	5' 10"	= if (Sill Visible, Height - Sill Thickness, Height)
Default Sill Height	3' 0"	=

The formula syntax is:
IF (<condition>, <result-if-true>, <result-if-false>)
Because Sill Visible is a Yes/No parameter, you only need to type the condition by itself.
Formulas and parameters are case sensitive.

To put this into English:

If the sill is visible (condition is true), then Height - Sill Thickness (raise the frame for the sill).

If the sill is not visible (condition false), then use the value held by the height parameter as the height of the window, filling in the space that would otherwise be occupied by the sill.

16. Click Apply. Change the sill thickness parameter to different values, and click Apply each time you change the value. Note how the height of the window frame now changes correctly.

Always flex your family from the Family Types dialog box to check if the model responds correctly.

17. Clear the Sill Visible parameter, and click Apply. Note how the frame resizes accordingly to fit precisely in the opening.

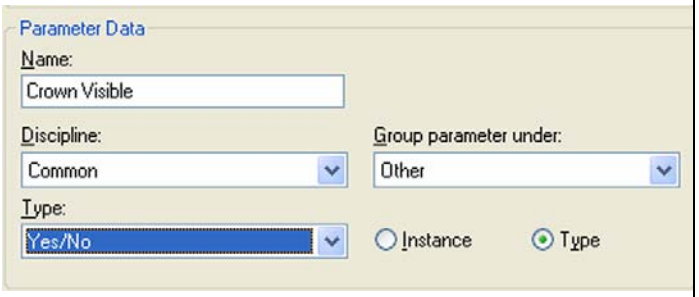
Note that the sill is still visible in the model but is dimmed. In the Family Editor even if visibility of a specific component is turned off, you still see it for editing purposes. In the normal project environment, the sill would not be visible.

Create a Crown Visibility Parameter

In the last section you controlled a length parameter by the visibility Yes/No parameter. In this section you do the opposite and control a visibility parameter based on a length. If the window width is greater than a specified width, show the Crown/Header. If it is less than the specified width, do not show it.

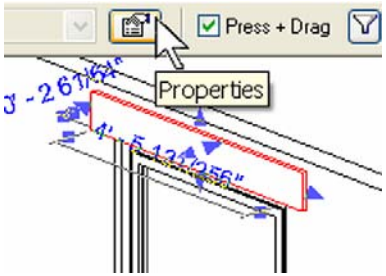
18. You next create a visibility parameter to control the crown visibility. Click the Add button under the Parameters category in the Family Types dialog box.

19. Create a new Yes/No parameter called Crown Visible (see image on the right). Click OK to return to the Family Types dialog box, and click OK again to close the dialog box.



You can create different types of parameters by opening the Type drop-down menu to see them all.

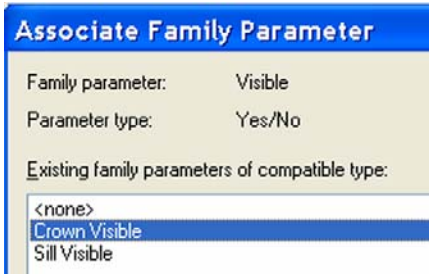
20. Select the solid that acts as the crown and open its Properties dialog box by right-clicking and choosing Properties or by clicking the Properties icon on the Options Bar.



21. Click the gray icon displaying an ellipsis (…) under the Visible row of its properties.

Clicking the button enables you to assign control of that element parameter to an equivalent family parameter that can then be either used in formulas or changed directly in the project.

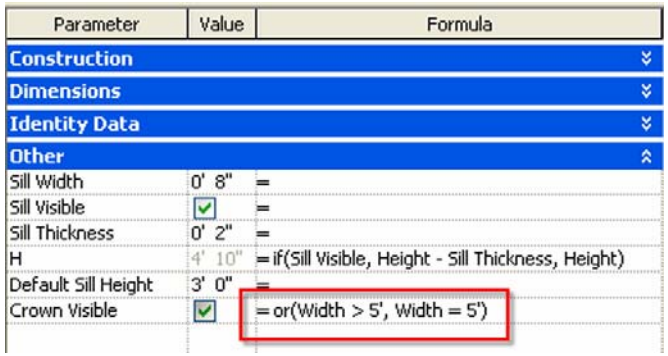
22. Assign it the Crown Visibility parameter, which you created in the previous step.
23. Click OK twice to close the dialog boxes.



The family parameters displayed are only those of the same type: length parameter if you are setting a distance, yes/no if you are selecting a visibility parameter, material if you are assigning a material parameter, and so on.

24. Open the Family Types dialog box, and under the Crown Visible parameter row, write the formula:

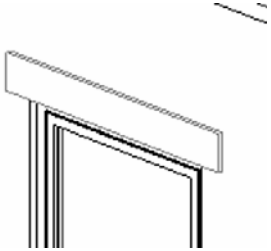
    or(Width>5', Width = 5')



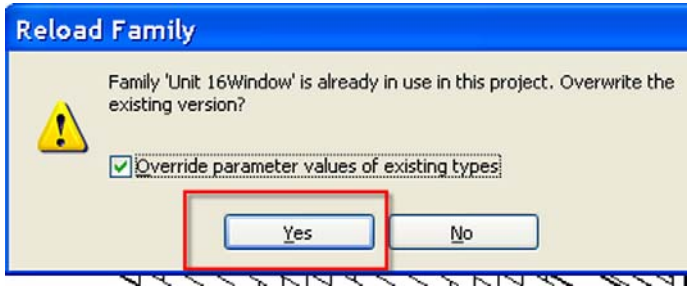
Remember that formulas are case sensitive.

It's a good idea to type the unit suffix in formulas directly to avoid confusion.

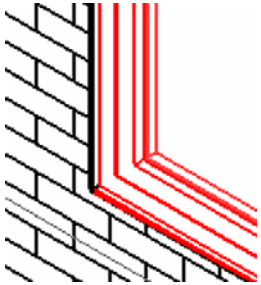
25. Change the window type from the active one to 4' x 4'.



26. On the Design Bar, click Load into Project.
27. Click the Unit 16 project you started the exercise with.
28. Click OK.
29. Click Yes to override the parameters in the project.

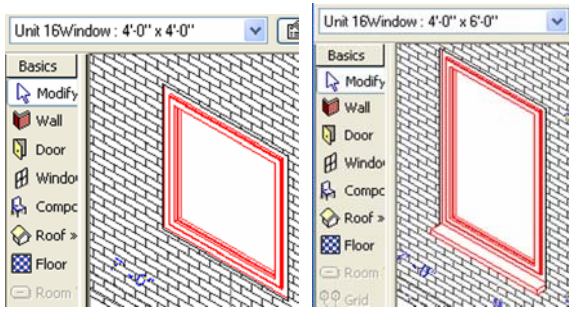


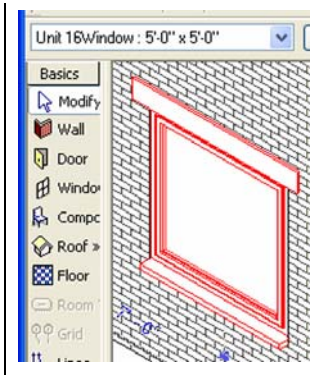
30. Flex the family in the project.
31. Turn off the sill in type properties.



The frame now fills in the full height when the sill is turned off.

32. Change the window to different types.





Unit 17

Theory: Databases

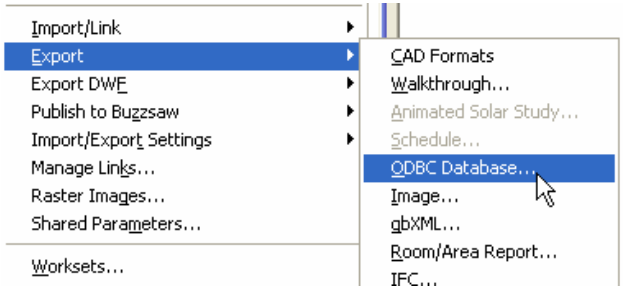
Autodesk Revit Building: Databases and Interoperability

In this exercise you export a Revit Building project to an ODBC-compliant database.

Export a Database

There is no data set provided for this exercise.

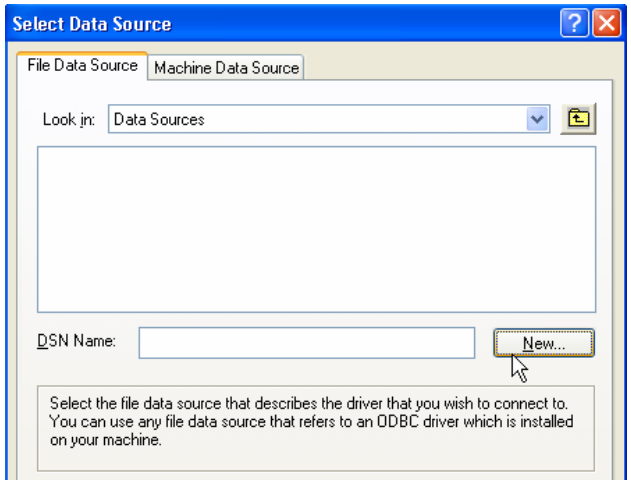
1. Open a project. If you are not working on your own project, open one of the projects provided with the workbook.
2. From the File menu, choose Export ODBC Database.



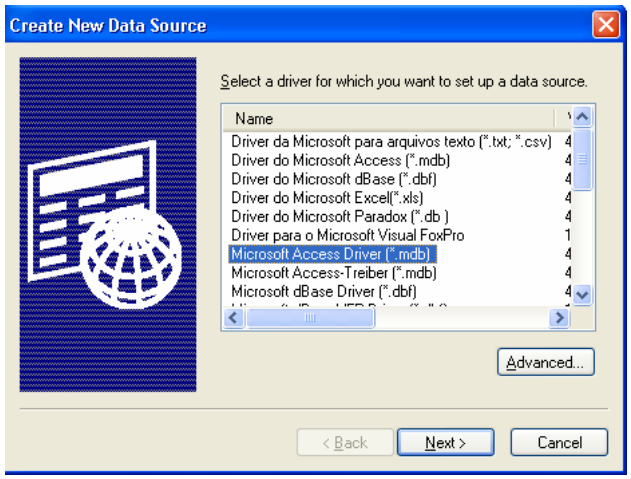
ODBC stands for Open DataBase Connectivity. The purpose of this is to create a database that any database management system can use. Part of an ODBC-compliant database is a data source name file. This file is like a translator to the database and provides a link between the database and the software used to interpret the data.

This example proceeds with creating both an access database (MDB) file and the data source name file.

3. In the Select Data Source dialog box, click the New button.

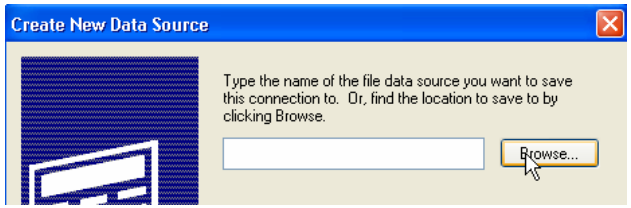


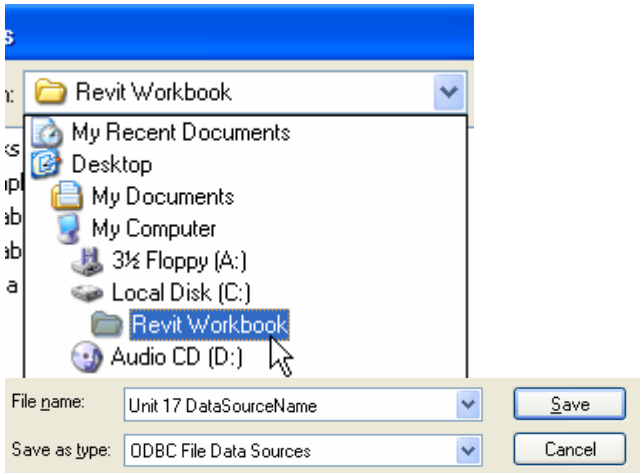
4. Click the Microsoft Access Driver and then click the Next button.

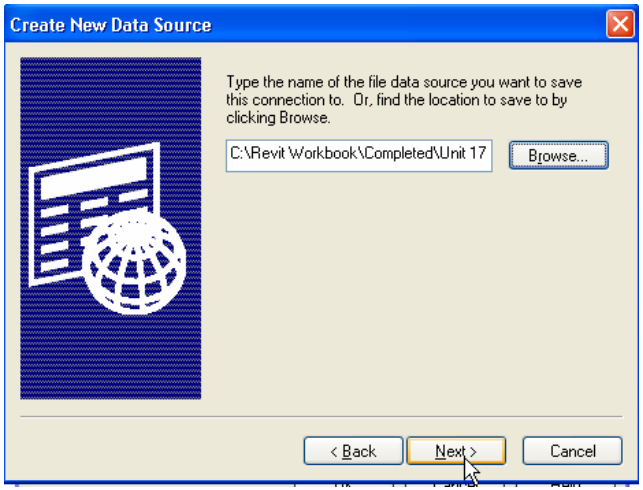


5. In the Create New Data Source dialog box:

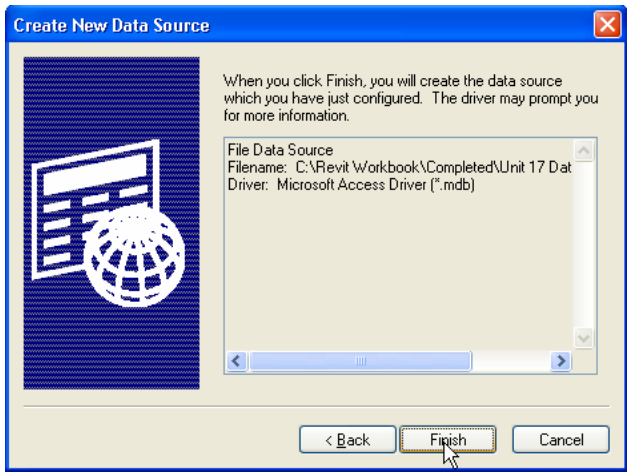
   a. Click the Browse button.
   b. Browse to the workbook's data set folder.
   c. Name the file.
   d. Click the Save button.
   e. Click the Next button.



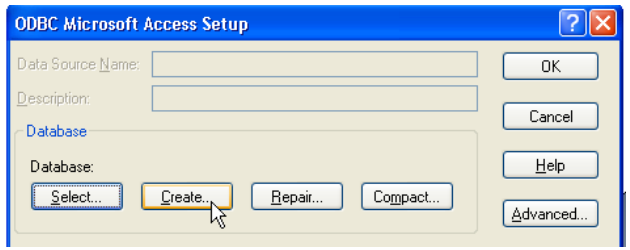




6. Click the Finish button.

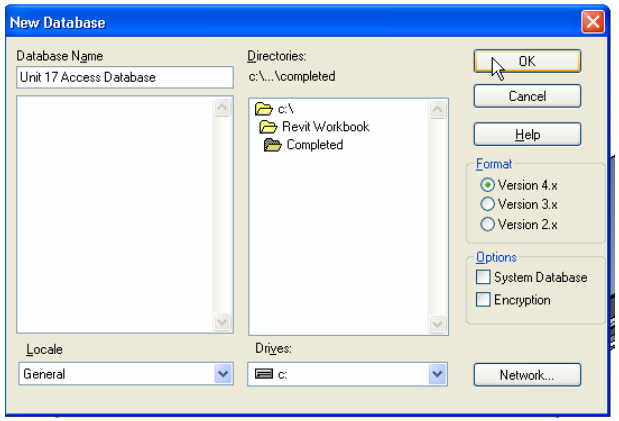


7. In the ODBC Microsoft Access Setup dialog box, click the Create button.

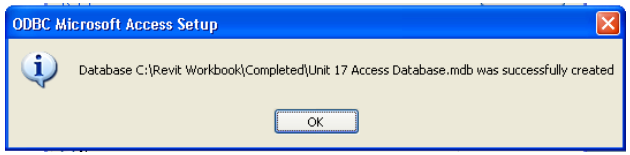


8. Enter a name for the database. Also in this dialog box you can verify the location where you want to create the database.

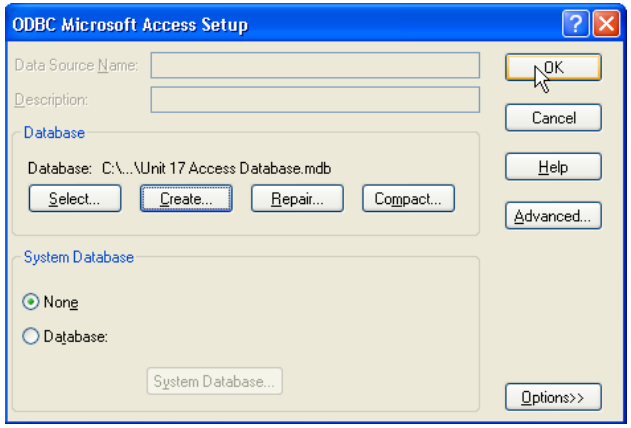
9. Click OK.



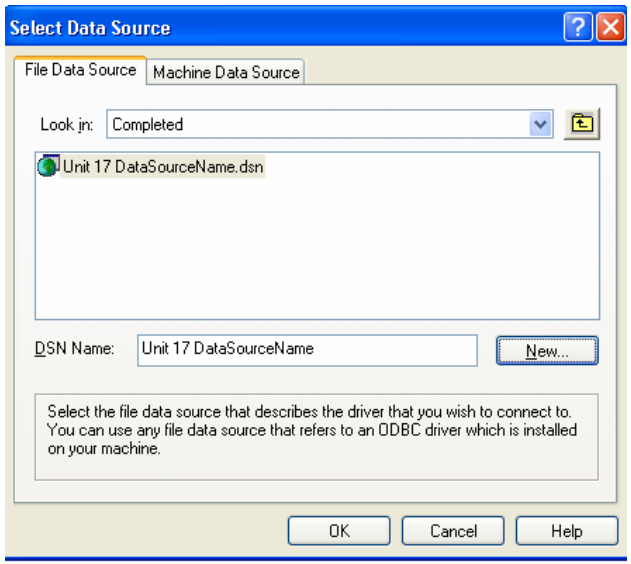
10. Click OK again.



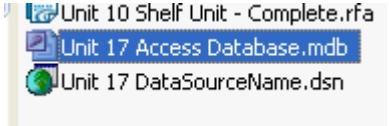
11. Click OK again.



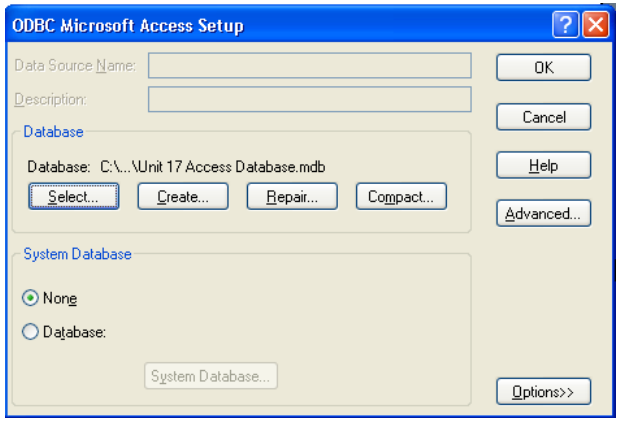
12. Click OK again.



The database has been created in the folder you specified. This sample is provided in the *Completed* folder of the workbook data sets.



13. Click OK again.



Unit 18

Theory: Schedules, Tables, and Legends

Schedules are just another view of the building model, but instead of representing the data in a graphical format, the information in the building database is presented in tabular format.

Autodesk Revit Building: Tags and Schedules

The seven exercises in this unit cover the scheduling capabilities of Autodesk Revit Building. Each covers a different aspect of schedules in the Revit Building environment.

- Exercise 18a – Door schedules
- Exercise 18b –Room objects schedule and tags
- Exercise 18c – Calculated values in a room schedule
- Exercise 18d – Room finish keys
- Exercise 18e – Color fill legends
- Exercise 18f – Symbol legends
- Exercise 18g – Material takeoff schedules

Unit 18, Exercise A – Door Schedules

In this exercise you create a door schedule, modify its properties, and place it on a sheet.

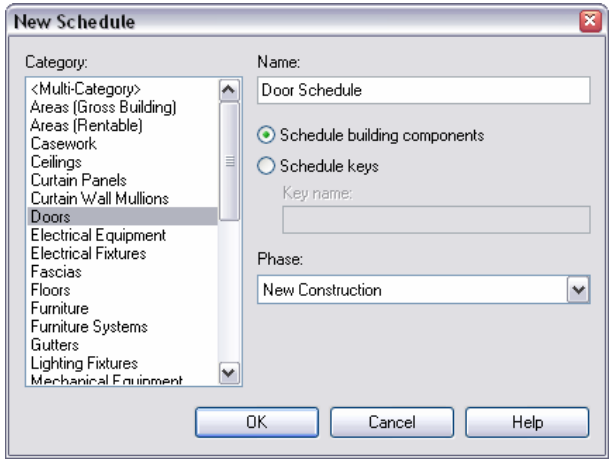
1. From the File menu, choose Open. Browse to find the file Unit 18a – Start delivered with the workbook and open it.

The file opens with a 3D view of the building. The active view doesn't have an effect on the creation of the schedule table. You can make a schedule table of any object having any view of the model. There are two ways to make a schedule table: using either the Schedule button on the View Design Bar or the View menu: New>Schedule Table.

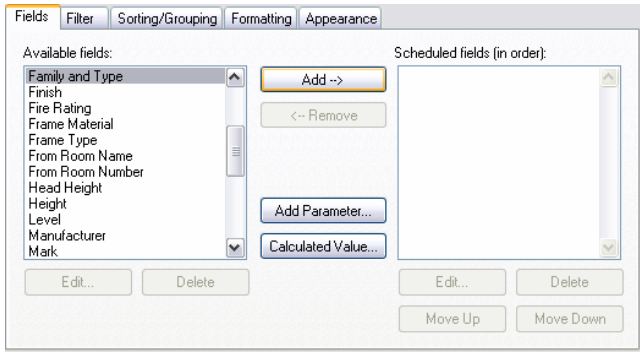
Create a Schedule

2. On the Design Bar, click Views and then Schedules.

3. From the Category list, select Doors and click OK.



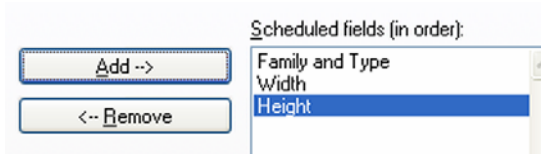
4. In the Schedule Properties dialog box under Available Fields, click Family and Type, and then click Add.



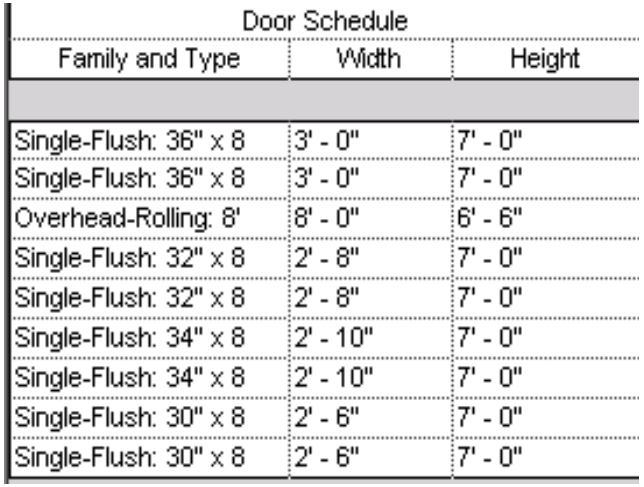
The Available Fields list contains all information that can be extracted from the door object. On the right is an empty list in which you add the information that you want to see displayed in the schedule table.

The schedule table is displayed in table form. The order of the fields that you have selected determines the order of the columns in the schedule table. You can easily modify this order using the Move Up and Move Down buttons.

5. The Family and Type field is now moved to the right, under Scheduled Fields. This will now be one of the columns in the schedule. Repeat for two other fields: Width and Height.



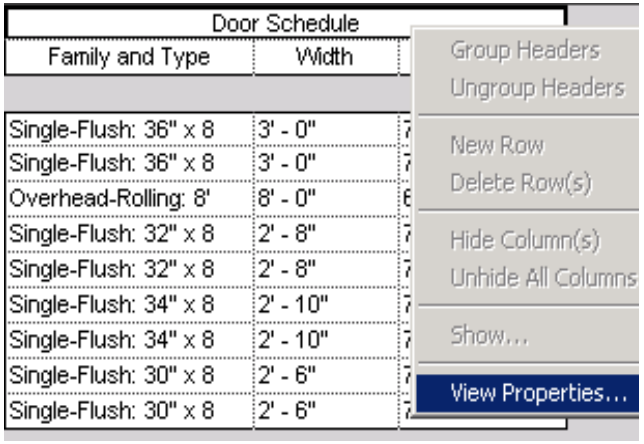
6. Click OK to close the Schedule dialog box.



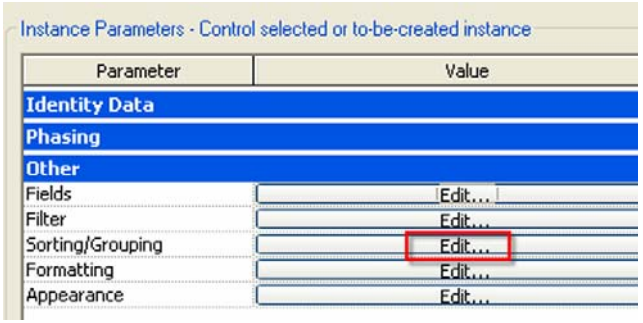
Door Schedule		
Family and Type	Width	Height
Single-Flush: 36" x 8	3' - 0"	7' - 0"
Single-Flush: 36" x 8	3' - 0"	7' - 0"
Overhead-Rolling: 8'	8' - 0"	6' - 6"
Single-Flush: 32" x 8	2' - 8"	7' - 0"
Single-Flush: 32" x 8	2' - 8"	7' - 0"
Single-Flush: 34" x 8	2' - 10"	7' - 0"
Single-Flush: 34" x 8	2' - 10"	7' - 0"
Single-Flush: 30" x 8	2' - 6"	7' - 0"
Single-Flush: 30" x 8	2' - 6"	7' - 0"

You can change the appearance of your schedule table by adjusting the width of the columns. The principle is simple: select the separation line between two columns in the title and drag it to the desired width.

7. Right-click over the schedule table, and choose View Properties.

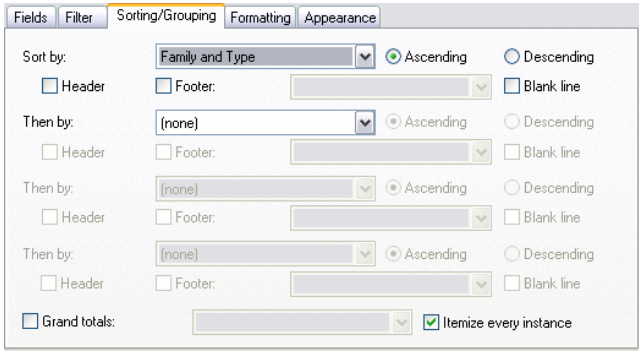


8. In the Element Properties dialog box, click the Edit button next to Sorting/Grouping.



9. In the newly opened dialog box, under Sort By, select Family and Type.

10. Click OK to close the dialog box.



The schedule table displays correctly according to the sorting criteria you have defined. Autodesk Revit Building allows four levels of sorting.

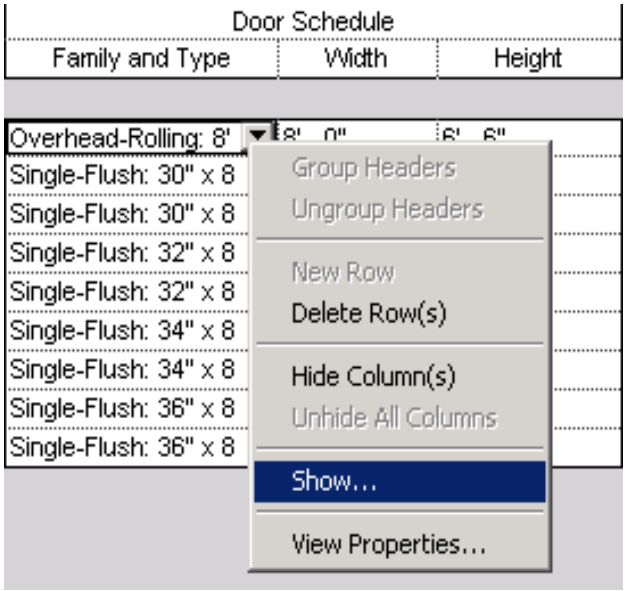
Every line in the schedule table represents a door within the project. You might think this is an odd way to represent a door, but Revit Building can represent an object in a textual manner, showing all important information about that object.

Before you continue working on your door schedule, you need to analyze the possibilities that Autodesk Revit Building proposes at this stage. Let's have a look at the Options Bar.

11. Click in any schedule table field, and then click the Show button.

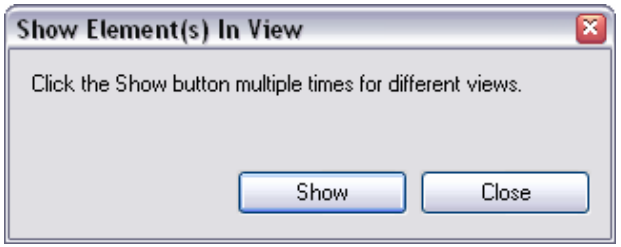
12. You can achieve the same by right-clicking the schedule field, and choosing Show.

13. Revit Building opens a view in which you can see a graphical representation of the selected door.



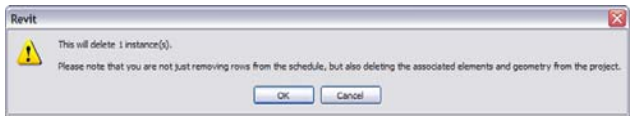
14. Click Show several times.

15. Click Yes in the search prompt.



Autodesk Revit Building enables you to search for other views in which this door is displayed. To do that, click the Show button. Should you not want to continue, simply click the Close button.

16. Click again in any schedule table field, and click Delete on the Options Bar.

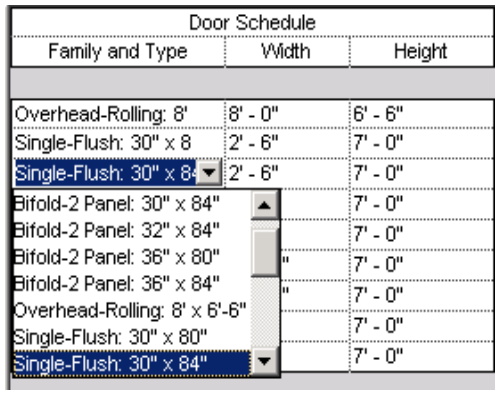


Autodesk Revit Building double-checks that you really want to delete that instance.

Again, you can find the same command by right-clicking and using the context-sensitive menu.

You have surely noticed that the schedule table cells are editable. You can change any value in the schedule table (for example, the width of the door).

You should be careful doing that, however, because the door width is a type parameter. This changes the width of all instances of this type in the project.



Finally, you can change the family and type simply by clicking the family and type field. This field contains a pull-down list from which you can select the desired door family or type.

17. What is important to understand here is that no matter what changes you undertake in the schedule table, they are populated everywhere in the project.

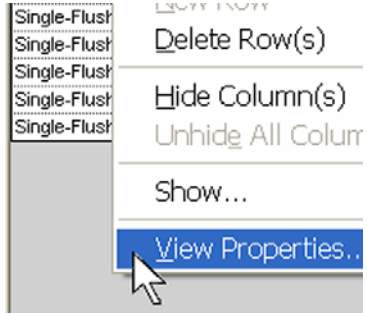
The opposite works as well. If, for example, you delete or add a door in the project, the door is automatically deleted or added in the schedule table. In the Revit Building BIM model, the schedule tables are always directionally synchronized with the project.

You are now going to work further on your schedule table, refine it, add new fields, sort it, modify its parameters, and finally place it on a layout sheet.

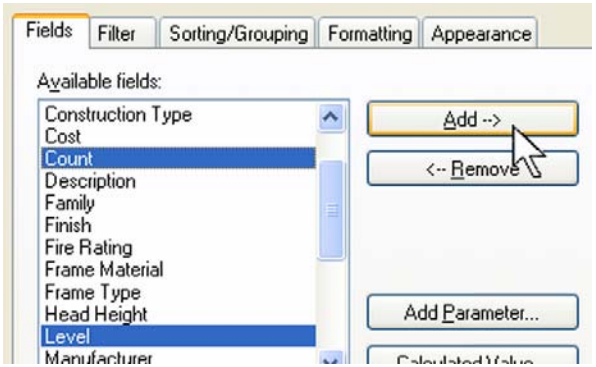
18. Right-click over the schedule table.

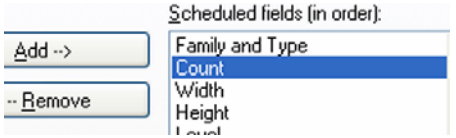
19. From the context-sensitive menu, choose View Properties.

20. In the Element Properties dialog box, click Edit next to Fields.



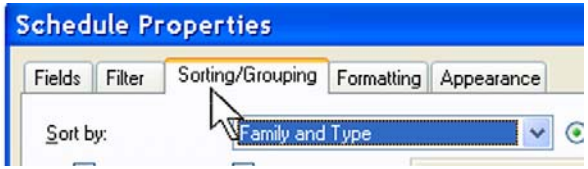
21. Add the fields Count and Level, and reorganize them as shown in the image using the Move Up and Move Down buttons.





You have now set all necessary fields. Next is to sort your schedule table to make it more usable. Revit Building lets you sort with four different criteria simultaneously. Here, you want to sort by level and then by family and type.

22. Click the Sorting/Grouping tab.



On the Sorting/Grouping tab you find the criteria set previously. You need to change them. You want to sort this time by level and then family and type. Because there are two criteria for sorting, you need to intervene on the Header and Footer.

23. On the Sorting/Grouping tab, set the following:

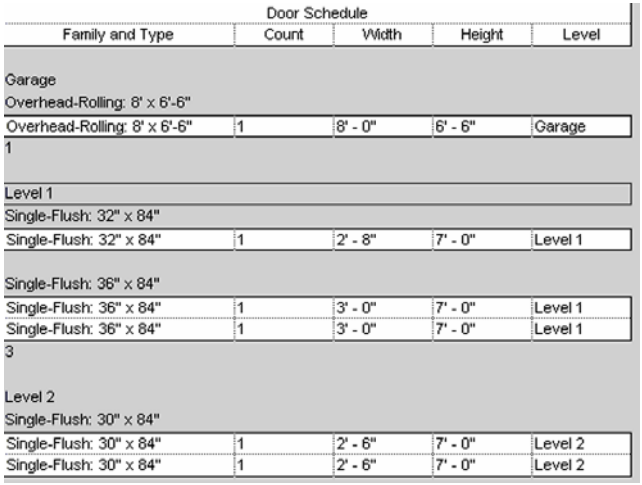
24. Under Sort By, select Level.

25. Select the Header and Footer check boxes, and in the list next to Footer, select Count and Totals. Also select the Blank Line check box.

26. In the Then By field, select Family and Type.

27. Select the Header and Blank Line check boxes.

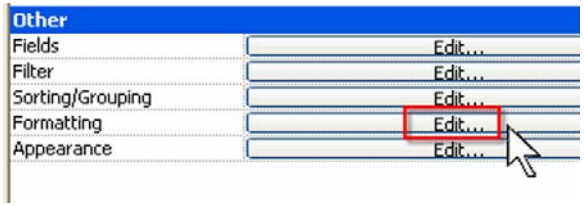
28. Click OK to close all dialog boxes.



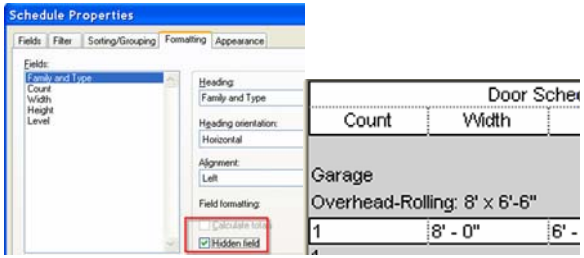
Door Schedule

Family and Type	Count	Width	Height	Level
Garage				
Overhead-Rolling: 8' x 6'-6"				
Overhead-Rolling: 8' x 6'-6"	1	8' - 0"	6' - 6"	Garage
1				
Level 1				
Single-Flush: 32" x 84"				
Single-Flush: 32" x 84"	1	2' - 8"	7' - 0"	Level 1
Single-Flush: 36" x 84"				
Single-Flush: 36" x 84"	1	3' - 0"	7' - 0"	Level 1
Single-Flush: 36" x 84"	1	3' - 0"	7' - 0"	Level 1
3				
Level 2				
Single-Flush: 30" x 84"				
Single-Flush: 30" x 84"	1	2' - 6"	7' - 0"	Level 2
Single-Flush: 30" x 84"	1	2' - 6"	7' - 0"	Level 2

29. Right-click over the schedule table.
30. Choose View Properties.
31. In the Element Properties dialog box, click Edit in the Formatting field.



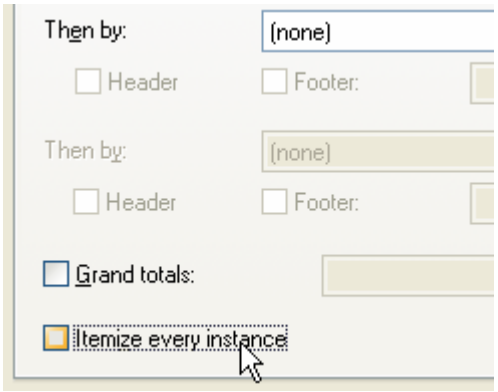
32. Verify that the selected field is Family and Type.
33. Select the Hidden Field check box at the bottom of the dialog box.
34. Click OK to close all dialog boxes.



As you can see, the Family and Type field is not displayed.

However, notice that the schedule table displays every instance of your doors, but you need to know the total number of doors of the same type. So, you need to fix that final problem.

35. Right-click anywhere over the schedule table again.
36. Choose View Properties.
37. In the Element Properties dialog box, click the Edit button next to Sorting/Grouping.
38. Clear the Itemize Every Instance check box.
39. Click OK to close all dialog boxes.



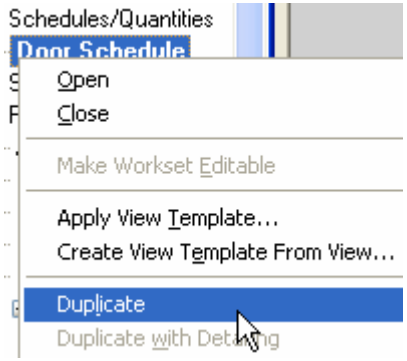
Should you need it, you can also display the total number of doors in your building. To make that visible, you need to select the Grand Totals check box on the Sorting/Grouping tab.

Duplicate the View

For the moment, you can consider your schedule table ready. However, you haven't yet learned about schedule filters. The filters allow you to filter through the data in the schedule tables. As for sorting/grouping, there are four levels of filtering. You can filter only fields that are already present on the Fields tab.

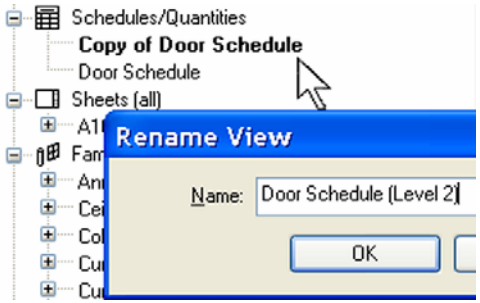
Next, you duplicate the schedule table view and apply a filter to the duplicated view. The goal is to have a schedule table that shows only the doors on Level 2. You reuse the schedule table in the second part of the exercise (Create a room schedule table).

40. In the Project Browser, scroll to the door schedule and right-click it. From the context-sensitive menu, choose Duplicate.



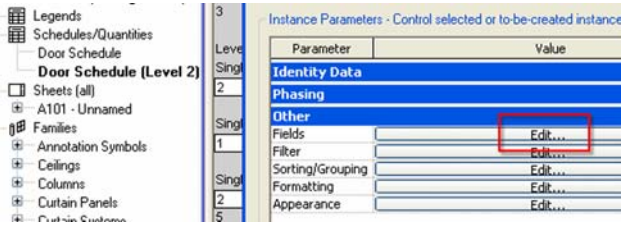
41. Right-click the Copy of Door Schedule, and choose Rename.

42. Change the Name to Door Schedule (Level 2), and click OK.

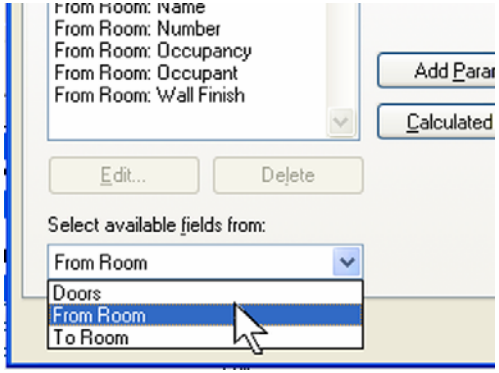


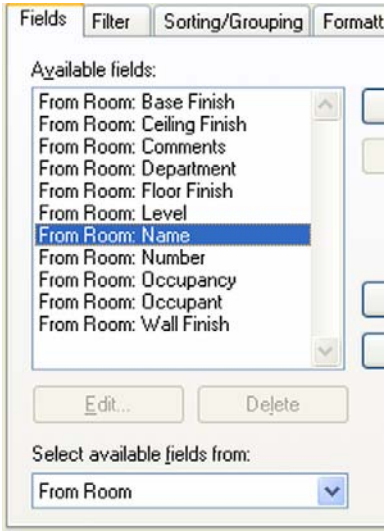
43. Right-click the Door Schedule (Level 2) schedule table, and go to the properties.

44. In the Element Properties dialog box, click the Edit button next to Fields.

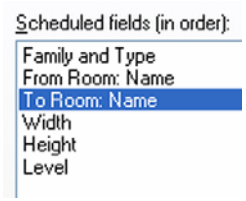


45. Using the Remove button, delete the Count field.
46. Using the Select Available Fields from drop-down menu, click From Room.
47. Under Available Fields, click From Room Name.
48. Click the Add button.
49. Repeat to add To Room: Name.





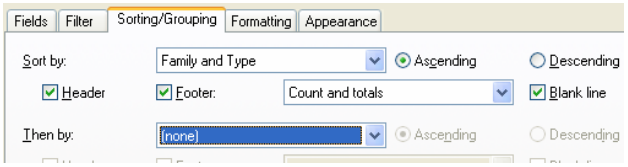
50. Again, arrange the list of fields as shown on the right using the Move Up and Move Down buttons.



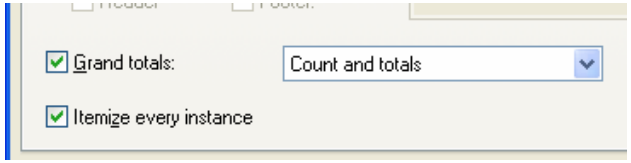
You can just as easily insert or delete fields from the schedule table by double-clicking the desired field.

51. In the Schedule Properties dialog box, click the Filter tab.
52. In the Filter By list, select Level.
53. In the next field, select Equals and set Level 2 in the field below Filter By.

54. Click the Sorting/Grouping tab.
55. Change Sort By back to Family and Type.
56. Verify that Header, Footer, and Count and Totals are set.
57. Set the Then By sorting line to (none).

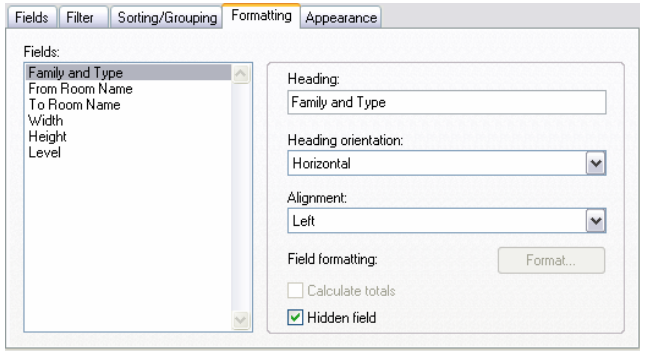


58. Select Blank Line and also Itemize Every Instance.

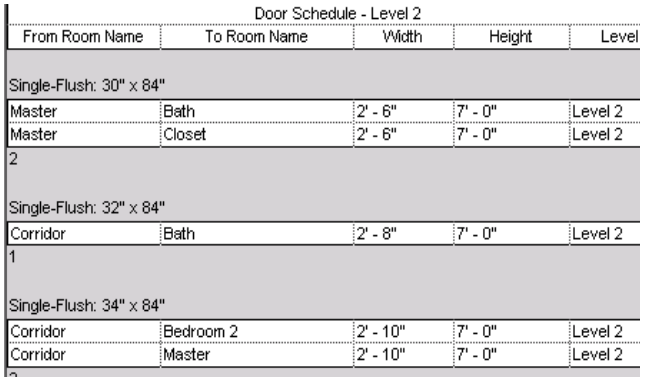


59. Click the Formatting tab.

60. Verify that the Family and Type field is a Hidden field.



61. Click OK twice to close all dialog boxes.



Door Schedule - Level 2

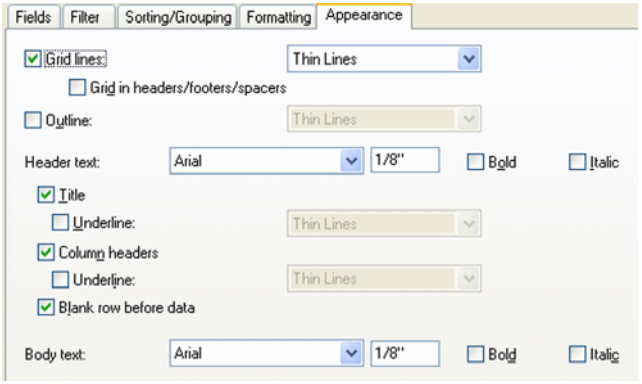
From Room Name	To Room Name	Width	Height	Level
Single-Flush: 30" x 84"				
Master	Bath	2' - 6"	7' - 0"	Level 2
Master	Closet	2' - 6"	7' - 0"	Level 2
2				
Single-Flush: 32" x 84"				
Corridor	Bath	2' - 8"	7' - 0"	Level 2
1				
Single-Flush: 34" x 84"				
Corridor	Bedroom 2	2' - 10"	7' - 0"	Level 2
Corridor	Master	2' - 10"	7' - 0"	Level 2

Here, the schedule table displays the criteria you just defined.

Create New Sheet for Door Schedule

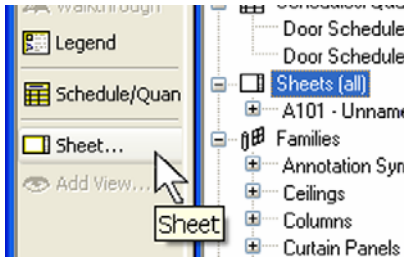
Certain parameters of the schedule tables are only visible once a schedule table has been placed on a sheet. That's the case with the parameters on the Appearance tab of the schedule table properties.

You are now going to study the placement possibilities of a schedule table on a sheet. For that purpose you use the entire schedule table of all doors in this building.



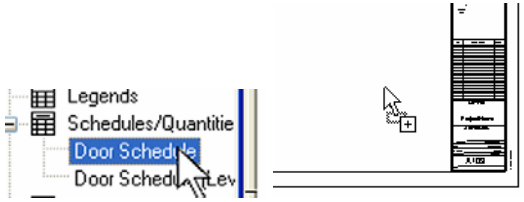
62. On the View tab of the Design Bar, click Sheet.

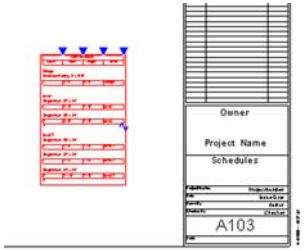
63. Click OK to accept the default title block that appears.



64. Rename the sheet Schedules. Accept the number assigned.

65. From the Project Browser, drag the door schedule table to the sheet you just created.





66. Click the schedule. You see a series of controls. Each of the blue grips does something different.

▼ Allows dimensioning of the column width (select, hold, move, and release at the desired position). Note that when you change the width of a column on one part of the split table, it changes in all other parts.

Allows moving of the table (click, hold, move, release).

Allows horizontal splitting of the table. Click the symbol and it's done. To reunite the split parts, select the one part and move it over the other. Revit Building automatically reconnects the parts.

● Allows you to change the height of a split part of a table (click, hold, move, release). The allowed moves are up and down. Obviously, changing the height of one schedule part means changing the height of the other. Try it out!

67. Save and close the project.

If you are going to work through the next exercise, you can keep this project open.

Unit 18, Exercise B: Room Schedules, Rooms, and Tags

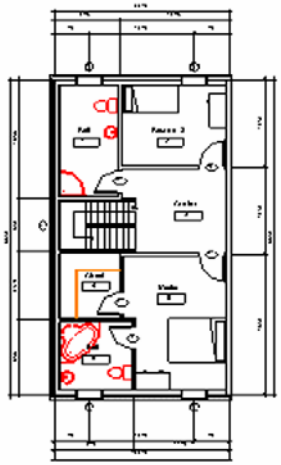
In this exercise you work with the room schedule and tags.

In the last exercise, we did not address the issue of tags. To work with or create a door schedule, all you need are the doors in a project. The tags just present information already associated with the door or in the schedule. The same is true for room schedules. A room does not appear in a schedule unless you place a room object.

This exercise uses the same data set as the previous exercise but does not build on the information created in that exercise.

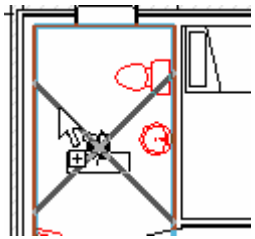
Exercise Setup

1. From the File menu, choose Open>Browse to find the file Unit 18b – Start delivered with the workbook.
2. From the Project Browser, select Level 2.



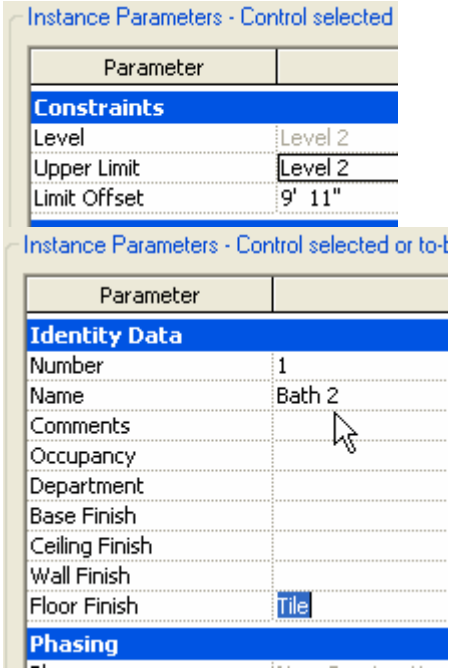
There are two ways to make a schedule table: either using the Schedule button on the View Design Bar or the View menu (New>Schedule Table).

3. Hover your cursor near a room tag.



The “X” is the room object in Revit Building. The room object contains the information for the room schedule about that space in the building.

4. Click the room object, and open its properties dialog box:
   a. Verify the level is set to Level 2.
   b. Change the name to Bath 2.
   c. Add Tile as the floor finish.
5. Click OK to close the dialog box.



Just like a door or window, the values here can be reported in a schedule.

Create a Duplicate View of the 2nd Floor

When creating a schedule view, it can be useful to duplicate the plan view in question so you have one plan view free of tags and colors, or to use a different type of tag.

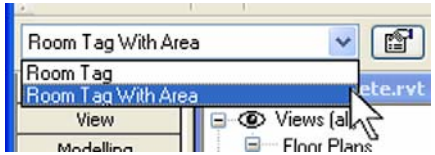
6. Right-click the Level 2 view, and choose Duplicate.
7. Right-click the created Copy of Level 2 view, and choose Rename.
8. Change the name to Level 2- Room Areas.
9. Click OK.

The duplicated view automatically becomes the active view.

10. On the Design Bar, Drafting tab, click Room Tag.

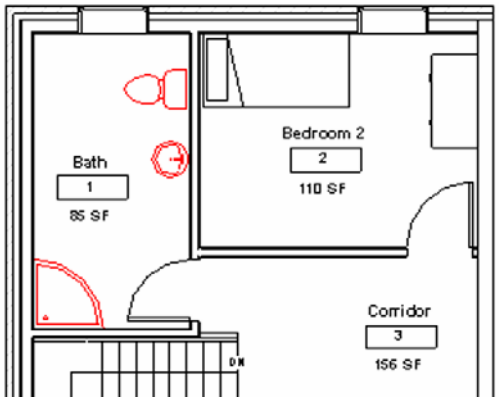
Note that the rooms know their name, even though this view has no tags. The information displayed by the tag is stored by the room object. This allows you to make multiple views of the same level but use different tagging and annotation styles.

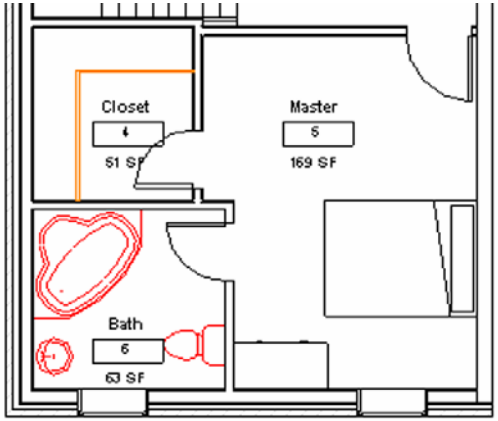
11. Set the Room Tag type to Room Tag with Area.



This is an annotation type. Like windows and doors, annotation such as text and tags are also based on family and type. Room Tag with Area is an external family file that you can load and use in any project.

12. Start clicking in each room on this floor. Don't worry about the name or number of the rooms you are tagging at the moment. Tag the rooms as shown in the illustrations at right.





Create a Room Schedule

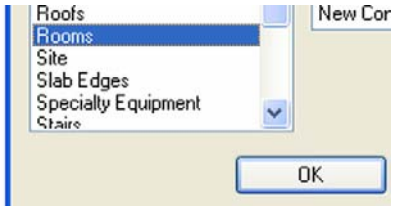
Autodesk Revit Building also allows modification of the names of the rooms from within the schedule table itself. For this, however, you need to have created the room schedule—something you have not yet done. Although the room names appear in your door schedule table, you cannot modify them from here.

When the room schedule is created before the actual room and with the condition that the room names exist in that table, you can select that room as it is inserted using the Options Bar.

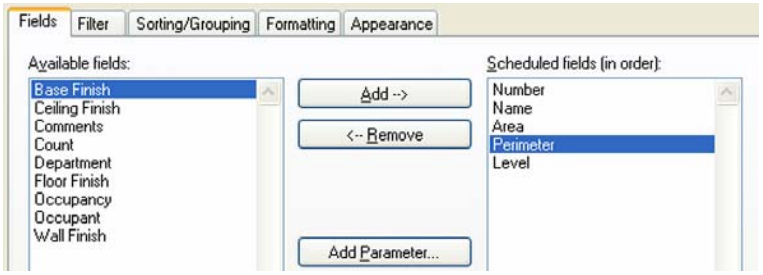
The most effective solution is to select the room tag itself and change its properties on the fly: click the room tag text, and the text becomes an editable zone. Type the desired text, and press Enter or simply click anywhere in the workspace with the left mouse button.

13. On the View tab of the Design Bar, select Schedule Tables.

14. Select Rooms as a category, and click OK.

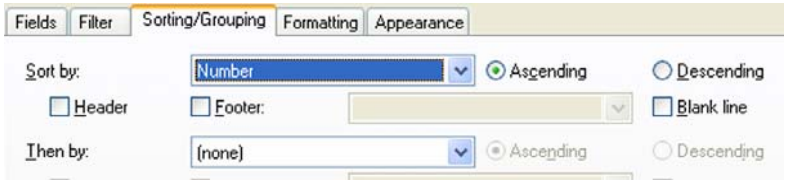


15. In the Schedule Table Properties dialog box add the fields Number, Name, Area, Perimeter, and Level.



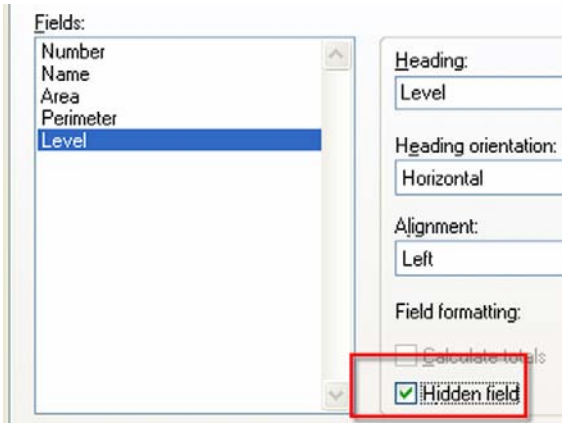
16. Click the Sorting/Grouping tab.

17. Under Sort By, select Number.

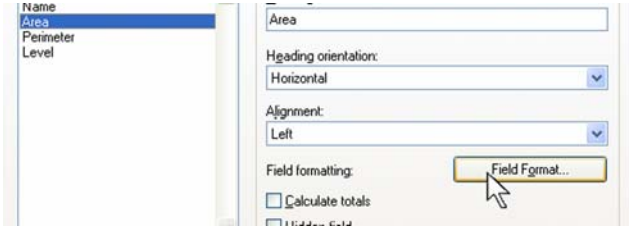


18. Click the Formatting tab.

19. Select Level and select the Hidden Field check box.



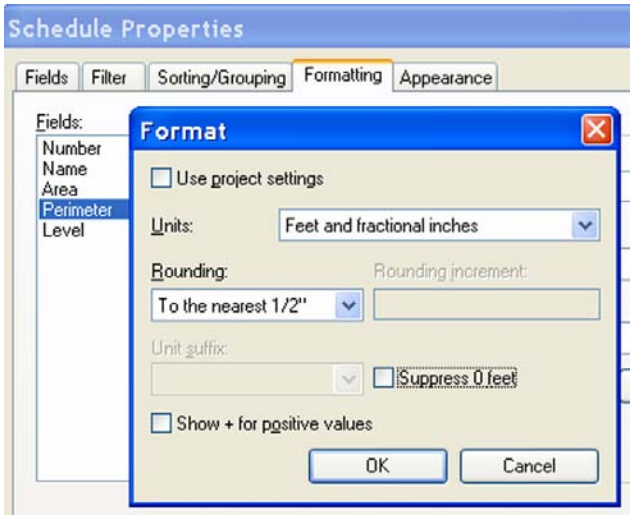
20. Select Area, and click Field Format.



21. Clear the Use Project Settings option, and then set Square Feet as Units, 1 Decimal Place as rounding, and SF as Unit Suffix.

22. Repeat for the Perimeter field (set units feet and fractional inches, rounding nearest 1/2").

23. Click OK.



Room Schedule			
Number	Name	Area	Perimeter
1	Bath 2	85.5 SF	38' - 10 1/2"
2	Bedroom 2	110.3 SF	42' - 4 1/2"
3	Corridor	155.8 SF	57' - 0 1/2"
4	Closet	51.0 SF	28' - 7"
5	Master	168.8 SF	54' - 0 1/2"
6	Bath	63.4 SF	31' - 10 1/2"

Notice how even though there are rooms on the level 1, they do not show up in the schedule because no rooms have been placed on this level.
Also even though you duplicated Level 2, only one row shows up in the schedule for each room.

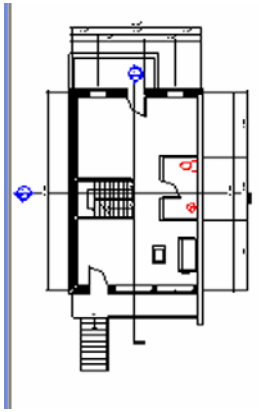
Putting Rooms and Tagging Together with the Room Schedule

In this section you open the first floor plan and tile the views before you add the rooms to the first floor.

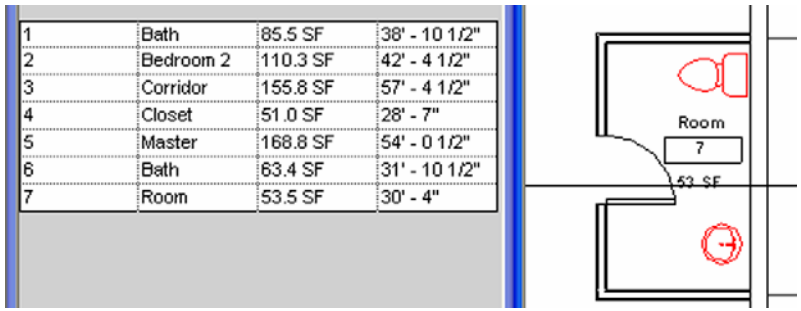
You also use the area separation lines to define rooms not enclosed by walls.

24. Close Hidden Windows, and tile the Room Schedule and Floor Plans: Level 1.

Room Schedule			
Number	Name	Area	Perimeter
1	Bath 2	85.5 SF	38' - 10 1/2"
2	Bedroom 2	110.3 SF	42' - 4 1/2"
3	Corridor	155.8 SF	57' - 0 1/2"
4	Closet	51.0 SF	28' - 7"
5	Master	168.8 SF	54' - 0 1/2"
6	Bath	63.4 SF	31' - 10 1/2"

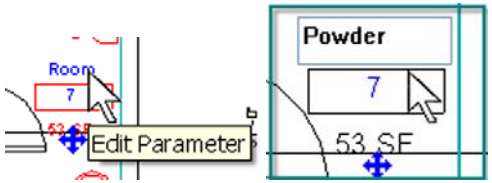


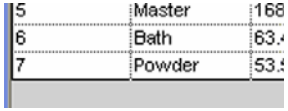
25. Use the Room tool from the basics tab of the Design Bar to add a room tag to the powder room at the middle right of the plan.



A room is added to the schedule, and a tag is added to the room. The room shows up in the schedule with its area and perimeter.

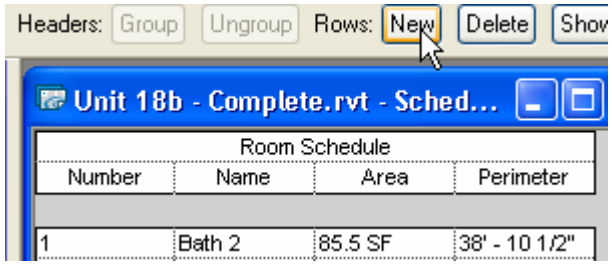
26. Click in the Tag Room Name field, and set the room name to Powder.



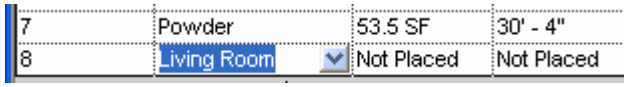


You can modify either the tag or the schedule.

27. Make the schedule the current view, and click the Rows: New button.



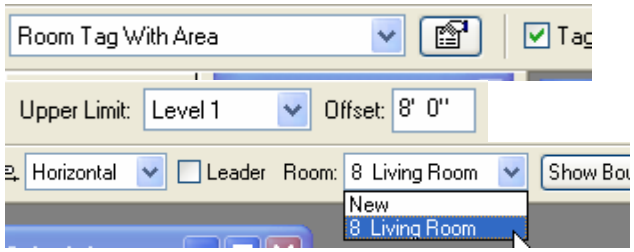
28. In the schedule, type Living Room for the new room name.



Because this room does not exist as a room object in the project yet, the area and perimeter cannot be calculated.

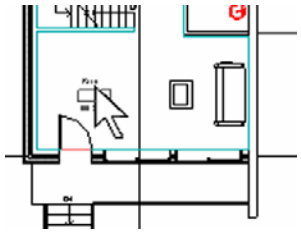
29. Click the Room tool, and on the Options Bar, set the following:

a. Tag type = Room Tag With Area
b. Upper Limit = Level 1
c. Offset = 8'-0"
d. Room = 8 Living Room



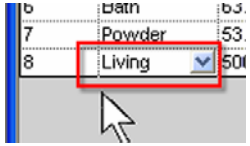
The room you added to the room schedule is available as a room to add.

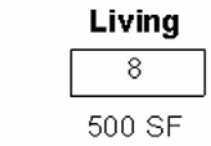
30. Use the Room tool to add a room and tag to the living room.



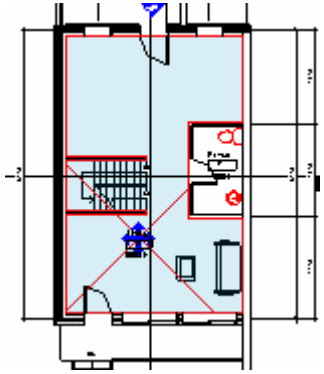
Before you place the tag, the assumed perimeter is highlighted.

31. In the schedule, change the name from Living Room to Living on the last line.





The tag updated.



The living room extends through the entire floor where there are no room bounding elements to constrain it. Room bounding elements can be columns, curtain walls, walls, or room separation lines.

Separating Rooms

In this section you add room separation lines between the stair and living room areas. These lines enable rooms to exist side by side when there is no wall between the rooms.

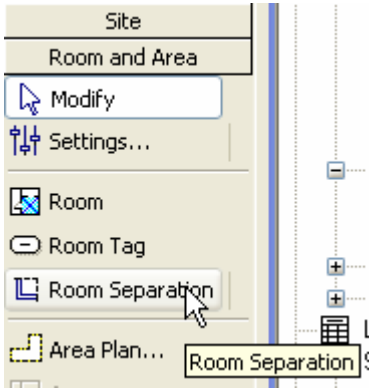
32. Tile both the room schedule and the view Level 2- Room Areas.

33. Click the Living room in the schedule, and then click the Show button on the Option Bar.

The plan view zooms to the room selected in the schedule. This shows the living room extending into the stair area.

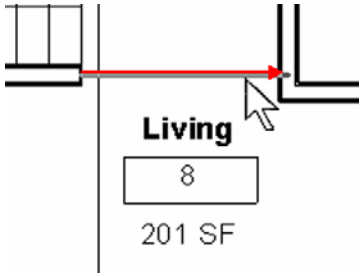
34. On the Design Bar, click the Room and Area tab.

35. Click the Room Separation tool.

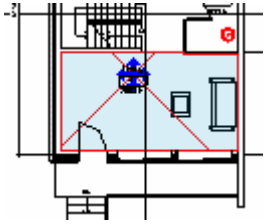


36. Click the wall at the bottom of the stairs.

37. Click the wall at the powder room.

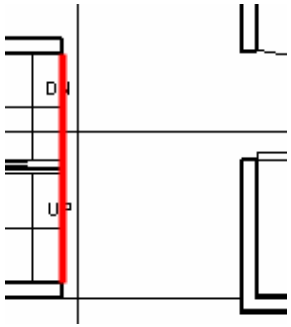


The tag is now associated with the area of the living room up to the room separation line. The tag updates to show the smaller size.

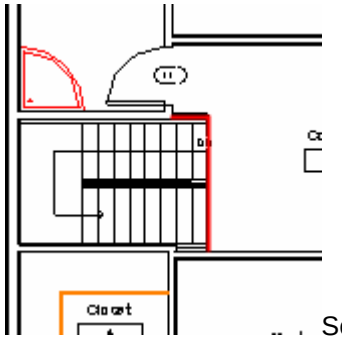


38. Add two more room separation lines to separate the stair:

    - Add this to both the first and second floors.

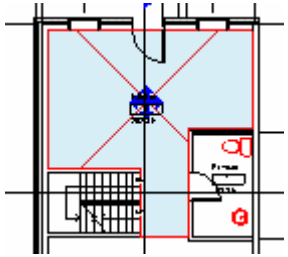


First Floor



Second Floor

39. Add a room to the north side of Level 1 and name it Kitchen.



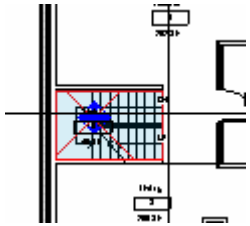
Add a Multifloor Spanning Room

Stairs and how their areas are calculated vary from region to region. Often stairs, atriums, or other spaces that span multiple floors are only calculated once. To do this, the room must have parameters that tell it to extend up to these upper levels.

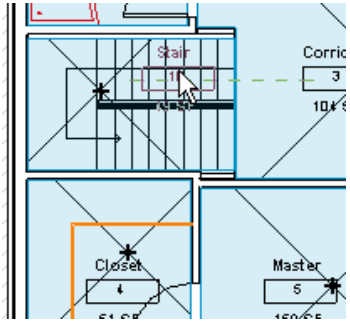
40. Set the Level 1 plan current.

41. Click the Room tool, and set the Upper limit to Level 2 with Offset of 8'.

42. Add this room to the stairs area on Level 1. Rename this room Stair.



43. Set the view Level 2 – Room Areas current and tag the stair.

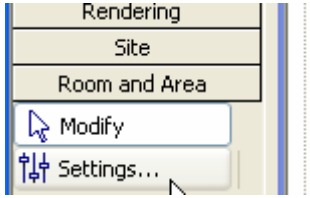


The tag takes on the value of the space you just added because the volume of the space extends up 8' past the 2nd floor level.

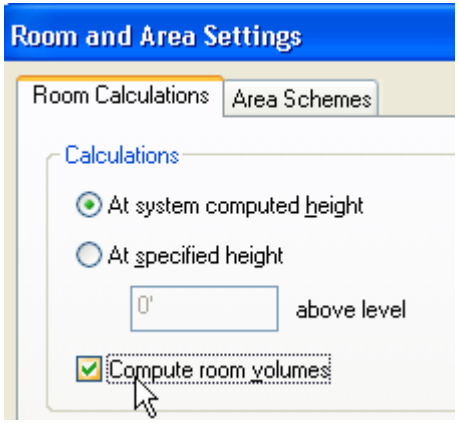
Add a Volume Column to the Room Schedule

If you turn on volume in the room and area settings, you can then add the volume column to the room schedule.

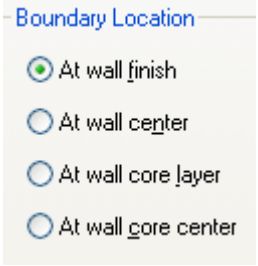
44. On the Design Bar, click the Room and Area>Settings tool.



45. Select Compute Room Volumes.

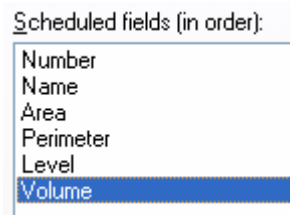


This dialog box also give you control over how the room areas are calculated.



46. Set the Room Schedule current, and open its view properties.

47. Edit the fields to add Volume to the schedule.



48. Click OK to return to the schedule.

Room Schedule

Number	Name	Area	Perimeter	Volume
1	Bath 2	85.5 SF	38' - 10 1/2"	847.42 CF
2	Bedroom 2	110.3 SF	42' - 4 1/2"	1093.70 CF
3	Corridor	104.5 SF	43' - 1 1/2"	1035.85 CF
4	Closet	51.0 SF	28' - 7"	506.18 CF
5	Master	168.8 SF	54' - 0 1/2"	1673.84 CF
6	Bath	63.4 SF	31' - 10 1/2"	629.10 CF
7	Powder	53.5 SF	30' - 4"	427.66 CF
8	Living	199.9 SF	59' - 4 1/2"	1598.93 CF
9	Kitchen	252.0 SF	76' - 8 1/2"	2016.09 CF
10	Stair	48.6 SF	28' - 7"	850.13 CF

The Schedule now reports volume for each of the rooms in the project.

Unit 18, Exercise C: Calculated Values for Rooms

In this exercise you duplicate a room schedule to create a schedule that shows each room as a percentage of the whole project.

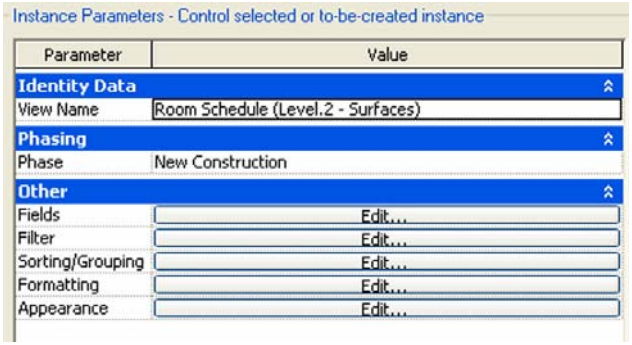
Create a Calculated Values Table for the 2nd Level

Using the room schedule table created in the previous exercise, you can easily create another one in which you directly read the total of each room (Kitchen, Living Room, Room) as well as the percentage of that room type according to the total area of the building.

1. Open data set: Unit 18c – Start.rvt. Verify the Room Schedule is the current view. In the Project Browser duplicate the Room Schedule and name it Room Schedule (Level2 – Surfaces).

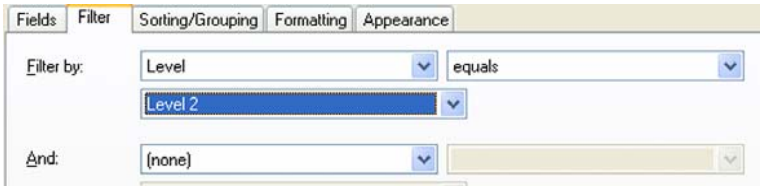
All these commands are also available when you right-click the schedule in the Project Browser.

2. Right-click the newly created schedule, and choose Properties.

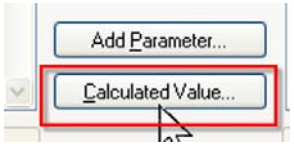


3. Click the Edit button next to the Filter.

4. Add a new filter condition under Filter By: Level equals Level 2.



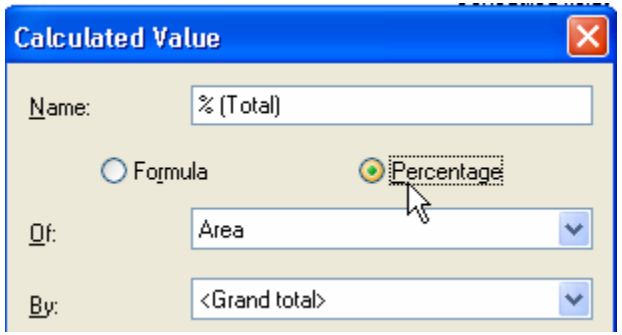
5. On the Fields tab, select the Number and click the Calculated Value button.



6. In this dialog box, set the following:

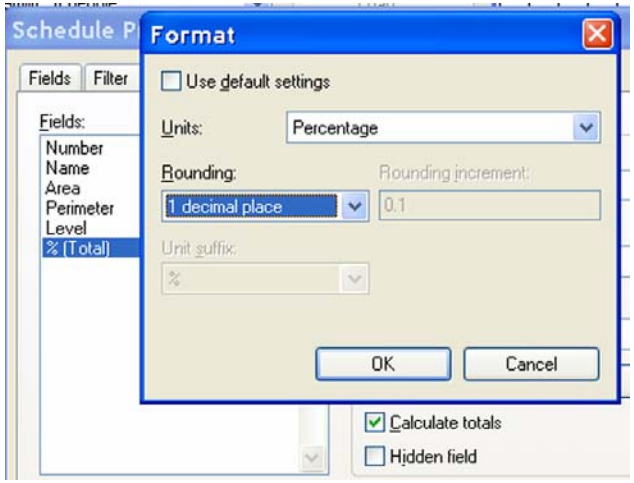
- Next to Name, enter % (Total).
- Click Percentage.
- Next to Of, select Area.
- Next to By, select Grand Total.

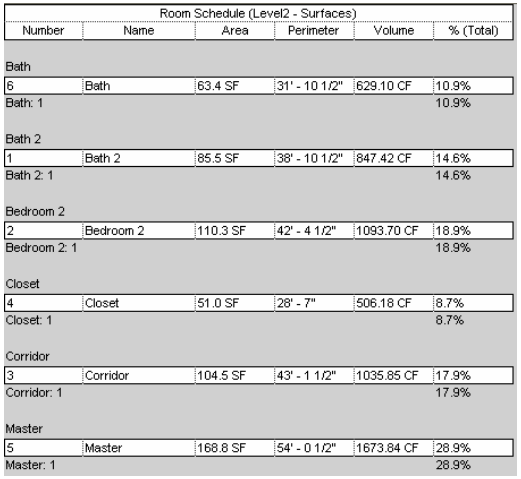
7. Click OK.



8. Click the Sorting/Grouping tab.
9. Change the sorting condition to Name.
10. Select Header and Footer (keep Title, Count, and Totals).
11. Select Blank Line.
12. Select Grand Total (keep the Title, Count, and Totals).

13. Click the Formatting tab.
14. Select the calculated field that you created previously (%Total).
15. Select Calculate Totals.
16. Click Format.
17. Next to Units, select Percentage, Rounding 1 Decimal Place.
18. Click OK to return to the schedule.





Room Schedule (Level2 - Surfaces)

Number	Name	Area	Perimeter	Volume	% (Total)
Bath					
6	Bath	63.4 SF	31' - 10 1/2"	629.10 CF	10.9%
Bath: 1					10.9%
Bath 2					
1	Bath 2	85.5 SF	38' - 10 1/2"	847.42 CF	14.6%
Bath 2: 1					14.6%
Bedroom 2					
2	Bedroom 2	110.3 SF	42' - 4 1/2"	1093.70 CF	18.9%
Bedroom 2: 1					18.9%
Closet					
4	Closet	51.0 SF	28' - 7"	506.18 CF	8.7%
Closet: 1					8.7%
Corridor					
3	Corridor	104.5 SF	43' - 1 1/2"	1035.85 CF	17.9%
Corridor: 1					17.9%
Master					
5	Master	168.8 SF	54' - 0 1/2"	1673.84 CF	28.9%
Master: 1					28.9%

19. Save the project.

Unit 18, Exercise D: Room Schedule Keys

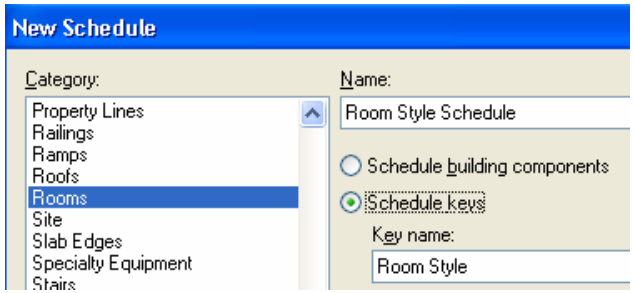
In this exercise you add room finish keys to the schedule.

Add Room Finish Keys to Schedule

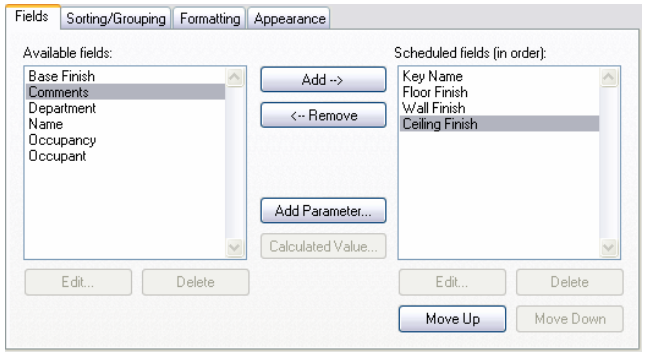
To finish your schedule table, you are going to create a schedule key. The idea is to be able to associate to each room a finish for the walls, floor, and ceilings.

Instead of tediously copying and pasting these values to each room, you prepare a new schedule in which all those finishes are listed and then link it to your room schedule.

1. On the Views Design Bar, click Schedule/Quantities.
2. From the Category list, select Rooms.
3. Select Schedule Keys.
4. You can change the name of the schedule if you want to.
5. Click OK.



6. From the Available Fields, select Floor Finish, Wall Finish, and Ceiling Finish.

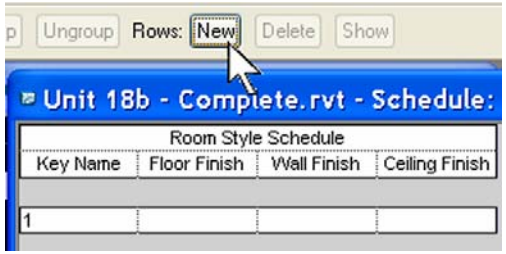


The Key Name field is automatically generated. It is this field that creates the link between the two schedules. So, do *not* delete it!

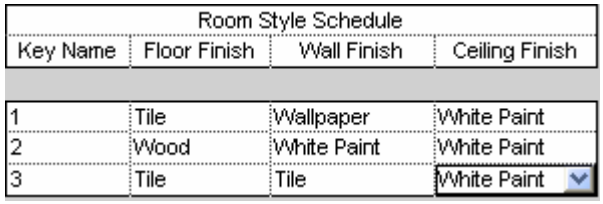
7. Click OK.

The schedule key tables are usually empty when created. Your next task is to fill it with all the necessary information.

8. On the Options Bar, click New.



9. In principle you should now fill out all the information you have about all possible finishes. The first column is automatically generated as a numeric column in which the number increments with every new added line. You can change the numbers but you *cannot* duplicate numbers.



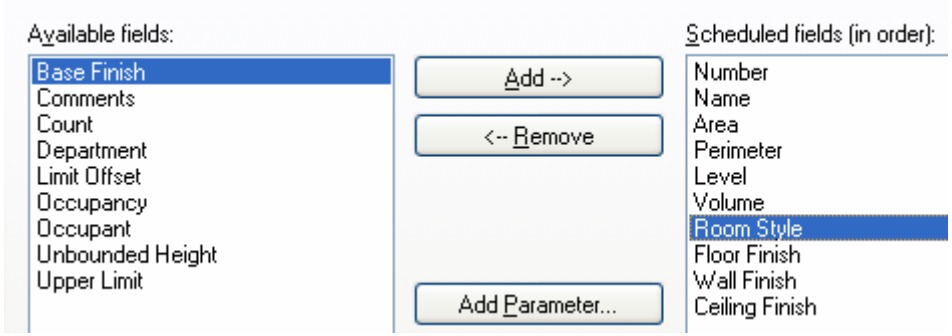
10. Next, you link this schedule to the room schedule so that you can use these values within it.

11. In the Project Browser, right-click the room schedule, and choose Properties.

12. Click the Edit button next to Fields.

13. Under Fields, you can now add the following fields: Room Style, Floor Finish, Wall Finish, and Ceiling Finish.

14. Click OK.



15. The principle is simple: you click the Room Style fields and select the key corresponding to the finishes in that room. The Floor Finish, Wall Finish, and Ceiling Finish columns are automatically filled.

Room Schedule

Number	Name	Area	Perimeter	Volume	Room Style	Floor Finish	Wall Finish	Ceiling Finish
1	Bath 2	85.5 SF	38' - 10 1/2"	847.42 CF	3	Tile	Tile	White Paint
2	Bedroom 2	110.3 SF	42' - 4 1/2"	1093.70 CF	2	Wood	White Paint	White Paint
3	Corridor	104.5 SF	43' - 1 1/2"	1035.85 CF	3	Tile	Tile	White Paint
4	Closet	51.0 SF	28' - 7"	506.18 CF	(none)			
5	Master	168.8 SF	54' - 0 1/2"	1673.84 CF	(none)			
6	Bath	63.4 SF	31' - 10 1/2"	629.10 CF	1			
7	Powder	53.5 SF	30' - 4"	427.66 CF	2			
8	Living	199.9 SF	59' - 4 1/2"	1598.93 CF	3			

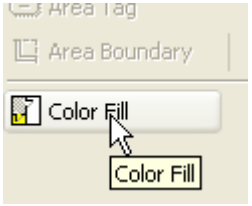
Unit 18, Exercise E: Color Fills

In this exercise you create a color fill legend to give a visual indicator to the information held in the room objects.

Add a Color Fill

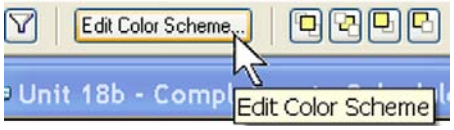
To finalize your plan, you add a color fill of the areas.

1. From the Project Browser, activate the Level 2- Room Areas.
2. From the Room and Area tab, click Color Fill and place the legend next to the floor plan.

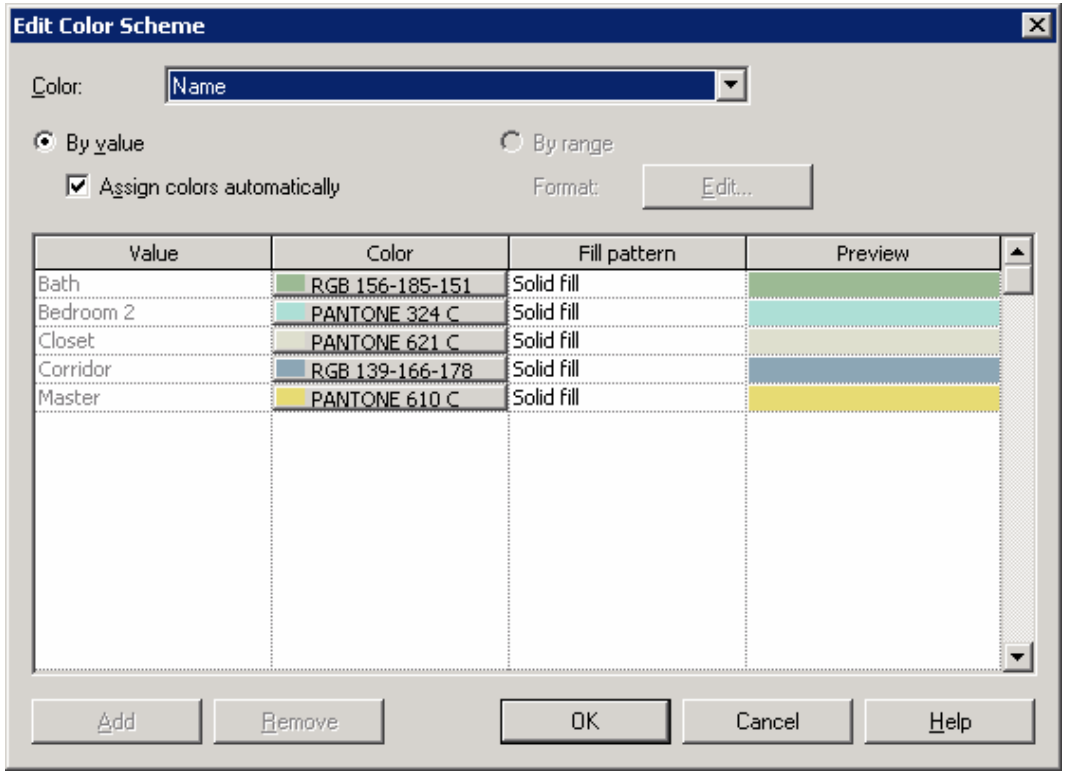


3. Click OK in the information dialog box that appears.

4. Select the Color Fill object, and click the Edit Color Scheme button on the Options Bar.



5. Change the Color value to Name.
6. Colors are automatically assigned to each room name in the view.
7. Click OK.
8. Repeat editing the color scheme. Try color by Floor Finish, color by Area.
9. Change colors by selecting a color button to the right of a name.
10. Return the color scheme to Name, and return to the drawing window.



11. Select the legend.

▼ Allows dimensioning of the width of the legend. If the legend has more than one column, you can change their widths independently.
● Allows dimensioning of the height of the legend. Should the height you are setting not be sufficient for the entire legend, Revit Building automatically splits the legend in various columns.

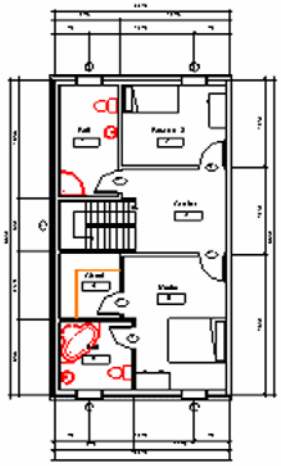
Unit 18, Exercise F: Legends

In this exercise you create a window legend. A legend is a chart of symbols in the project. You can create legends of any Autodesk Revit Building objects, such as walls, windows, furniture, and so forth.

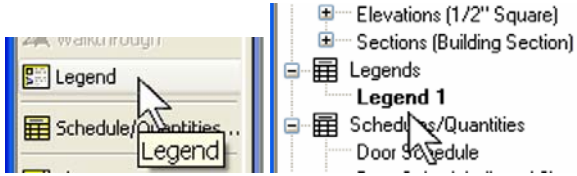
The exercise uses the same data set as the previous exercise but does not build on the information created in that exercise.

Create a Legend

1. From the File menu, choose Open>Browse to find the file Unit 18f – start delivered with the workbook.

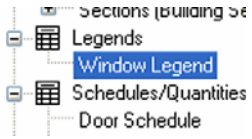


2. On the Design Bar, click Views, and then click the Legend tool.



This creates and opens a new view. The new view is created in its own category in the Project Browser.

3. Rename the legend to Window Legend.

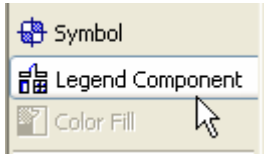


The legend view appears blank with no views of the building model. Think of a legend as a piece of paper on which you place symbols that represent the objects in the building model.

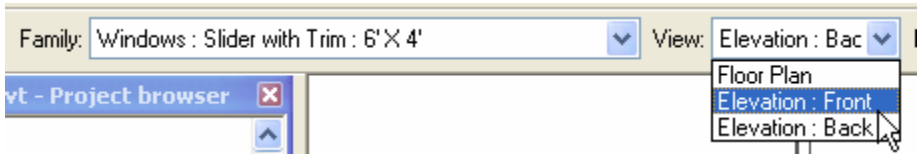
4. Click the Design Bar Modeling tab.

Notice that all the tools are unavailable. There is a special tool you use to add the objects in symbol mode to the legend.

5. Click the Design Bar Drafting tab.
6. Click the Legend Component tool.



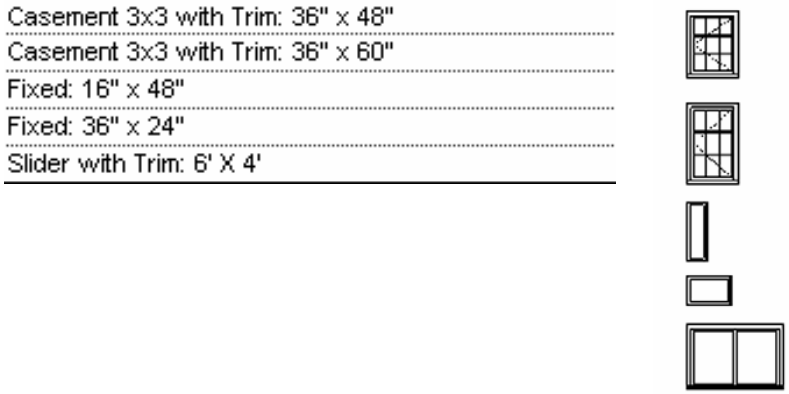
7. Use the Options Bar drop-down to select the following:
   a. Family = Windows:Slider with Trim 6’ – 4’
   b. View = Elevation Front



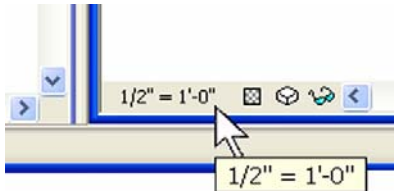
8. Click in the legend to place the window.

The symbol of the window is shown in the legend.

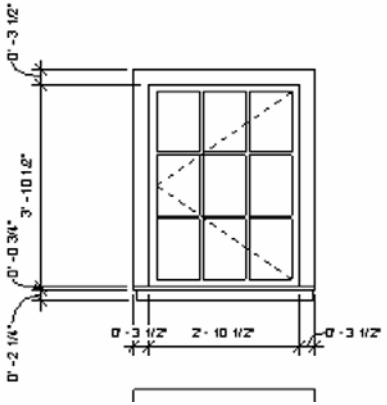
9. Repeat, adding the window types shown here.



10. Change the scale of the legend to 1/2” = 1’-0”.

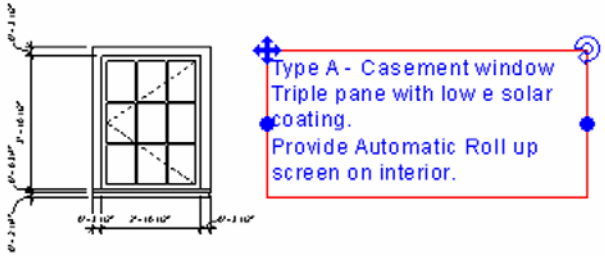


11. On the Design Bar, Basic tab use the dimension tool to dimension the windows.

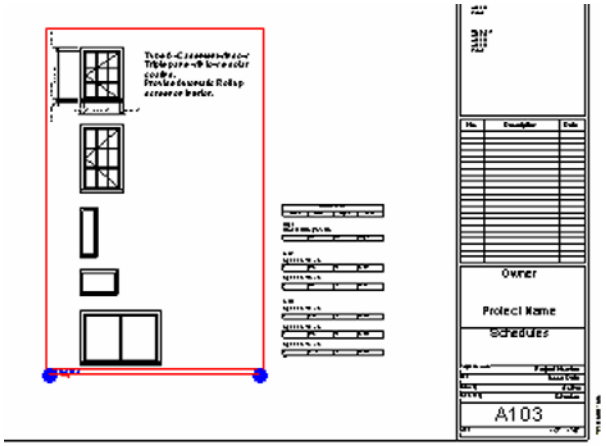


Because this is a window *type*, the window legend is a convenient location to place common information about this window that occurs in multiple locations in the project.

12. On the Design Bar, Basic tab use the Text tool to add notes to the legend.



13. Open the schedules sheet, and drag the legend onto it from the Project Browser.



14. Save and close the project.

Unit 18, Exercise G: Material Takeoffs

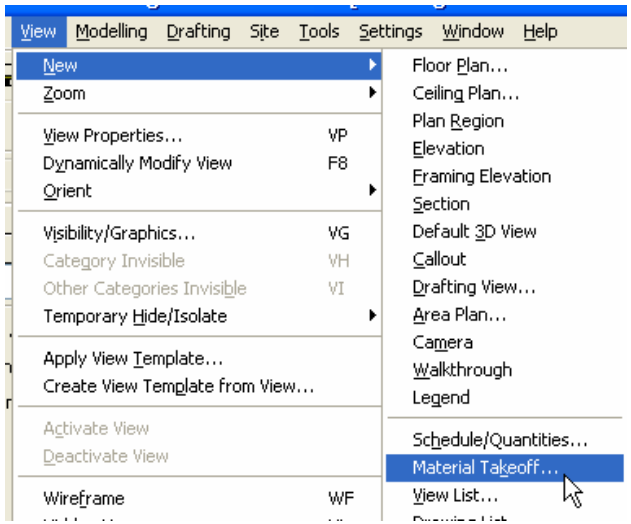
A material takeoff is just a specialized form of schedule. This exercise leads you through creating a material takeoff view for the walls.

The exercise uses the same data set as the previous exercise but does not build on the information created in that exercise.

Create a Material Takeoff List

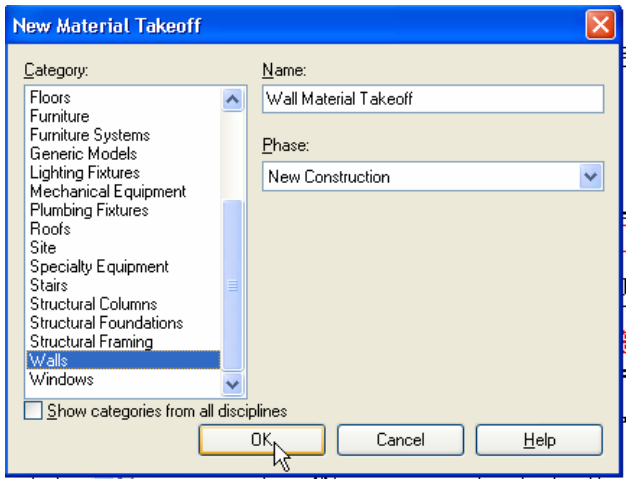
1. From the File menu, choose Open>Browse to find the file Unit 18g – start delivered with the workbook.

2. From the View menu, choose New>Material Takeoff.

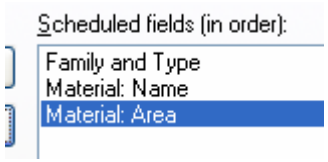


3. In the New Material Takeoff dialog box:

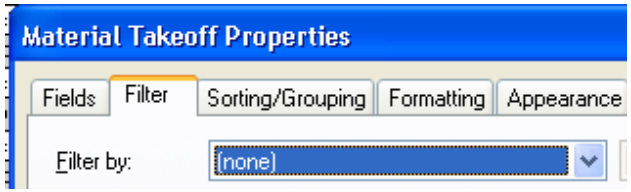
   a. Click Category: Walls.
   b. Click OK.



4. On the Field tab, add the fields shown in the illustration at right.

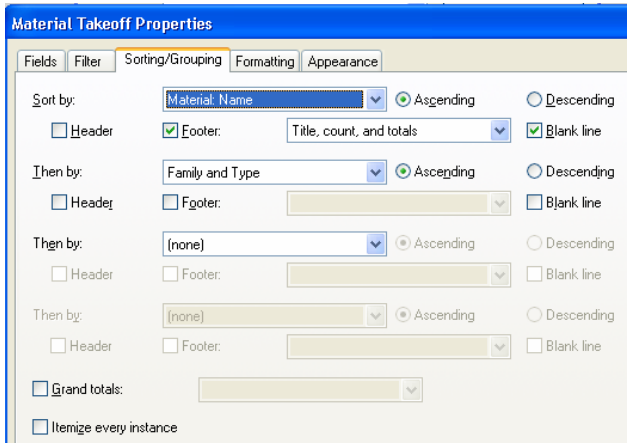


5. Leave the Filter set to None.



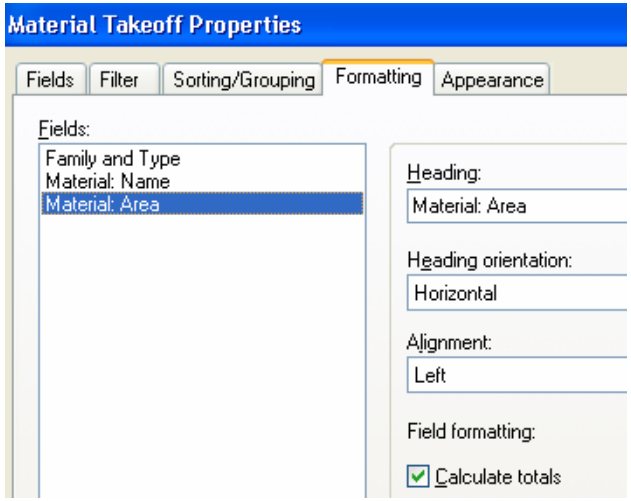
6. On the Sorting/Grouping tab:

   a. Set Sort By to Material Name.
   b. Check Footer and set to Title Count and totals.
   c. Check Blank Line for this sort criteria.
   d. Clear Itemize Every Instance check box.

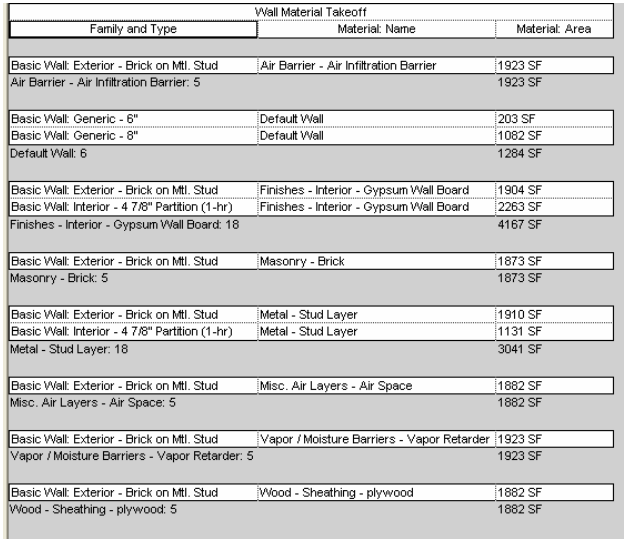


7. On the Formatting tab:

   a. Select Material:Area.
   b. Select Calculate Totals.



8. Click OK.



Wall Material Takeoff

Family and Type	Material: Name	Material: Area
Basic Wall: Exterior - Brick on Mtl. Stud	Air Barrier - Air Infiltration Barrier	1923 SF
Air Barrier - Air Infiltration Barrier: 5		1923 SF
Basic Wall: Generic - 6"	Default Wall	203 SF
Basic Wall: Generic - 8"	Default Wall	1082 SF
Default Wall: 6		1284 SF
Basic Wall: Exterior - Brick on Mtl. Stud	Finishes - Interior - Gypsum Wall Board	1904 SF
Basic Wall: Interior - 4 7/8" Partition (1-hr)	Finishes - Interior - Gypsum Wall Board	2263 SF
Finishes - Interior - Gypsum Wall Board: 18		4167 SF
Basic Wall: Exterior - Brick on Mtl. Stud	Masonry - Brick	1873 SF
Masonry - Brick: 5		1873 SF
Basic Wall: Exterior - Brick on Mtl. Stud	Metal - Stud Layer	1910 SF
Basic Wall: Interior - 4 7/8" Partition (1-hr)	Metal - Stud Layer	1131 SF
Metal - Stud Layer: 18		3041 SF
Basic Wall: Exterior - Brick on Mtl. Stud	Misc. Air Layers - Air Space	1882 SF
Misc. Air Layers - Air Space: 5		1882 SF
Basic Wall: Exterior - Brick on Mtl. Stud	Vapor / Moisture Barriers - Vapor Retarder	1923 SF
Vapor / Moisture Barriers - Vapor Retarder: 5		1923 SF
Basic Wall: Exterior - Brick on Mtl. Stud	Wood - Sheathing - plywood	1882 SF
Wood - Sheathing - plywood: 5		1882 SF

The materials schedule is now part of the project. On your own add the cost field and add a calculated parameter that multiplies the area field times the cost field.

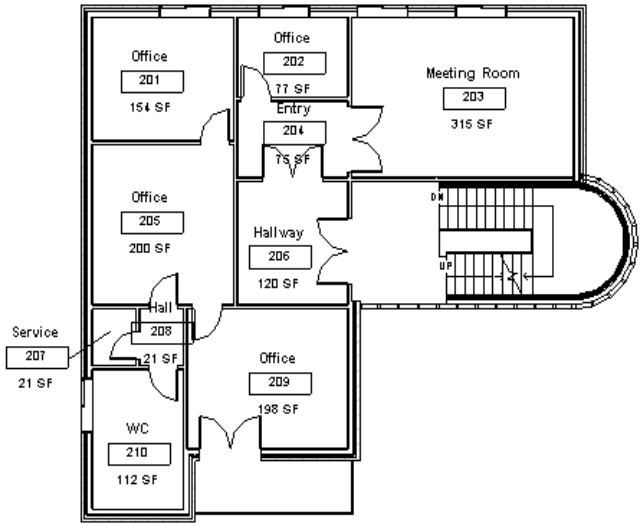
Unit 19

Theory: Time

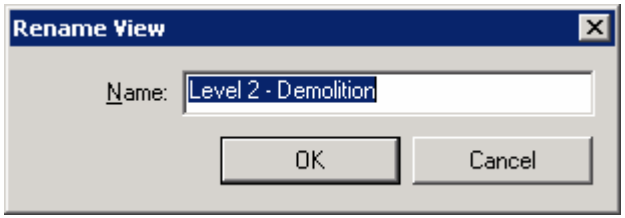
Autodesk Revit Building: Phasing

This unit explains how the time parameter is managed in Autodesk Revit Building.

1. Open File Unit 19 – Start.



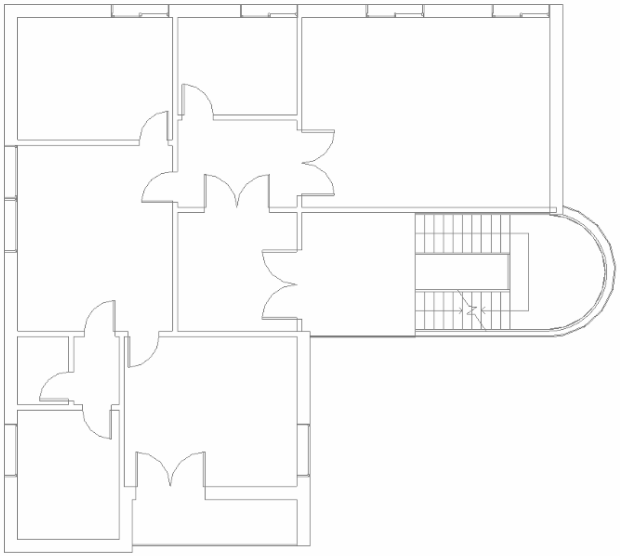
2. In the Project Browse, right-click Floor Plan Level 2.
3. Duplicate the view.
4. Rename the new view Level 2 – Demolition.



5. Open the view properties for Level 2 – Demolition and change the following:
    a. Phase to New Construction
    b. Phase Filter to Show All

To open View Properties you can right-click the view in the Project Browser and choose Properties, or right-click anywhere in the view and choose View Properties from the context-sensitive menu.

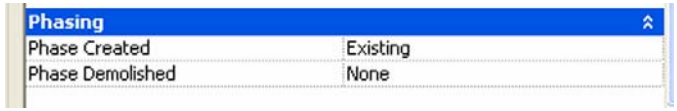
6. Click OK to close the dialog box.



Note how the appearance of the existing components changes when the phase of the view is changed.

The first thing you should notice is that views have a parameter called phase. Depending on the value of this parameter, all components created (or demolished) in this view, have their Created Phase set as the one the view belongs to. In this case, the walls and doors you demolish were created in the Existing Phase and will be demolished in the New Construction Phase.

7. Click one of the walls in the plan. Open its properties.
8. Verify the wall's Phase Created is set to Existing and Phase Demolished is set to None.

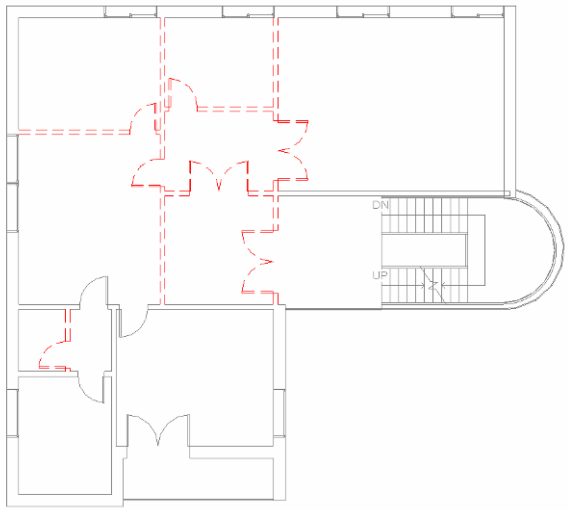


For every object in the building model there is also a phasing property. For each object, Autodesk Revit Building tracks the phase created and the phase demolished. As noted earlier, the phase created is read from the phase property of the view in which it is created.

Demolish Walls and Doors

9. Click the Demolish icon on the toolbar, and then click the walls in the middle of the building (see image).

10. Click the wall dividing the bathroom area on the bottom left (see image).

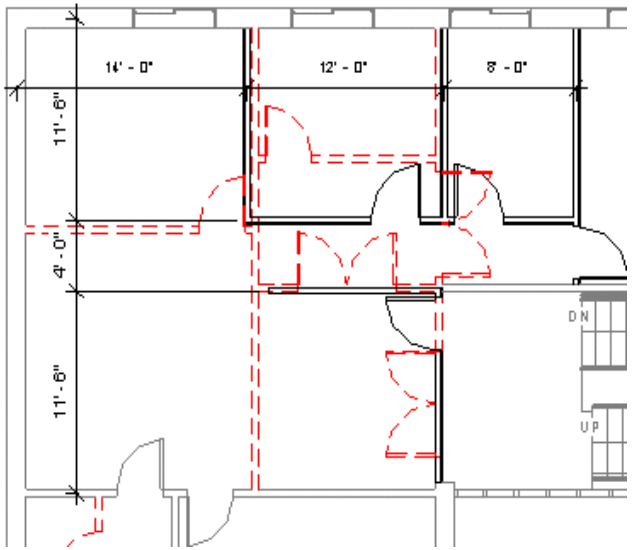


When you demolish a component, its display changes according to the phase filter assigned to the view.

Phase filters are found in the view properties.

The override of the display of the components is defined in the phase settings: Settings>Phases> Graphic Overrides tab.

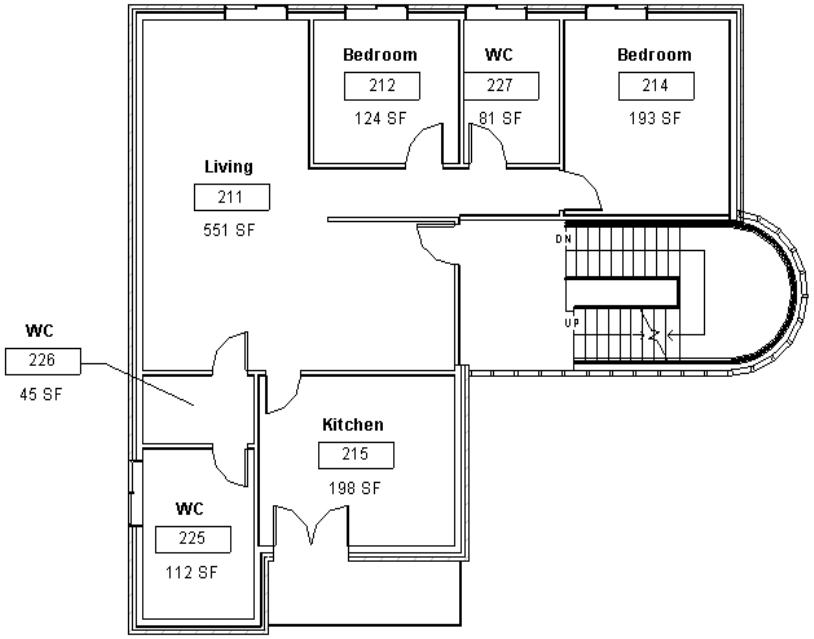
11. Add new walls and doors as shown in image. You don't need to be exact about positioning the components, but you should design a plan that makes sense.



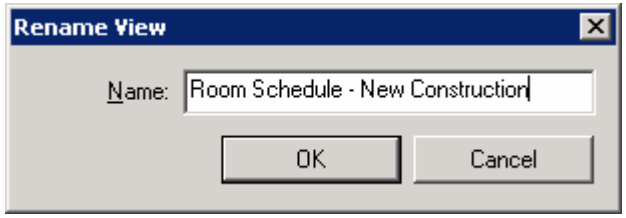
As you add the walls, verify that the height is set to Level 3.

12. Duplicate the Level 2 Demolitions plan view from the Project Browser and rename it to Level 2 – Complete.
13. Open the View Properties and change the Phase Filter parameter to Show Complete.
14. Click OK to exit the dialog box.

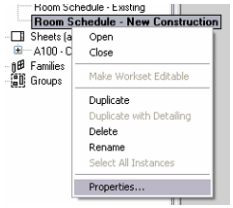
15. On the Room and Area Design Bar, click Room and create (and rename) the rooms as shown in the image.



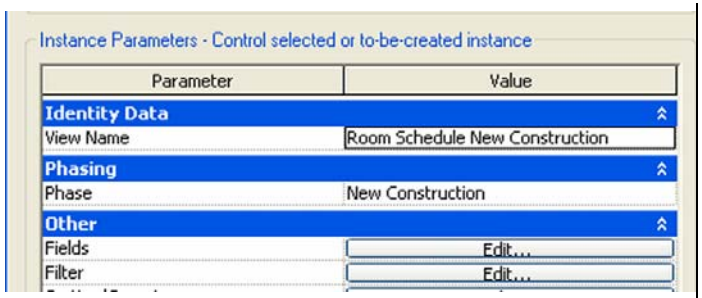
16. In the Project Browser>Schedules/Quantities, right-click the Schedule table: Room Schedule – Existing and duplicate it.
17. Rename it to Room Schedule – New Construction.



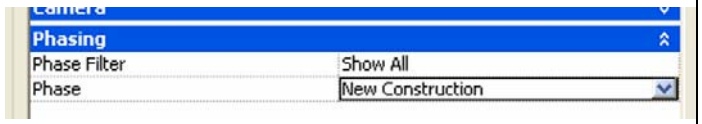
18. In the Project Browser, right-click the newly created schedule, and choose Properties from the context-sensitive menu.



19. Change the Phase parameter to New Construction.
20. Click OK to close the window.



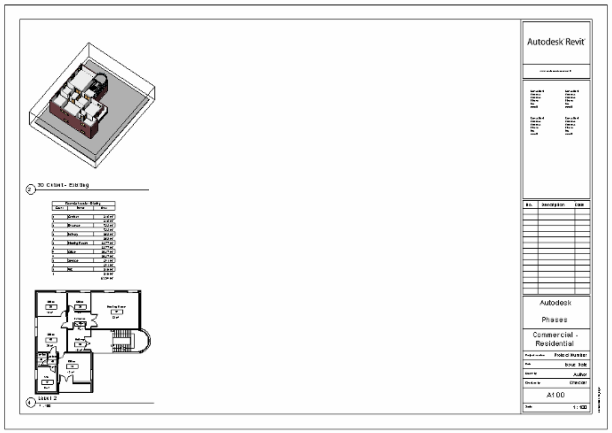
21. In the Project Browser duplicate the 3D view: 3D Existing Cropped and rename the new view 3D Demo Cropped.
22. Open the newly created 3D View properties and change the Phase to New Construction.



23. Click OK to close the dialog box.

24. Duplicate this 3D view and name the new view 3D Complete Cropped.
25. Open the newly created view's properties and change the Phase filter to Show Complete, and Phase to New Construction.
26. Click OK to close the dialog box.

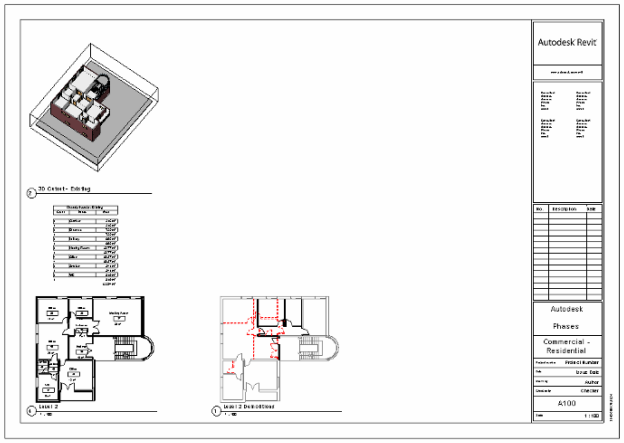
27. Set the existing sheet A101 Unnamed current.



This sheet already has the original views placed on it:

- 3D Existing Cropped
- Existing Room Schedule
- Level 2 (Floor Plan)

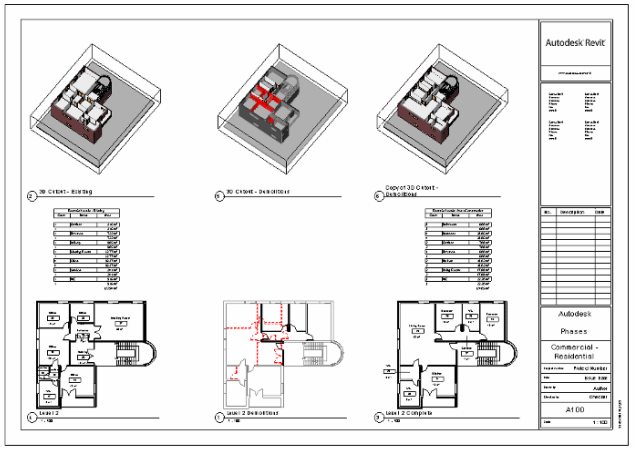
28. Drag the view: Level 2 - Demolition on the sheet and position it in the middle, as shown in image.



29. Drag on the sheet the views:

- Level 2 – Complete
- 3D Demolition Cropped
- 3D Complete Cropped
- Room Schedule – New Construction

30. Position them as shown in image.



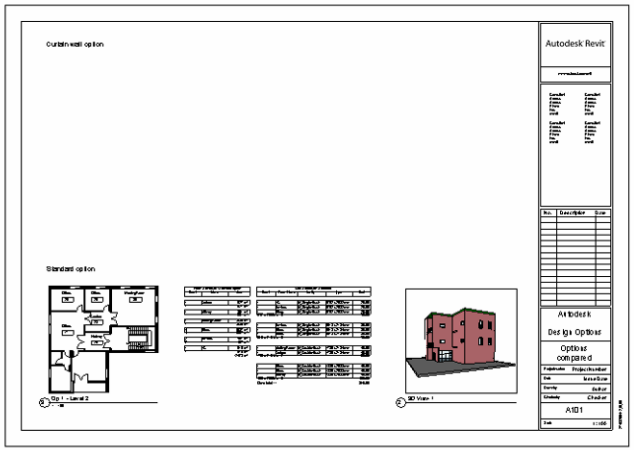
Unit 20

Theory: Variation

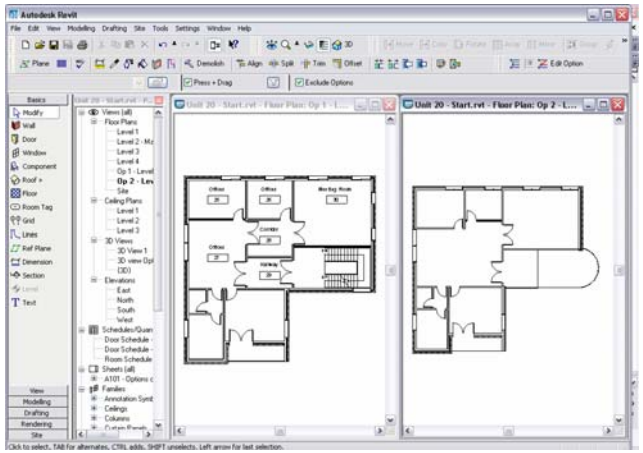
Autodesk Revit Building: Options

This unit guides you through the powerful Design Options feature. You start using a file that already contains a couple of design options.

1. Open File Unit 20 – Start. This file contains an option set with two different design options.
2. Open Floor Plan Level 2 – Option 1.



3. Close hidden windows. Open Floor Plan Level 2 – Option 2 and tile windows to display both options.

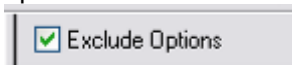


Note how tiling windows lets you visualize both—or more—options in different views.

Both views represent the 2nd floor of the building. All components are held in the building model. However, the interior walls of the floor, along with the stair and east wall,are held in design options.

4. In Plan: Level 2 – Option 1, try to click the door of Office 212.

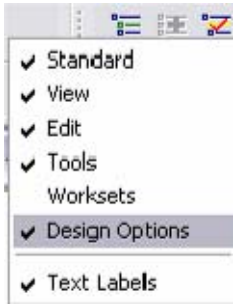
When the project contains Design Options, the Options Bar displays a check box to allow selection of components that are part of the option set:



This is just a check to keep you from inadvertently changing objects that are in a design option.

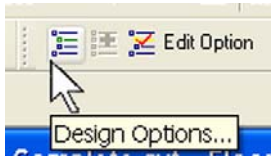
View the Options

5. Right-click the toolbars, and select the Design Options toolbar.

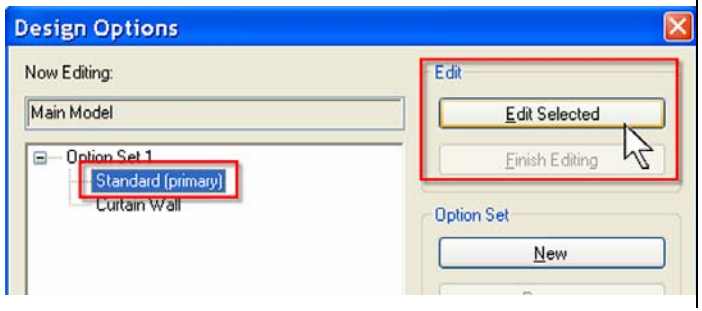


In this file you have only one option set, but you can have as many as you want. Normally, an option set is a specific part of a building where you want to try different design alternatives. An option set can contain as many options as you want.

6. Click the Design Options tool to open the Design Options dialog box.



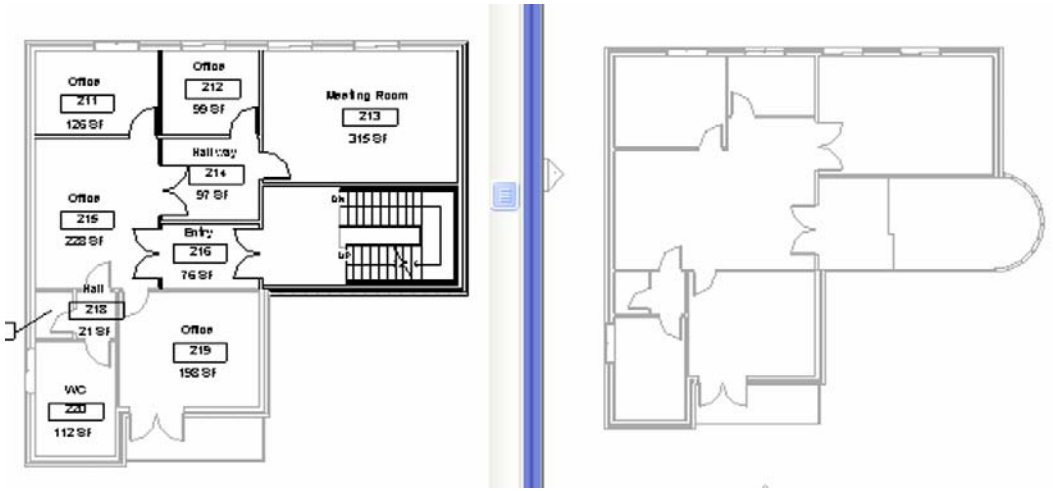
7. Select Option 1 – Standard, and click Edit Selected.



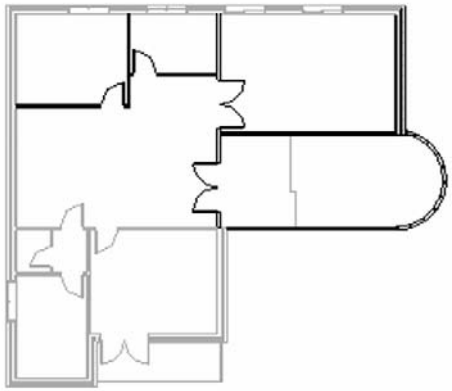
The Now Editing window displays the active edited option.

When you edit an option, all components that are not part of the option are displayed in gray.

8. Do not dismiss the Design Options dialog box yet.



9. In Design Options dialog box:
   a. Click Finish Editing.
   b. Click Curtain Wall.
   c. Click Edit Selected.



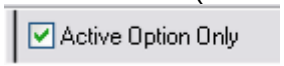
With two options as in this case, you have three sets of objects:

- Those in the main model
- Those in sets unique to each of the options

When you are editing an option, you can see and refer to objects in the main model, but by default you cannot edit them.

10. While still in Edit Curtain Wall option mode, click Close in the Design Options dialog box.

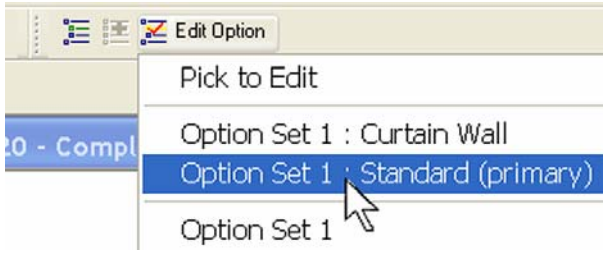
The Options Bar displays a check box that allows selection of components that belong to the main model (not to an option set).



11. Click the Edit Options Tool button to end editing the curtain wall option.

You are returned to standard editing mode with neither option open.

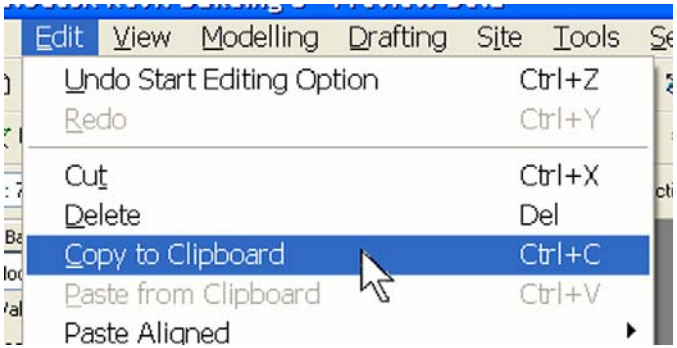
12. Click the Edit Options Tool button, and from the drop-down menu, select Options Set 1: Standard (Primary).



This shortcut bypasses the Design Options dialog box.

This tool is cyclical. If you click it again, you exit the edit option mode (don't do this yet).

13. Select the stairway on the east end of the building. From the Edit menu, choose Copy to Clipboard.



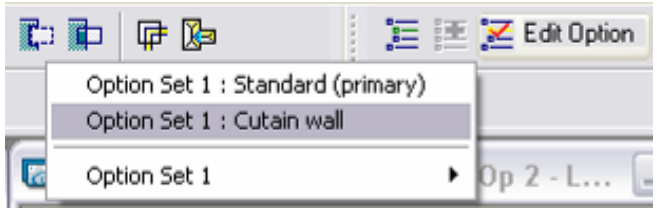
Copy to Clipboard and Paste Aligned (Same Place) constitute an easy way to replicate a situation among different options.

You can also duplicate an option within an option set by selecting it in the Design Options dialog box and clicking Duplicate.

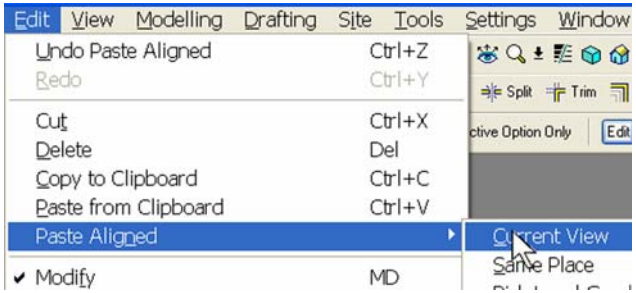
14. On the Design Options toolbar click the Edit Option button to finish editing the option.

The Design Options toolbar allows for quick selection of the available design options.

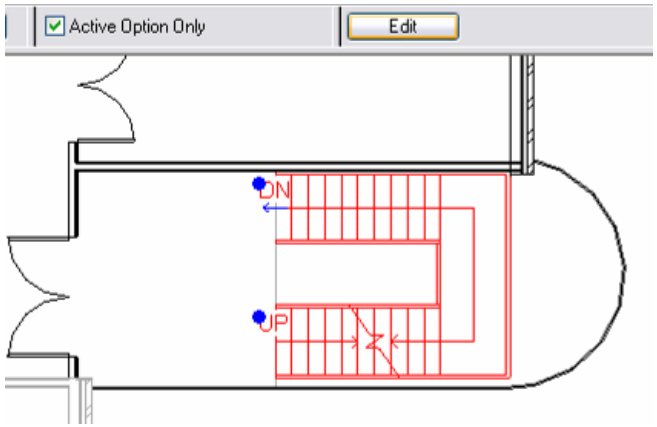
15. Click Edit Option button again and from the drop-down list, select Option Set 1: Curtain Wall.



16. From the Edit menu, choose Paste Aligned>Current View.

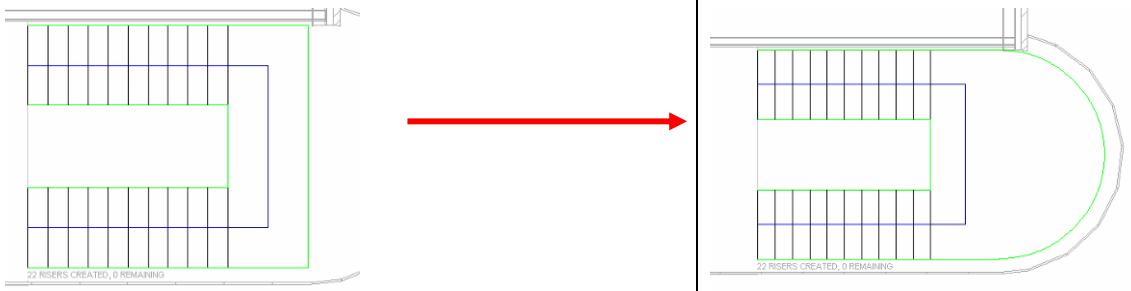


17. In the Level 2 Option 2 window, select the stair, and click Edit on the Options Bar.

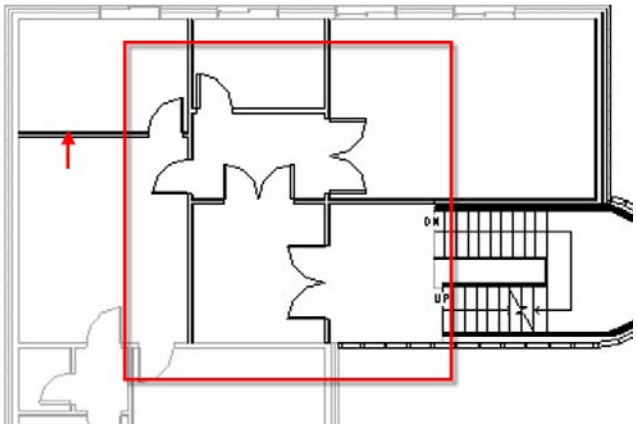


When editing stairs, you enter sketch mode.

18. Reshape the landing boundary of the stair as shown in image. On the Design Bar, click Finish Sketch.

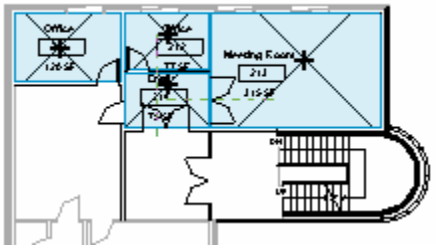


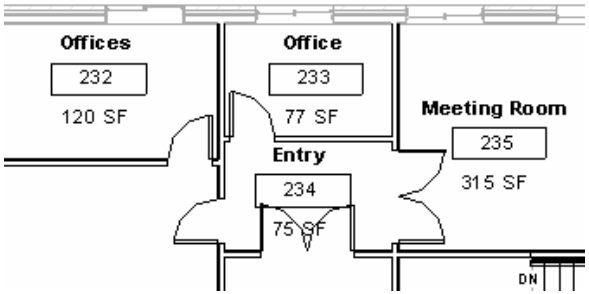
19. Add walls and doors to complete the design, as shown in image.



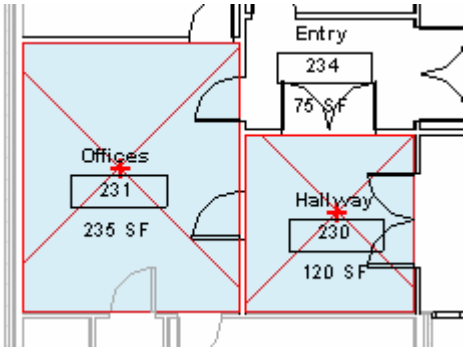
When working in the stair sketch mode, click the Boundary button on the Design Bar to draw the boundary using lines. Select the arc line template. Draw the line and click Finish Sketch.

20. On the Basics Design Bar, click Room Tag. Tag all the existing rooms in the option. After placing the tags, rename the rooms as shown in image.





21. Add rooms with tags to the new rooms you created by modifying the walls.



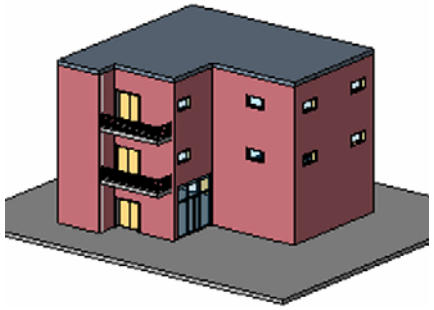
If you want the rooms to be part of the option, make sure you are still editing the option before adding the rooms.

22. On the Design Options toolbar, click the Edit Option button to finish editing the option.

Assign an Option to a View

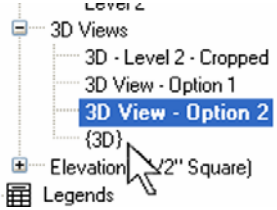
You have been working in two views that are both views of the 2nd level. The only difference between these is a setting in the view properties assigning one option or the other.

23. Open 3D View – Option 1.

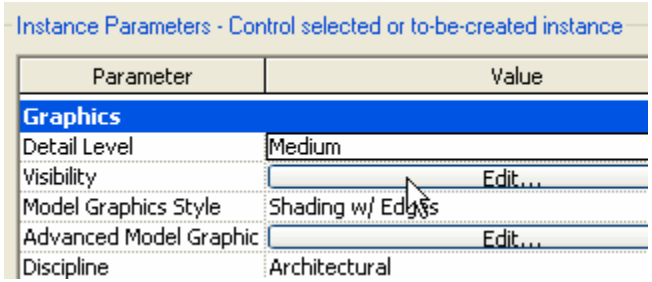


By default, a view shows the option marked (Primary), in this case the standard option.

24. In the Project Browser, right-click the 3D view 1 and choose Duplicate.
25. Rename the view 3D View - Option 2.



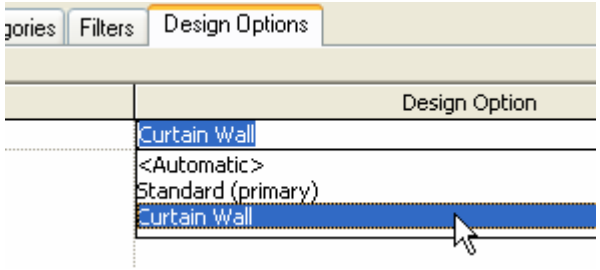
26. Open the View Properties dialog box by right-clicking the view in the Project Browser and choosing Properties. Click the Edit button next to the Visibility parameter.



When there are design options in the project file, Autodesk Revit Building adds a new tab in the visibility settings of the views.

You can display any option in any desired view: plans, elevations, sections, and so forth.

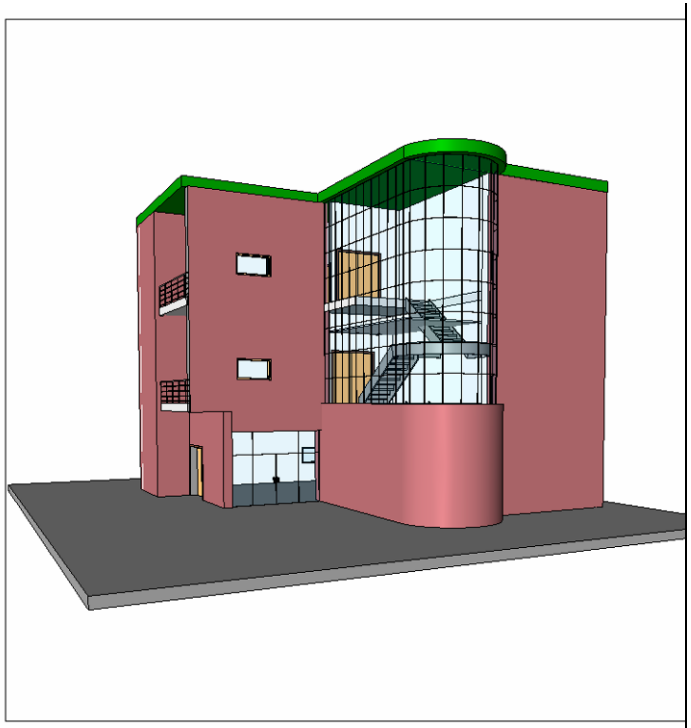
27. On the Design Options tab, select Curtain Wall from the drop-down menu under Option Set 1.



The drop-down menu displays the available options for the option set.

When the value is set to Automatic, the view displays the primary option but switches to show the one you are modifying when in edit mode.

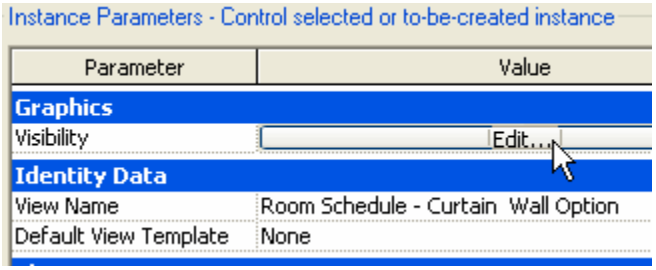
28. Click OK twice to close the dialog boxes and see the changes.



Assign an Option to a Schedule

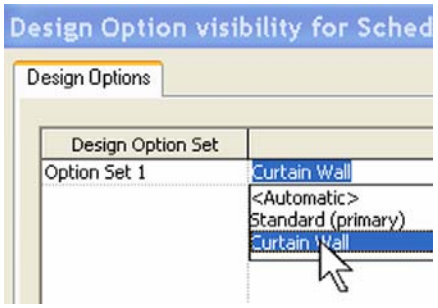
29. In the Project Browser, duplicate the Schedules/Quantities: Room Schedule.
30. Rename the new schedule view to Room Schedule - Curtain Wall Option.
31. Right-click the newly renamed schedule and choose Properties.

32. Click the Edit button in the Visibility row.



Schedules are views as plans and sections. They can display the desired design option to evaluate the different quantities or costs according to the option displayed.

33. From the drop-down menu select Curtain Wall. Click OK to close the dialog box.



Room Schedule		
Name	Count	Area
Entry	1	76 SF
1	1	76 SF
Hall	1	21 SF
1	1	21 SF
Hallway	1	97 SF
1	1	97 SF
Meeting Room	1	315 SF
1	1	315 SF
Office	4	651 SF
4	4	651 SF
Service	1	21 SF
1	1	21 SF
WC	1	112 SF
1	1	112 SF
	10	1295 SF

Predesign options set shows the entire model along with the standard option (primary) rooms.

Although access to this component is a bit different for the schedule than for the 3D view, the theory is the same. A schedule is just a text view of the building model.

Room Schedule - Curtain wall option		
Name	Count	Area
Entry	1	75 SF
1	1	75 SF
Hallway	1	120 SF
1	1	120 SF
Meeting Room	1	315 SF
1	1	315 SF
Office	1	77 SF
1	1	77 SF
Offices	2	354 SF
2	2	354 SF
	6	942 SF

After you assign the option, it lists only those rooms that have been tagged in that option.

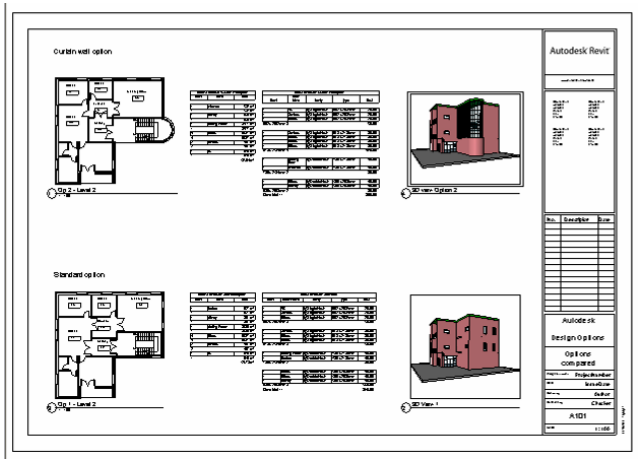
This is essential because one option may call a room an office, and in another office a similar area may be a storage closet.

Place Views of the Options on a Sheet

34. In the Project Browser, double-click the sheet A101 – Options Compared.

35. In the Project Browser, drag Floor Plan – Level 2 Option 2 onto the sheet as shown in the image.

36. Place the following views on the sheet, as shown in the image: 3D view Option 2, Door Schedule Curtain Wall Option, and Room Schedule – Curtain Wall Option.



You have to turn on the crop region of the 3D view Option 2 and adjust the boundaries of the crop region to fit on the sheet.