Chapter 3

Creating Building Envelopes

Learning Objectives

After completing this chapter, you will be able to:

- *Understand the concept of Levels*
- *Understand the concept of Grids*
- *Work with Project Views*
- *Understand walls*
- *Add doors and windows*
- *Create openings in walls*
- *Create ceilings*
- *Create floors*
- *Create rooms*



INTRODUCTION

The building envelope behaves as a physical barrier between the interior and exterior of a building. It comprises of walls, floors, roofs, fenestrations and doors. In a project, fenestration are any opening in the structure such as windows, skylights, clerestories, etc. In a Revit project, the building envelope also comprises of beams, columns, datum elements, and standard views.

In an HVAC system, the building envelope is considered as an important aspect of an HVAC design. The building evelope is the outer shell that maintain a dry, heated, or cooled indoor environment and facilitate its climate control. Building envelope design is a specialized area of architectural and engineering practice that draws from all areas of building science and indoor climate control. While working in an MEP project you can either create a building envelope in the current MEP project or link the architectural and structural models created in Revit to the current MEP project.

In this chapter, you will learn about various tools and options to create the Building Envelope for carrying out an MEP project.

LEVELS

Levels, in a multistory building, refer to the infinite horizontal planes that define each story of the structure. Autodesk Revit uses levels as references for level-hosted elements such as walls, ducts, AHUs, air terminals, pipes and pipe fixtures, sanitary fixtures, floor, roof, ceiling, and so on. The distance between levels can be used to define the story height of a building model, as shown in Figure 3-1. Autodesk Revit also provides flexibility to create a non-story level or a reference level such as sill level, parapet level, and so on.

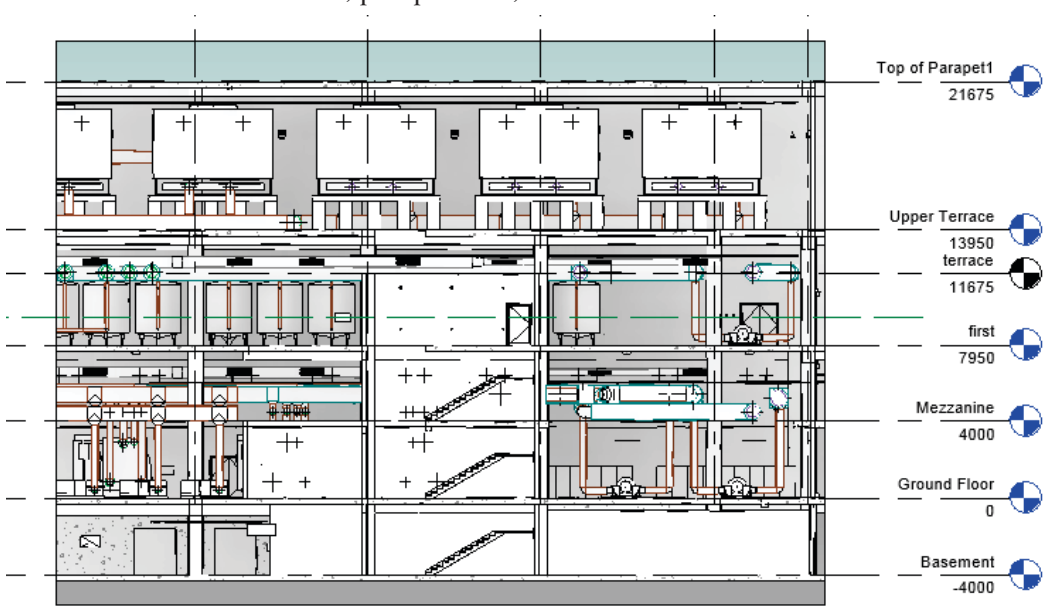


Figure 3-1 *The elevation view of a building model displaying different levels*

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For example, a multistory office building, refer to Figure 3-1, displays different story heights for each floor. MEP and architectural components such as ducts, pipes, fixtures, electrical wiring, fire fighting fixtures, exterior walls, windows, doors, and furniture may also differ on each floor. You can create levels based on the story height of a building. You can then create various building elements on each level such as an entrance door on the first floor level, bay windows on the second floor level, an elevator room on the roof level, and so on.

When you use the default template file for creating a new project file, two predefined levels, **Level 1** and **Level 2**, are displayed in the elevations or section views. You can view any of the elevation or section view using the **Project Browser**. Levels can be added, renamed, and modified at any time during the project development.



Tip

In an MEP project, it is recommended to create the levels and save them as a template. On doing so, you can save time while working on a project deadline. Also, the number of levels that you will create in the template will be based on the type of project your firm frequently works on. After you create the levels, you need to assign appropriate plans such as Lighting, Power, HVAC Piping, and more based on your requirement for each of the created levels.



Note

*In Revit, you can view the levels in the elevations or section views displayed in the **Project Browser** under each discipline such as Mechanical, Electrical, or Plumbing, refer to Figure 3-2.*

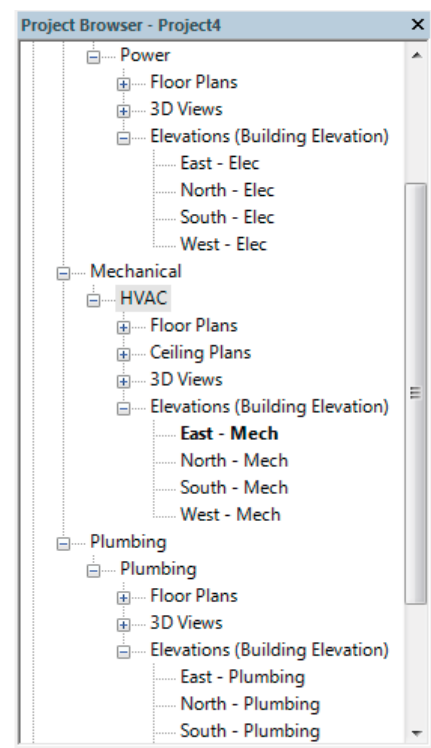


Figure 3-2 *The **Project Browser** displaying various elevation views for different disciplines*

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Tip

If you are using a linked architectural model to create an MEP model, you can reuse the levels created in an architectural model for the current MEP model. To do so, choose the ***Select Link*** *tool from* ***Collaborate > Coordinate > Copy/Monitor*** *drop-down. The use of the* ***Copy/Monitor*** *tool has already been discussed in Chapter 2 of this textbook.*

Understanding Level Properties

A typical level is represented by a level line, level bubble, level name, level elevation, and so on, refer to Figure 3-3. Using these parameters and controls, you can modify the appearance of a level. The level name is a modifiable parameter that is used to refer to each level. The level elevation is the distance of the level from the base level. The visibility of the level bubble on either side of the level line can be controlled by using the bubble display control. The length alignment control can be used to align level lines. Autodesk Revit provides the 2D or 3D extents control for datums when they are selected. This enables you to change their extents in one or multiple views in which they are visible. When a datum is in 3D mode, any modification made in the 3D view reflects in all views of the building model. Therefore, you cannot modify a specific view in the 3D mode. However, 2D mode can be used to modify a datum in a specific view, thereby making it view-specific.

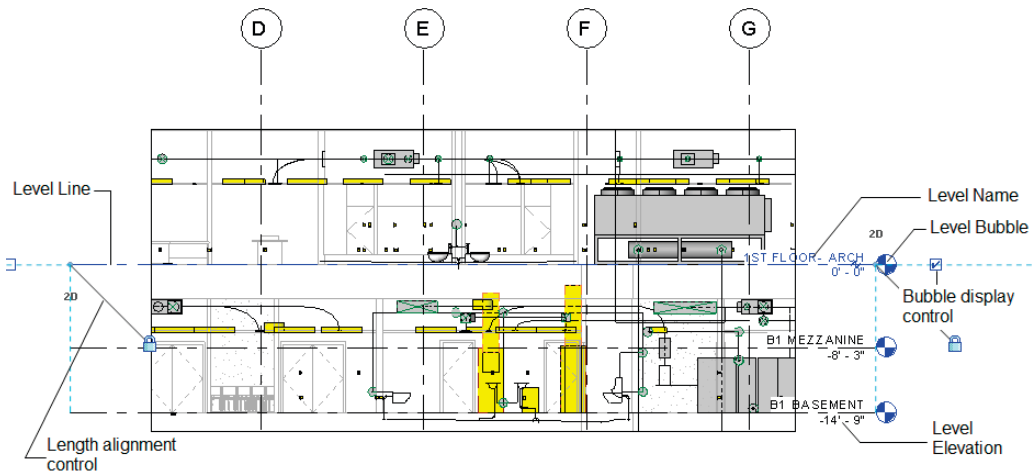


Figure 3-3 *A section view displaying levels with its various components*

Like other building and MEP elements used in an Autodesk Revit project, levels also have associated types and instance properties. You can view and modify instance properties of a level in the **Properties** palette. You can also use the **Properties** palette to view and modify the type properties of the selected level. To do so, choose the **Edit Type** button in the **Properties** palette; the **Type Properties** dialog box will be displayed. You can use this dialog box to modify and view the type properties of the selected level from the drawing. Various properties of level are described next.

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Type Properties of Level

The type properties of a level can be viewed and modified in the **Type Properties** dialog box of a level, as shown in Figure 3-4.

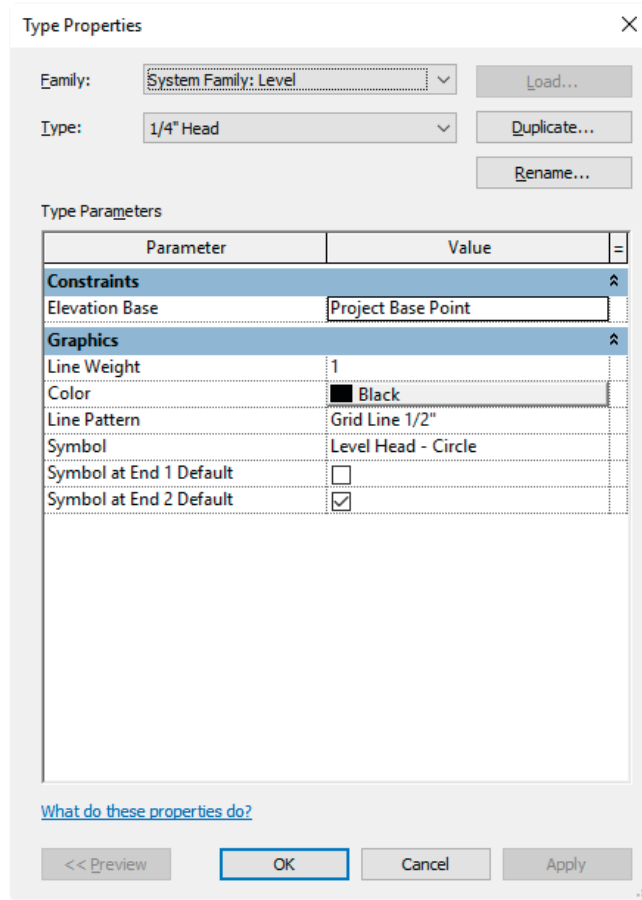


Figure 3-4 *The* ***Type Properties*** *dialog box displaying the type parameters of a selected level type*

When you change the type properties of a level, all its instances are also modified. In the **Type Properties** dialog box of a level, you can modify the value of a parameter by clicking on its corresponding **Value** field and then selecting a new value from the drop-down list or entering a new value in the field. Different level type properties are described in the table given next.

Parameter Name	Value and Description
Elevation Base	Describes the elevation base value with respect to the project or the shared origin.
Line Weight	Refers to the line weight of the level. It can be specified by clicking in its **Value** field and selecting a desired option from the drop-down list displayed.

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Color	Refers to the color of the level line and can be selected from the available colors. The default color is black.
Line Pattern	Used to set the linetype of the level line.
Symbol	Refers to the symbol indicating the level and can be chosen from the drop-down list. The **None** option can be specified if the level head is not required.
Symbol at End 1 Default	Check box is selected if a bubble is required at the left end of the level line.
Symbol at End 2 Default	Check box is selected if a bubble is required at the right end of the level line.

Instance Properties of Level

You can change the instance properties of the selected level by using the **Properties** palette, refer to Figure 3-5. When you change the instance properties of a level, the properties of only the selected instance are changed.

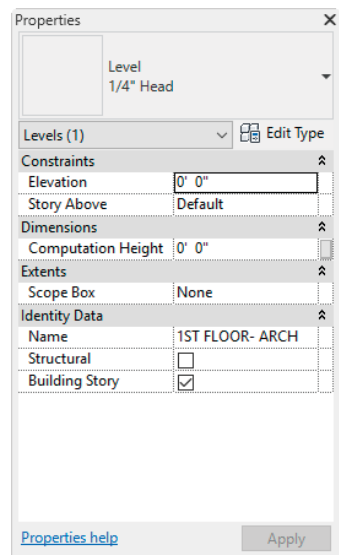


Figure 3-5 *The* ***Properties*** *Palette displaying the instance parameters of a selected level*

The instance properties of a level are described in the following table:

Parameter Name	Value and Description
Elevation	Refers to the vertical height of the level from the elevation base.
Name	Refers to the name assigned to the level. You can enter any name based on the project requirement.

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Computation Height	Specifies the computation height for a level. This value is used to compute the area, perimeter, and volume of a room.
Structural	By default, the check box corresponding to this parameter is cleared. You can select the check box to define the level as structural. For example, the level defined for the top of a foundation can be a structural level.
Building Story	By default, the check box corresponding to this parameter is selected. As a result, you can define a level as a functional story or a floor in the project.
Story Above	Specifies the next building story for the level.
Scope Box	Refers to the scope box assigned to the level that controls its visibility in different views.

Adding Levels

In Autodesk Revit, you can create multiple levels based on your project requirements. Note that the **Level** tool remains inactive in the **Datum** panel for all the plan views. The **Level** tool will only be activated in an elevation or section view. To create a level, first select the desired section or elevation view on which you want to add the level. Next, invoke the **Level** tool from the **Datum** panel of the **Architecture** tab, as shown in Figure 3-6; the **Modify | Place Level** tab will be displayed. In this tab, choose any of the sketching options displayed in the **Draw** panel to create levels in your project. You can also invoke the **Level** tool by typing **LL**. In the displayed tab, you can select level type from the **Type Selector** drop-down list to modify an existing level. This drop-down list has three level types in Imperial unit system: **Level: 1/4" Head**, **Level: No Head**, and **Plenum**. In Metric unit system, the **Type Selector** drop-down list displays two types of levels: **Level: 8mm Head** and **Level: Plenum**. To make the level head visible, select the **Level: 1/4" Head** option for Imperial or **Level: 8mm Head** for Metric system. Else, select the **Level: No Head** or **Plenum** option.

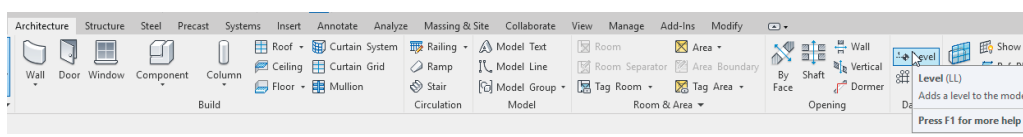


Figure 3-6 *Choosing the* ***Level*** *tool from the* ***Datum*** *panel*

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Tip

*You can select the **Plenum** option from the **Type Selector** drop-down list when you are required to add a plenum level. The plenum level is generally added above the ceiling level. This level is used to generate a plan view in which you can add spaces to make the heating and cooling load analysis of a building accurate.*

In the **Draw** panel of the **Modify | Place Level** tab, you can use the **Line** (default selection) or **Pick Lines** tool to sketch a level line. In the **Options Bar**, the **Make Plan View** check box is selected by default. As a result, while adding a level in a project view, its associated plan view/s will be created. To specify the associated view/s to the level, choose the **Plan View Types** button displayed next to the **Make Plan View** check box; the **Plan View Types** dialog box will be displayed. In the **Select view types to create** area of this dialog box, two associated views will be displayed namely, **Ceiling Plan** and **Floor Plan**. You can select any one of them or both from the area and then choose **OK** to close the dialog box; the selected view/s will be associated with the level. If you clear the **Make Plan View** check box, the associated views will not be created. The **Offset** edit box in the **Options Bar** can be used to add a level at a specified distance from the selected point or element.

To add a level in the current project view(elevation/section), invoke the **Level** tool and move the cursor near the existing levels. On doing so, the temporary dimensions will be displayed, indicating the perpendicular distance between the nearest level and the cursor. To add a level at the specified distance from the existing level, specify the perpendicular distance value, as shown in Figure 3-7.

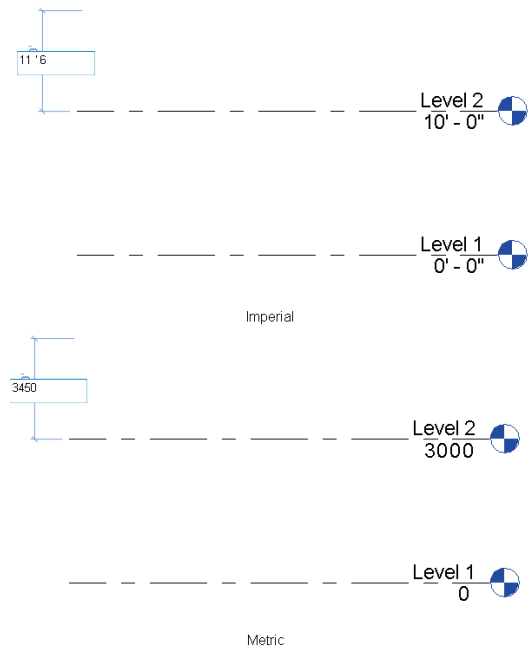


Figure 3-7 *Specifying the distance from the existing level*

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To sketch a level line, specify its start point and endpoint. The level elevation and the level name will be specified simultaneously. Click to specify the first point and move the cursor to the left or the right. You will notice that the level line, level name, and elevation appear on the cursor and move along with it. Also, if you move the cursor above the endpoint of the existing level line, a dashed alignment line will appear, indicating its alignment with the existing level. When the alignment line appears, click to specify the endpoint of the level line. You can also specify the elevation of the level by entering the value before specifying the start point.



Note

Although you are required to specify the start point and the end point of level lines, the levels corresponding to these lines are infinite horizontal planes. However, the placement of the level line can be useful in the elevation and section views.

When you select a recently added level, it is highlighted and displays two square boxes, one each on either side of the level. These boxes are used to control the visibility of the level bubble. They can be selected or cleared to make the bubble visible or invisible at the desired side(s). The two small circles representing the drag controls for the level line can be used to increase or decrease the length of the level line by dragging. The padlocks act as the length alignment control for the alignment of all the level lines. When locked, the modification in the length reflects on all the level lines, simultaneously. To modify the length of a level line separately, unlock the control and then modify its length.

Modifying Level Parameters

You can change a level type by selecting the level from the drawing and then selecting the desired level type from the **Type Selector** drop-down list in the **Properties** palette. On doing so, the current level will be modified into the selected level. You can also specify the properties of the modified level using the **Properties** palette before adding it. Some of the parameters of the level can also be modified by clicking on the level in the drawing window and entering the new value.

For example, after selecting a level, you can click on its name and assign a new name to it. As you start typing the new name, an edit box appears with the new value. Also, Autodesk Revit prompts you to rename all the associated views such as the floor plan, ceiling plan, and so on, if required. If you choose to rename the views, the name of the associated views will change in the **Project Browser**. Similarly, you can modify the elevation of a level by selecting it and entering the new temporary dimension value. When you enter a new value, the level automatically moves to the specified elevation.

You can also move levels by simply dragging them to the desired location. Click to select a level(s) and drag it to the desired location. As you drag, the elevation level changes dynamically with respect to the cursor location. Hold the SHIFT key to move the cursor vertically. Next, release the mouse button at the appropriate location to complete the dragging process. When you move the cursor near a level, level will be highlighted. Right-click on the highlighted level line; a shortcut menu will be displayed with various options. You can choose the **Go to Floor Plan** option from the shortcut menu to open the corresponding floor plan for the level. On choosing the **Find Referring Views** option from the shortcut menu, the **Go To View** dialog box will be displayed. In this dialog box, select the desired view from the list of views and then choose the **Open View** button; the view in which the selected level is visible will be displayed.

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For certain levels, you may want to move the level bubble to a different location. When you select a level, you will notice a break control, also known as **Add elbow**, appearing below the level name, next to the level bubble. This break control can be used to break the level line and move the level bubble away from it. On clicking this control, you will observe that the level name and the level bubble are also moved to the new location and an extension line is created. You can then use the displayed blue dots to place the level bubble at the appropriate location.

Controlling the Visibility of Levels

You can control the visibility of levels in any of the project views. To do so, select a level and right-click; a shortcut menu will be displayed, as shown in Figure 3-8. Choose **Hide in View > Category** from the shortcut menu; the level category will be hidden in the current view. To hide a particular level, choose **Hide in View > Elements** from the shortcut menu; only the selected level will be hidden in the current view and will be displayed in all other views.

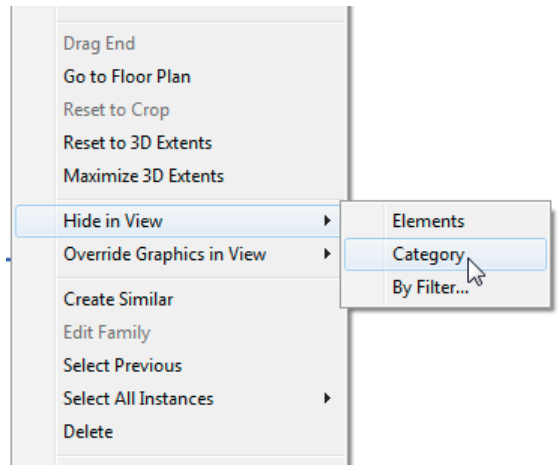


Figure 3-8 *Choosing the* ***Category*** *option from the shortcut menu*

To hide all the levels in a project view, select a level in the project view. Next, choose the **Override by Category** tool from **Modify| Levels > View > Override Graphics in View** drop-down; the **View-Specific Category Graphics** dialog box will be displayed. In this dialog box, clear the **Visible** check box and choose **OK**; all levels will be hidden from the current view. You can use the **Scope Boxes** feature to control the visibility of the levels. You will learn about this feature later in this chapter.

WORKING WITH GRIDS

Autodesk Revit provides you the option of creating rectangular or circular grids for your projects. Using these grids, you can create building envelopes easily and also place the MEP elements at desired locations and intersections.

Creating Grids

You can create grid patterns based on your project requirement. Grid patterns can be rectangular or radial, depending on the project geometry. A rectangular grid pattern can be created using straight grid lines, whereas a radial grid pattern can be formed using arc grids. The created grids are visible in all plan, elevation, and section views.

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To create a grid line, invoke the view in which you want to create it and then choose the **Grid** tool from the **Datum** panel of the **Architecture** tab, as shown in Figure 3-9; the **Modify|Place Grid** tab will be displayed. Using this tab, you can modify the type and instance properties of grid. You can also change the grid type by selecting an option from the **Type Selector** drop-down list. The **Modify | Place Grid** tab, as shown in Figure 3-10, displays various options to draw and modify grids in a drawing. The **Draw** panel in the **Modify | Place Grid** tab displays various tools to draw grids as lines and curves or to convert existing model lines into grids. The methods of creating grids are discussed next.

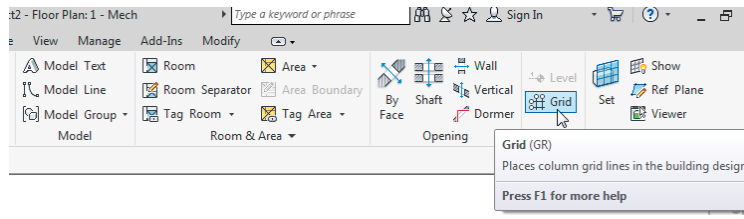


Figure 3-9 *Choosing the* ***Grid*** *tool from the* ***Datum*** *panel*

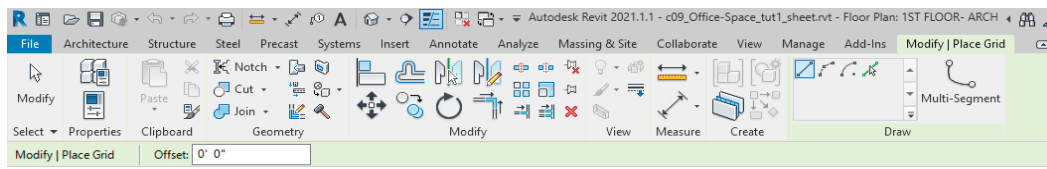


Figure 3-10 *Various options in the* ***Modify / Place Grid*** *contextual tab*

Creating Grids Using the Draw Tools

To create a straight grid line, select any floor plan view from the **Project Browser** and then choose the **Grid** tool from the **Datum** panel in the **Architecture** tab; the **Modify | Place Grid** tab will be displayed. The **Line** tool in the **Draw** panel is chosen by default. As a result, you can start sketching the grid line by clicking at the appropriate location to specify the start point and then moving the cursor to the desired direction. As you move the cursor, you will notice that a grid line is created with one end fixed at the specified point and the other end attached to the cursor. Also, a temporary angular dimension indicating the angle of the line with the horizontal axis is displayed. Click to specify the endpoint of the grid line when the appropriate angular dimension is displayed. You can also sketch an arbitrary inclined grid line and then click on the angular dimension to enter a new value of the angle. To draw orthogonal grids, hold the SHIFT key and restrict the movement of the cursor to the horizontal and vertical axes. When you click to specify the endpoint, a grid is created and its controls are highlighted. The grid thus created is highlighted and displays one square box on either side. These boxes are used to control the visibility of the grid bubble. They can be checked or cleared to make the grid bubble visible or invisible at the desired side(s). The two circles, on either corner, can be dragged to extend or reduce the extents of the grid line.

Similarly, when you sketch a new grid line near an existing one, a temporary dimension indicating the distance between the two grid lines is displayed. You can enter the value of distance in the displayed edit box. Alternatively, you can move the cursor to the desired distance using the temporary dimensions. Next, click to specify the start point of the second grid line. To do so, move the cursor horizontally to the right and click to specify the endpoint of the grid line when

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the alignment line is displayed. On doing so, the second grid line is created. Notice that the name of this grid is 2. Autodesk Revit automatically numbers the grid lines as they are created.

Similarly, you can draw other parallel grid lines as well. These lines will be numbered automatically as you draw them. The **Offset** edit box in the **Options Bar** can be used to create a grid line that starts at a specified offset distance from a point defined on an existing element. The offset distance can be specified in the **Offset** edit box in the **Options Bar**. The shape of the resulting grid line depends on the selected sketching tool.

To create vertical grid lines, specify the start point above the first grid line. Now, move the cursor vertically downward and click below the last horizontal grid line to specify the endpoint. The procedure used for creating multiple horizontal grid lines can be used to create multiple vertical grid lines too.

You can create a rectangular grid pattern that is aligned at a given angle to the horizontal axis. You can also specify different angles for the grid lines and create the grid patterns based on the project requirement. Figure 3-11 shows some other examples of the rectangular grid patterns.

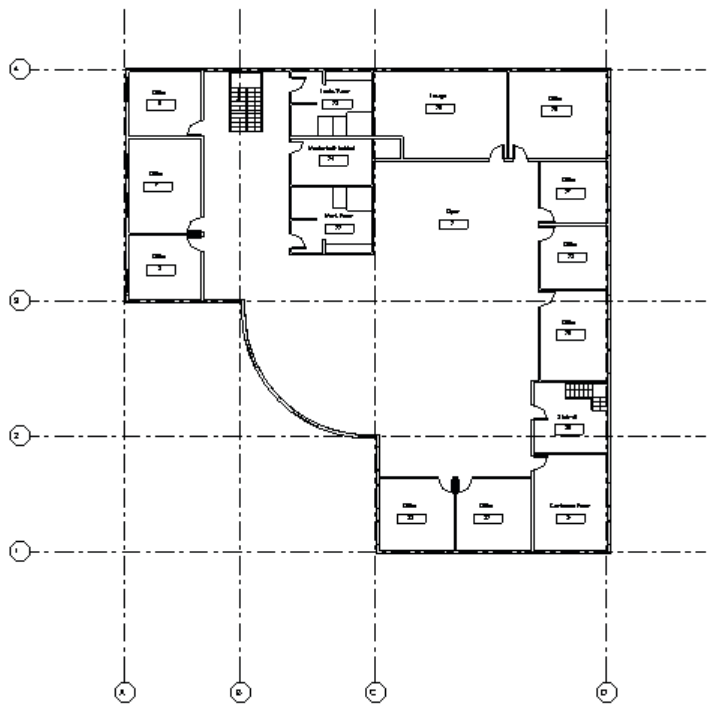


Figure 3-11 *Example of a rectangular grid pattern in an architectural layout*

In the **Draw** panel of the **Modify | Place Grid** tab, you can use the **Start-End-Radius Arc** and **Center-ends Arc** tools to create curved or radial grid patterns. The procedure of creating the curved grid lines using these options is similar to the sketching options for creating walls, which has been discussed later in this chapter. You can create multiple curved grids using the tools in the **Draw** panel and specifying their radius in the **Radius** edit box in the **Options Bar**. You

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can specify a value in the **Radius** edit box in the **Options Bar** only if you select the check box located before it.



Tip

*You can use the **Pick Lines** tool to create grid lines that are aligned to the existing elements. Invoke this tool from the **Draw** panel of the **Modify / Place Grid** tab and move the cursor near an existing element and click when the element is highlighted; a grid aligned to the highlighted element will be created.*

Creating Grids Using the Multi-Segment Tool

You can use the **Multi-Segment** tool to sketch a multi-segmented grid in the project. To do so, choose the **Grid** tool from the **Datum** panel of the **Architecture** tab; the **Modify | Place Grid** tab will be displayed. In this tab, choose the **Multi-Segment** tool from the **Draw** panel; the **Modify | Edit Sketch** tab will be displayed. In the **Draw** panel of the tab, you can choose any of the sketching tools, displayed in the list box, to sketch the multi-segmented gridline. After choosing the desired sketching tool, you need to use various options in the **Options Bar** to control the creation of the gridline in the project. After setting the options in the **Options Bar**, click in the drawing area; a magenta colored gridline with a temporary dimension will emerge from the point at which you have clicked. Next, click at the desired location to create the first segment of the grid. Similarly, you can click on multiple locations in the drawing area to create other segments. To finish the creation of the multi-segmented grids, choose the **Finish Edit Mode** button from the **Mode** panel of the **Modify | Edit Sketch** tab. Figure 3-12 shows a sketch with multi-segmented gridlines.

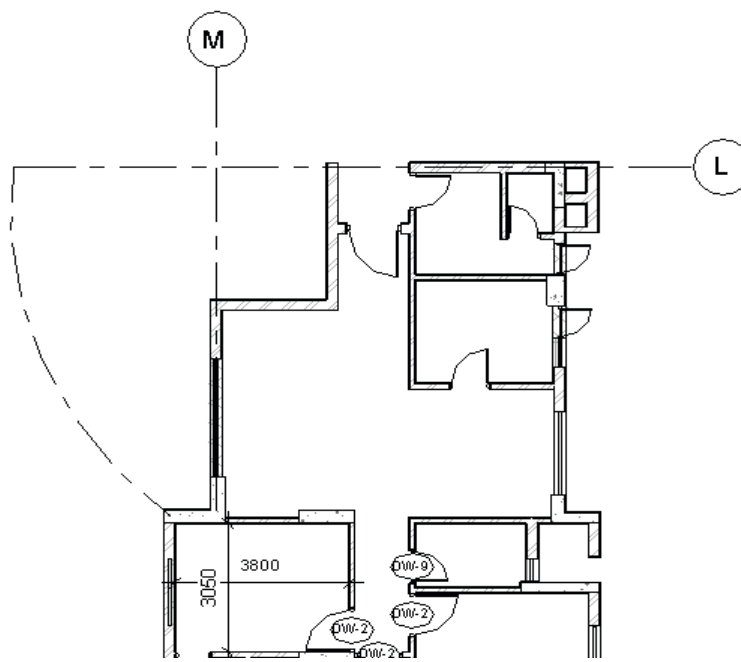


Figure 3-12 *A multi-segment grid pattern in an architectural layout*

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Modifying Grids

As mentioned earlier, grids can be modified once they are created. To modify a grid, you need to select it and then modify its properties from the **Properties** palette. For example, after selecting a grid, you can click on its name and assign it a new name. Similarly, you can modify the distance between grids by selecting the temporary dimension and entering a new value. When you enter a new value, the grid automatically moves to the specified distance. You can also move the grids by simply dragging them to the desired location. To do so, click to select a single grid or click the multiple grids using the CTRL key to select multiple grids. You can now drag the grid(s) to the desired location. Hold the SHIFT key to restrain the movement of the cursor in the orthogonal direction. When you move the cursor near a grid, it gets highlighted. Now, right-click; a shortcut menu will be displayed with various options such as **Select Previous**, **Select All Instances**, **Create Similar**, **View Properties**, and so on.

For certain grids, you may need to move or offset the grid bubble to a different location. When you select a grid, a blue circle appears on each of its endpoints. The drag control, as mentioned earlier, controls the extents of the grid line. The grid line break control, which appears near the grid bubble, is used to create a grid bubble offset. You can click on this control and use the displayed drag controls to move the grid bubble to the desired location. While moving the grid bubble, the grid name also moves to the new location and an extension line is created.

Grid Properties

Like levels, grids too have associated properties. A typical grid consists of a grid line, grid bubble, grid name, and other controls. The usage of the controls such as grid bubble visibility, 2D or 3D extents, and grid bubble break is similar to the usage of controls described for levels.

To view and modify the properties of a grid, select it; the instance parameter of the selected grid will be displayed in the **Properties** palette. In this palette, choose the **Edit Type** button; the **Type Properties** dialog box will be displayed. You can use this dialog box to view and modify the type properties of the selected grid. The type properties of grids and their description are discussed next.

Type Properties of Grids

When the type properties of a grid are changed, the properties of all instance parameters related to it are also changed. You can click in the **Value** field and select a new value from the corresponding drop-down list or enter a new value in that field. The properties of grid types are described next.

Parameter Name	Value and Description
Symbol	Refers to the display of the symbol at the end of the grid line. You can control the display of the symbol by selecting an option from the drop-down list.
Center Segment	Refers to the display type of the center segment of the grid line. You can select **Continuous**, **None**, or **Custom** from the drop-down list.
Center Segment Weight	Refers to the line weight of the center segment, if the **Center Segment** parameter is set to **Custom**.

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Center Segment Color	You can assign a color to the center segment if the **Center Segment** parameter is set to **Custom**.
Center Segment Pattern	Refers to the line type of the segment at the center if the **Center Segment** parameter is set to **Custom**. You can select various line patterns from the drop-down list.
End Segment Weight	Refers to the line weight of the grid line if the **Center Segment** parameter is set to **Continuous**. You can set the line weight of the end segments if the **Center Segment** parameter is set to **None** or **Custom**.
End Segment Color	Refers to the color assigned to the grid line if the **Center Segment** parameter is set to **Continuous**. You can set the color of the end segments if the **Center Segment** parameter is set to **None** or **Custom**.
End Segment Pattern	Refers to the line type of the grid line if the **Center Segment** parameter is set to **Continuous**. You can set the line type of the end segments if the **Center Segment** parameter is set to **None** or **Custom**.
End Segments Length	Refers to the length of each end segment as measured in the sheet if the **Center Segment** parameter is set to **None** or **Custom**.
Plan View Symbols End 1(Default)	Refers to the default status for the visibility of the symbol at end 1 of the grid line in plan views. By default, the check box is cleared. If you select the check box, the visibility of the symbol at end 1 in the plan view will be turned on.
Plan View Symbols End 2(Default)	Refers to the default status for the visibility of the symbol at end 2 of the grid line in the plan views. By default, the check box is selected. If you clear the check box, the visibility of the symbol at end 2 in the plan view will be turned off.
Non-Plan View Symbols (Default)	Refers to the default status for the visibility of the grid line in the sections and elevations, other than in the plan views. You can control the visibility of the symbol at the top and bottom of the grid line by selecting the desired option from the drop-down list.

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Instance Properties of Grids

The instance properties of grids are given next.

Parameter Name	Value and Description
Name	Refers to the name assigned to the grid. You can enter any name, based on the project requirement.
Scope Box	Refers to the scope box assigned to the grid that controls its visibility in different views.

REFERENCE PLANES

Reference planes are useful while sketching and adding building elements to a design. They can be used as datum planes that act as a guideline for creating elements. They can also be used effectively for creating new family elements. To create a reference plane, choose the **Ref Plane** tool from the **Work Plane** panel of the **Architecture** tab; the **Modify | Place Reference Plane** tab will be displayed. Select the tools from the **Draw** panel and start drawing the reference plane in the drawing. Alternatively, you can type **RP** to invoke the **Ref Plane** tool.

After invoking the tool, click at the desired location in the drawing window to start a line that defines the reference plane. Now, move the cursor to the new location and release the left button to specify the endpoint of the reference line; the reference plane will be created. To assign a name to the reference plane, select it from the drawing. Next, in the **Properties** palette, enter the desired name of the selected reference plane in the value field of the **Name** instance parameter.

WORK PLANES

As the name suggests, the work plane is a plane that can be used for sketching elements. In Autodesk Revit, you can create and edit only those elements that lie in the current work plane. The work plane can be horizontal, vertical, or inclined at any specified angle. Each generated view has an associated work plane. This workplane is automatically defined for some standard views such as floor plans. For other views such as sections, elevations, and 3D views, you can set the work plane based on the location of the elements that are to be created or edited. The concept of work planes is quite useful for creating elements in elevations, sections, or inclined planes.

Setting a Work Plane

You can set a work plane based on your project requirement. To set a work plane, choose the **Set** tool from the **Work Plane** panel in the **Architecture** tab; the **Work Plane** dialog box will be displayed. It shows the current work plane and assists you in specifying the parameters to set a new work plane. A drop-down list of available views is displayed corresponding to the **Name** radio button. Select the required work plane from the drop-down list, which contains the names of levels, grids, and reference planes. You can select the **Pick a plane** radio button in the **Work Plane** dialog box to set a work plane along an existing plane. On selecting this radio button and choosing the **OK** button in this dialog box, you will be prompted to select an existing plane in the drawing with which you want to align the new work plane. The existing plane can be a face of a wall, floor, or roof. You can also select the **Pick a line and use the work plane it was sketched in** radio button from this dialog box to create a work plane that is coplanar with the plane on which the selected line was created.

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Note

*In the project environment of Autodesk Revit, you can choose the **Viewer** tool from the **Work Plane** panel of the **Architecture** tab to display the **Workplane Viewer** window. In this window, you can modify the workplane dependent element with an ease.*

Controlling the Visibility of Work Planes

You can control the visibility of the current work plane by using the **Show** button from the **Architecture** tab. This button is used to toggle the display of grids in the workplane.

You can also set the grid spacing for a work plane. To do so, select the workplane in the drawing, the work plane will be highlighted. Specify the spacing by entering the new value in the **Spacing** edit box in **Options Bar**. You can snap to the work plane grid using the object snap tools.

WORKING WITH PROJECT VIEWS

While working on the building envelope and MEP models, you may need to view its different exterior and interior portions in order to add or edit the elements in the design. Revit provides various features and techniques that can be used to view the building model.

Viewing a Building Envelope

In Revit, the default template file (Mechanical, Electrical, Plumbing, or Systems) has certain predefined standard project views. These views are displayed under the **Views** head of the **Project Browser**, as shown in Figure 3-13.

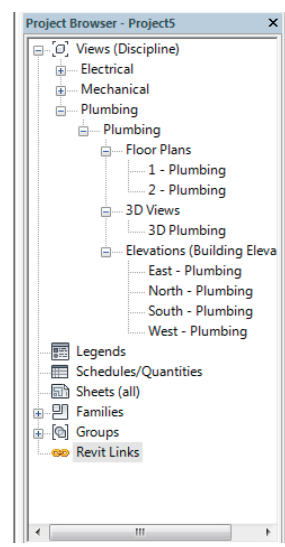


***Figure 3-13 Project Browser** displaying various project views*

These include floor plans (Mechanical, Electrical, and Plumbing), ceiling plans (Mechanical, Electrical, and Plumbing), elevations, sections, and 3D Views. To open any of these views, double-click on the name; the corresponding view will be displayed in the viewing area. You can control the visibility of the **Project Browser** by selecting the **Project Browser** check box from the **View > Windows > User Interface** drop-down.

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W hen you open a new project, the viewing area displays four inward arrow symbols in the floor plan view, which indicate the four side elevations: North, East, South, and West. You can use these symbols to view the appropriate building elevation by double-clicking on them.

Apart from these standard building views, you can use different viewing tools to view the building model from various angles. To restrict the visibility of certain categories of elements, choose the **Visibility/Graphics** tool from the **Graphics** panel of the **View** tab; the **Visibility/Graphic Overrides** dialog box will be displayed. The **Model Categories** tab of this dialog box contains a list of model elements such as Air Terminal, HVAC Zones, doors, windows, and so on. The **Annotation Categories** tab contains annotations such as duct tags, flex pipe tags, wire tags dimensions, door tags, and so on. You can clear the category of elements that you want to hide from the current view using this dialog box.

Overriding the Visibility/Graphic of an Element

You can override the visibility and graphics of any element in a view. To do so, select an element and right-click; a shortcut menu will be displayed. Choose **Override Graphics in View > By Element** from the shortcut menu; the **View-Specific Element Graphics** dialog box will be displayed, as shown in Figure 3-14. The options in this dialog box are discussed next.

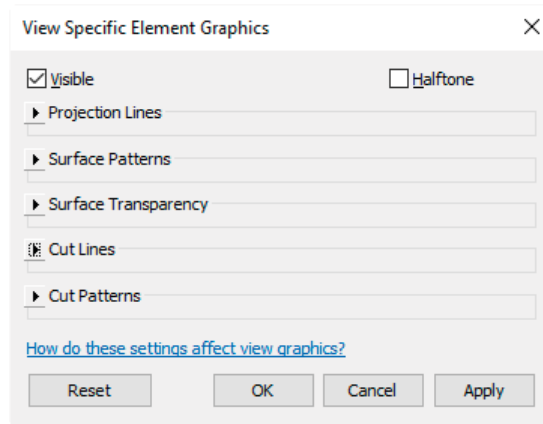


Figure 3-14 *The* ***View-Specific Element Graphics*** *dialog box*

Visible

The **Visible** check box controls the visibility of an element in a view. This check box is selected by default. As a result, the selected elements are visible in view. Clear the check box to hide the selected element in the view.

Halftone

Select the **Halftone** check box to adjust and blend the line color of an element with the background color.

Projection Lines

Choose the arrow button on the left of this option; the **Weight**, **Color**, and **Pattern** options of the projection lines will be displayed. Set the line weight of the projection lines using the options in the **Weight** drop-down list. To change the color of a projection line, choose the button at the right of the **Color** option; the **Color** dialog box will be displayed. Select the required color from

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the dialog box and choose the **OK** button. To change the pattern of the projection lines, choose the button at the right of the **Pattern** option; the **Line Patterns** dialog box will be displayed. Select a pattern of the projection lines from the dialog box and choose the **OK** button.

Surface Patterns

Choose the arrow button on the left of the **Surface Patterns** option to expand it. You can change the visibility of the surface pattern by clearing the **Visible** check box. Select the color and pattern of the surface in the same way as explained earlier for the projection lines.

Surface Transparency

Choose the arrow button on the left of the **Surface Transparency** option to expand it. In this area, you can change the transparency of the selected element by moving the **Transparency** slider or by entering a suitable value in the edit box displayed next to the slider. Note that higher the value you enter in the edit box, more transparent will be the object.

Cut Lines/Cut Patterns

Choose the arrow button on the left of these options to expand them. Change the visibility, weight and pattern of the cut lines or cut patterns, as explained earlier for the **Projection Lines** option. Once you have edited the graphics and visibility settings of an element in the **View Specific Element Graphics** dialog box, choose the **Apply** button to view the changes in the selected element. Choose the **OK** button to retain the settings and close the dialog box.

Overriding the Visibility/Graphic of Element Category

To edit the visibility and graphics of an element category in a project view, open the project view. Next, select an element of the required category and right-click; a shortcut menu will be displayed. Choose **Override Graphics in View > By Category** from the shortcut menu; the **View -Specific Category Graphics** dialog box will be displayed. Choose the **Open the Visibility Graphics dialog** button; the **Visibility/Graphic Overrides for Floor Plans** dialog box for the loaded view will be displayed, refer to Figure 3-15.

The dialog box contains various tabs. The options in these tabs are used to edit the settings for the visibility and graphic display of the models, annotations, and imported elements. Choose a tab to edit the visibility and graphics of the selected category. To edit the visibility in the view, clear or select the visibility check box available on the left of the category name in the **Visibility** column. To specify overrides to a category, click on the name of the category in the **Visibility** column; the **Overrides** button will be displayed for the respective column in the specified tab. To override patterns for the selected category, choose the **Override** button displayed in the **Patterns** column corresponding to the selected category; the **Fill Pattern Graphic** dialog box will be displayed. Set the visibility, color, and pattern by using the **Visible**, **Color**, and **Pattern** options, respectively in the dialog box and choose the **OK** button. Similarly, to override the transparency of the selected object, choose the **Override** button displayed in the **Transparency** column; the **Surfaces** dialog box will be displayed. In this dialog box, you can use the **Transparency** slider to control the transparency of the selected element.

Similarly, click in the required columns in the **Visibility/Overrides** dialog box to edit the graphic display of the category. Select the check boxes in the **Halftone** column, if required. You can set the detail level of the selected category in the **Detail level** column. To do so, click in the **Detail Level** column and choose the down arrow displayed on the left. Select the detail level from

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the **Detail Level** drop-down list displayed. Choose the **Apply** button to view the changes in the visibility and graphic display of the selected category. Choose the **OK** button to retain the changes and close the **Visibility/Graphics Overrides** dialog box.

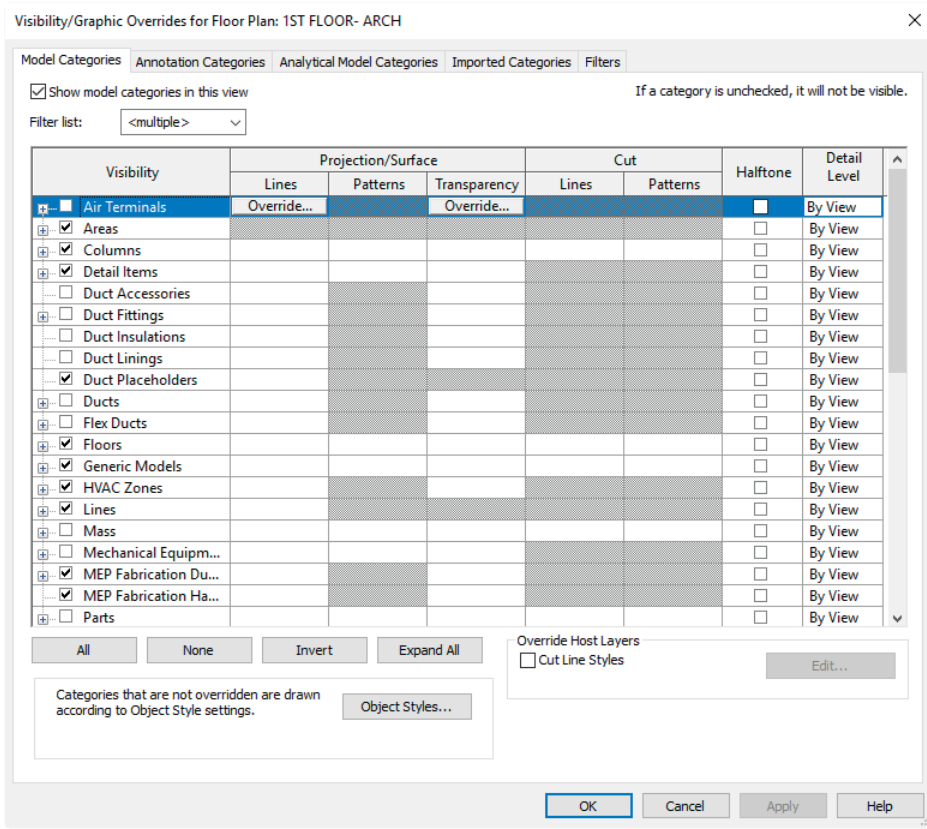


***Figure 3-15** The **Visibility/Graphics Overrides for Floor Plan** dialog box*

Making Elements Transparent

Revit provides you with a tool to make elements transparent so that you can see through them. This tool can be used to view the interior of a building from the top even after adding roofs or ceilings.

To make an element transparent, select it and right-click; a shortcut menu will be displayed. Choose **Override Graphics in View > By Element** from the shortcut menu; the **View Specific Element Graphics** dialog box will be displayed. In this dialog box, click on the arrow on the left of the **Surface Transparency** area; the options in this area will be displayed. In this area, the **Transparency** slider is used to control the transparency of the selected object. You can increase the transparency by moving the slider toward right. Alternatively, you can enter a desired value in the edit box, next to the **Transparency** slider, to control the transparency of the selected element. After setting the transparency in the **Surface Transparency** area, choose the **OK** button; the selected element will become transparent and you will be able to see through it. Although the element becomes transparent, the edges and surface pattern of the element will still be visible. You can view the change in the element before and after using the **Transparency** slider.

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Using the Temporary Hide/Isolate Tool

The **Temporary Hide/Isolate** tool can be used to hide or isolate elements temporarily from a project view. This tool will be available only after a selection is made. Select the element or elements that you need to hide or isolate in the project view and then choose the **Temporary Hide/Isolate** tool from the **View Control Bar**; a cascading menu will be displayed. You can hide or isolate elements or their categories using the tools or options given in the cascading menu. It contains six tools. On choosing any of the tools from it, a cyan color border will be displayed in the drawing area, indicating that the elements in the drawing are in the **Temporary Hide/Isolate** mode. You can choose the **Hide Element** tool from the cascading menu, refer to Figure 3-16, to hide the selected element in a view. On choosing the **Isolate Element** tool, only the selected elements will be displayed in the view while the rest will be hidden. The **Hide Category** tool is used to hide all the elements of the category of the selected element. The **Isolate Category** is used to display only the elements belonging to the category of the selected element in the view.

The **Reset Temporary Hide/Isolate** tool is used to revert to the original view without saving the temporary or isolate changes in the view. The **Apply Hide/Isolate to view** option is used to hide or isolate the temporary hidden or isolated elements permanently in the view. On choosing this tool, the blue boundary around the screen becomes invisible and the temporarily hidden or isolated elements and categories are permanently hidden or isolated. On hiding or isolating an element or category, the sunglasses symbol of the **Temporary Hide/Isolate** tool in the **View Control Bar** is highlighted in the same color as that of the boundary, indicating that certain elements have been hidden temporarily. When you choose the **Reset Temporary Hide/Isolate** option, the sunglasses symbol is no longer highlighted.

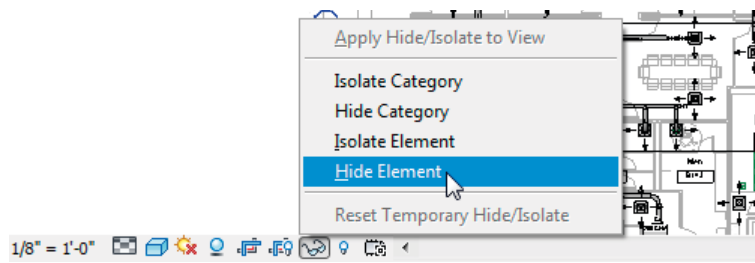


Figure 3-16 *Choosing the* ***Hide Element*** *tool from the* ***View Control Bar***

Revealing and Unhiding Elements

To reveal and unhide the hidden elements in the view, choose the bulb icon from the **View Control** bar to invoke the **Reveal Hidden Elements** tool. On doing so, a magenta color border will be displayed and the hidden elements will be highlighted in the same color. Select the required elements and choose the **Unhide Element** or the **Unhide Category** button from the **Reveal Hidden Elements** panel in the **Architecture** tab. Now, again you need to click on the bulb icon to invoke the **Exit Reveal Hidden Elements** mode. You will notice that all the hidden elements and categories will be displayed in the view.

Plan Views

In Autodesk Revit, you can use the floor and ceiling views to view the building plan of the respective discipline. If you are using the *Systems-Default.rte* template file to start a new project, by default Autodesk Revit opens the **1-Mech** floor plan view. The *Systems-Default.rte*

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template file contains floor plans for the Electrical, Mechanical, and Plumbing disciplines and ceiling plans for Electrical and Mechanical discipline.

Adding a Plan View

To create a new plan view for the added levels that do not contain associated plans in the **Project Browser**, choose the **Floor Plan** tool from **View > Create > Plan Views** drop-down; the **New Floor Plan** dialog box will be displayed, as shown in Figure 3-17. In the **New Floor Plan** dialog box, the **Floor Plan** option is selected in the **Type** drop-down list, refer to Figure 3-17. You can edit the existing type or create a new type by choosing the **Edit Type** button. On choosing the **Edit Type** button; the **Type Properties** dialog box will be displayed. In this dialog box, you can edit various type parameters for the existing view type or choose the **Duplicate** button and create a new type. Choose the **OK** button to return to the **New Floor Plan** dialog box. In this dialog box, you can select the appropriate level to create the plan view in the list box displayed. You can also select multiple levels by holding the SHIFT key. The **Do not duplicate existing views** check box can be cleared to create a plan view for a level that has an already existing plan view. The duplicate view is created and added in the **Project Browser** with the suffix (1). The number in the brackets increases as more copies of the plan view are added.

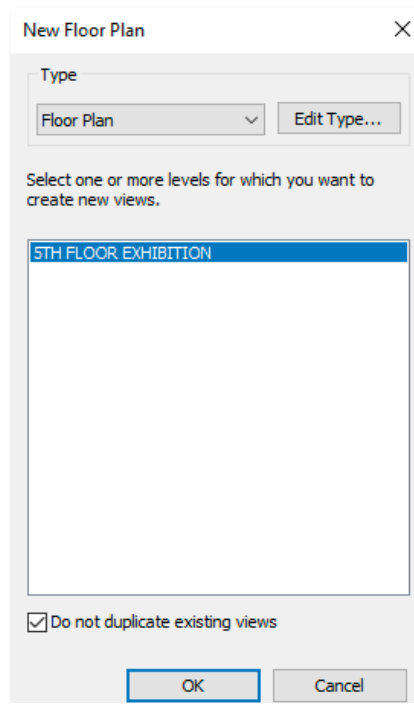


Figure 3-17 *The* ***New Floor Plan*** *dialog box*



Note

While creating a level, if you have cleared the ***Make Plan View*** *check box in the* ***Options Bar****, then its corresponding plan view will not be created.*

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Modifying the Plan View Properties

To modify the view properties of a plan view or any other project view, select the view from the **Project Browser**; the properties of the selected view will be displayed in the **Properties** palette. Using this palette, you can modify the parameters related to the current view such as **View Scale**, **Display Model**, **Detail Level**, **View Name**, and so on. The **View Range** parameter in the **Extents** category controls the visibility and appearance of the elements in the view by defining the extent of horizontal plane of the view. The crop region parameter defines the boundary of a view and can be turned on or off using the **Crop Region Visible** check box. You can also access the tools related to the visibility settings of the view using the **View Control Bar** available near the bottom left corner of the drawing window.

Elevation Views

An elevation view refers to the view of the building model from the four sides, North, East, South, and West. If you are using the default template file, the four sided elevation views are created automatically by Autodesk Revit when the default template file is used. Using the elevation view, you cannot only visualize the building from its exterior but also create the views of the interior walls of various internal spaces.

Creating an Elevation View

To create an elevation view, invoke the **Elevation** tool from **View > Create > Elevation** drop-down; the **Properties** palette for the elevation will be displayed. In this palette, select the elevation type from the **Type Selector** drop-down list. On moving the cursor near the exterior walls, you will notice that the arrow head of the elevation symbol has changed its alignment and become perpendicular to the wall, as shown in Figure 3-18.

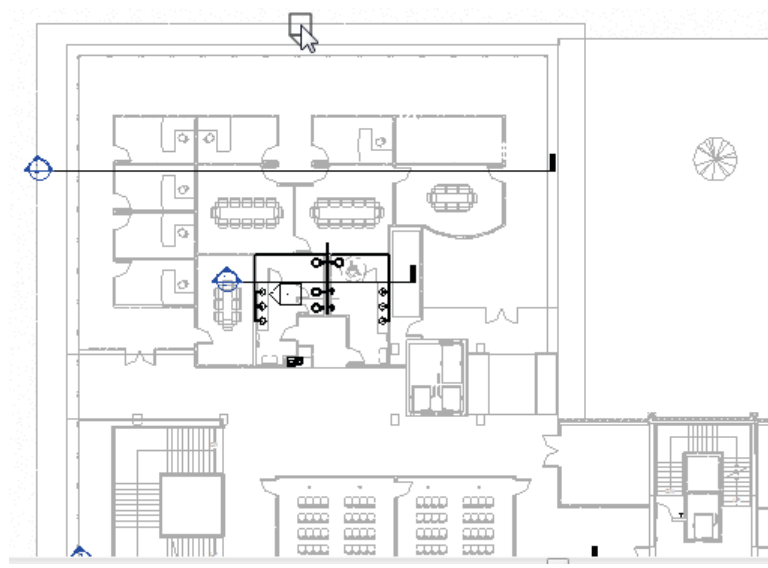


Figure 3-18 *The elevation symbol aligned perpendicular to the wall*

Now, click when the elevation arrow head symbol points toward the desired direction; the new elevation view will be created and added to the list of elevations in the **Project Browser**. Revit

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automatically numbers the elevation names. Note that if you add the elevation symbol in any of the floor plan view specific to the Mechanical discipline, the elevation corresponding to the added elevation symbol will be displayed under the **Mechanical** discipline of the **Elevations (Building Elevation)** head in the **Project Browser**, refer to Figure 3-19.

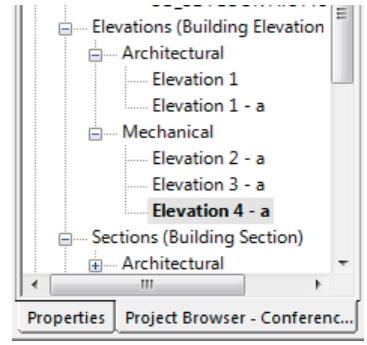


Figure 3-19 *Partial view of the* ***Project Browser*** *with the added elevation*

You can also set the width of the elevation view using the clip plane control. When you click on the arrow head of the elevation symbol, the clip plane is displayed as a blue line with the drag control dots on its two ends. You can drag them to resize the width of the elevation view. For the interior elevation views, Autodesk Revit automatically extends the clip plane to the extents of the room. You can drag the blue dots to increase or decrease the extents of the elevation view. To rename an elevation view, right-click on the view name in the **Project Browser**; a shortcut menu will be displayed. Choose the **Rename** option from the shortcut menu; the **Rename View** dialog box will be displayed. In this dialog box, enter a desired name in the **Name** edit box and choose the **OK** button; the elevation view will be renamed.

There are several methods to display an elevation view. To display an elevation view in the drawing area, double-click on the name of the elevation in the **Project Browser**; the corresponding elevation view is displayed in the drawing window, as shown in Figure 3-20. You can also display the elevation view by double-clicking on the arrow head of the elevation symbol. Alternatively, right-click on the elevation symbol; a shortcut menu is displayed. Next, choose **Find Referring Views** from the shortcut menu; the **Go To View** dialog box will be displayed. Next, select the view to be displayed from this dialog box and then choose the **Open View** button or double-click on the name of the view. The other method to display the elevation view is to select the arrow head of the elevation symbol and then right-click to display a shortcut menu. Next, choose the **Go to Elevation View** option from the shortcut menu displayed; the corresponding elevation will be displayed in the drawing area.

You can modify the properties associated with elevation views by using the **Properties** palette. This palette is displayed with instance parameters when you select the required view or when the required view is displayed in the drawing area.

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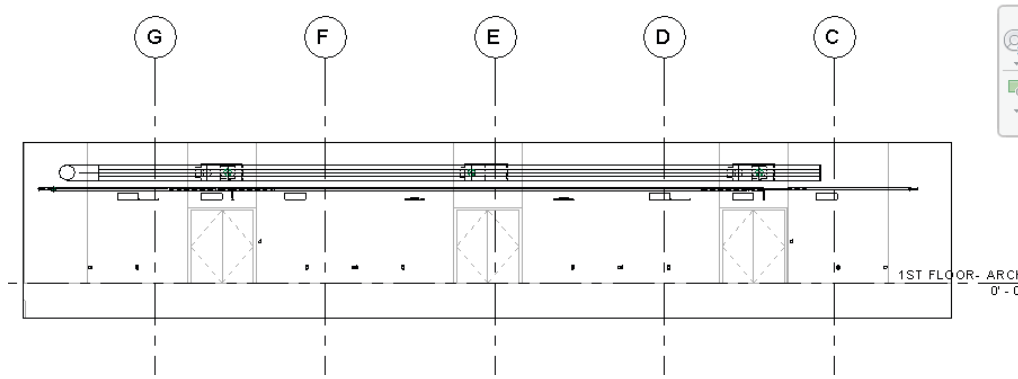


Figure 3-20 *The elevation view of the building model*

Note

While working on the floor plan, if the created building model extends beyond the clip planes of the four sided elevation views, the corresponding elevations no longer show the complete exterior views. Instead, an elevation view that is cut through the building model is displayed. You can drag the clip plane control symbol beyond the extent of the building profile to retain the view as a complete exterior elevation view.

Section Views

Section views are generated by cutting sections through the building model. These views are created to display various wall elevations, floor heights, and special vertical features of the project. They are also useful in creating and editing elements added to the interior spaces of the building model.

For example, in an office building, to emphasize the salient features of the central atrium, you may need to show a section through the central atrium. Autodesk Revit enables you to create it with relative ease. You can also modify the sectional view to create a section that displays the interior spaces.

Creating a Section View

To create a section view, invoke the **Section** tool from the **Create** panel of the **View** tab; the **Modify | Section** tab will be displayed. The options in the **Modify | Section** tab are used to specify the section type to be created and to specify the instance and its type properties. The section can be created in the plan, elevation, and section views. You can create different types of section views such as the building section, wall section, and detail section. You can choose the section view type to be created from the **Type Selector** drop-down list in the **Properties** palette. In the **Options Bar**, you can use the **Reference Other View** check box to create a reference section that acts as a reference for another view. Notice that the reference sections are not added as an additional section in the list of section views in the **Project Browser**.

To create a section, invoke the **Section** tool from the **Create** panel and move the cursor to the viewing area; the cursor will change into a cross symbol and you will be prompted to draw the section line in the current view. Click at the desired location to specify the start point. To create a section through a specific length of an area, click at desired point in the area. As you move the cursor, a section line will appear with one end fixed at the specified point and the other end

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attached to the cursor. You can even create a section line at any angle. To create a horizontal or vertical section view, move the cursor horizontally or vertically across the area, as shown in Figure 3-21 and click to specify the endpoint. The section line along with its controls is shown in Figure 3-22. It is represented by a section head and a line. The section head indicates the direction toward which the section will be created. Note that, the methods used for displaying the section views are similar to the ones described for the elevation views.

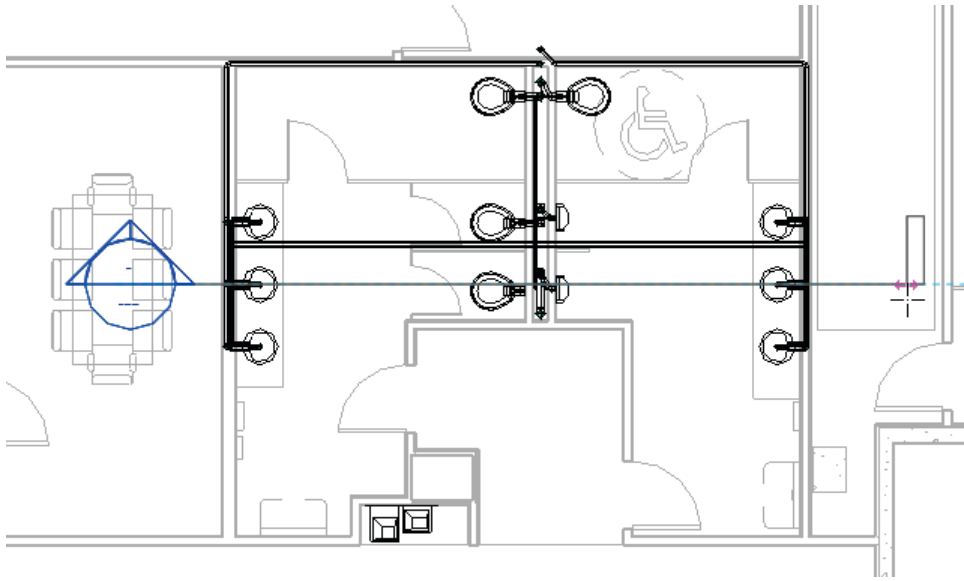


Figure 3-21 *The section line drawn horizontally across the plumbing layout*

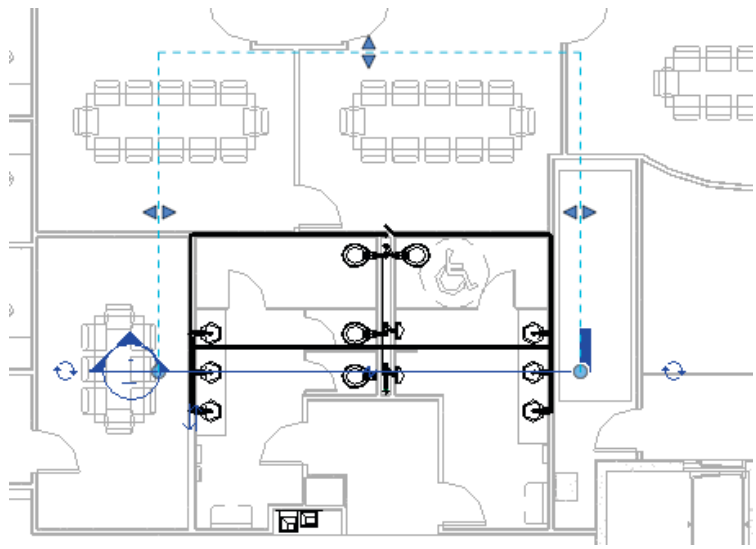


Figure 3-22 *The section line displayed along with its controls*

Modifying a Section View

After creating a section view, you can modify the location of the section line of the section view by dragging it. When you drag a section line, the corresponding section view is updated

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immediately. You can modify the parameters of the section view by using the controls available on the section view line. When you select the section line, the controls are displayed in it. The twin arrow symbol represents the flip tool that can be used to flip the viewing side of the section view. By default, the section head appears on one side. The cyclic control on both the ends of the section line can be used to change the visibility of the section head and tail at the respective ends. You can click on the symbol to hide or display them. Click on the break line symbol, which appears in the middle of the section line, to break it. You can then resize the two section lines to the required extent of the view. To rejoin the section line, click on the break line control again. When you create a section view, Autodesk Revit intuitively creates its view depth, which is the extent of the view in the current view. It is represented by a dashed line and the blue arrows as drag controls. To modify the view depth, drag the arrows to the desired location. The section view shows only those elements that are within the view depth. To modify the properties of a section view, select its section line; the **Properties** palette will be displayed with the instance parameters of the section view. Using this palette, you can modify various instance properties such as **View Name**, **View Scale**, **Crop Region Visible**, and so on. To do so, click in the corresponding field in the **Value** column and select a new value from the drop-down list if available, or enter a new value in that field.

You can choose the **Edit Type** button to display the **Type Properties** dialog box and modify the type properties of the section view such as **Callout Tag**, **Section Tag**, and **Reference Label** from it.

Creating a Segmented Section

Autodesk Revit enables you to split the section into segments that are orthogonal to the direction of the section view. This enables you to show different parts of the building model in the same section view.

To create a segmented section, create a straight section line in the drawing area and then choose the **Split Segments** tool from the **Section** panel of the **Modify | Views** tab. On doing so, a split symbol will be attached to the cursor. Move it over the section line and click at the point from where you want to split it. Move the cursor perpendicular to the section line; it will break from the specified point. Next, you can move the cursor in the desired direction to split the section line along the head or tail side. Click again to specify the location of the split segment.

Controlling the Visibility of a Section Line

The section line is visible in plan, section, and elevation views, if the view range of the created views intersects the crop region of the current view. The section line created in any view is visible and is created simultaneously in all the other views.

You can also control the visibility of the section line in the views. To do so, select the section line, right-click, and choose the **Hide in View > Element** option from the shortcut menu displayed. The selection line becomes hidden in the current view.



Note

The section of elements is displayed when a section is cut through them. Sections through in-place elements are not available; therefore they are not displayed in the section view.

Creating a Detail and a Wall Section View

In Autodesk Revit, you can create different types of section views. There are three different types of section views such as detail, building, or wall section view in both the Imperial and the

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Metric systems. These section views can be selected from the **Type Selector** drop-down list in the **Properties** palette.

To create a detail section view from the building model, select the **Detail View : Detail** option from the **Type Selector** drop-down list of the **Properties** palette. Similarly, to create a building section or a wall section of the building model, select the **Section : Building Section** or **Section : Wall Section** option from the **Type Selector** drop-down list. After creating a wall section using the **Section : Wall Section** type, you will notice that its section view has been added to the list of sections under the subhead **Sections (Wall Sections)** in the **Project Browser** and you can display it by double-clicking on the section name. Similarly, a section view created as a building section or a detail section will be displayed in the subhead **Sections (Building Sections)** or **Detail Views (Detail)**, respectively. You will learn more about these views in the later chapters.

Using the Scope Box Tool

Autodesk Revit provides you the option of controlling the visibility of the datum elements in the project views using the **Scope Box** tool. As described earlier in this chapter, the datum planes have an infinite scope and extend throughout the project. Using the **Scope Box** tool, you can limit the boundary for the visibility of the datum planes. You can also specify the views in which these datum planes become visible.

Creating a Scope Box

The Scope box can be created in the plan view by invoking the **Scope Box** tool. You can invoke this tool from the **Create** panel of the **View** tab; the **Options Bar** displays the **Name** and **Height** edit boxes. You can enter the name and height of the scope box in these edit boxes. To create a scope box, move the cursor in the viewing area. It changes into a cross symbol, that prompts you to draw the scope box in the plan view. To draw the scope box, click on its upper left corner, move the cursor to the lower right corner, and then click to specify the diagonally opposite ends to draw a rectangle. The rectangle should be drawn in such a way that the elements that need to be visible are enclosed in it. The scope box with the assigned name is created. When it is selected, the drag controls are visible on it, as shown in Figure 3-23. These drag controls can be used to resize the scope box.

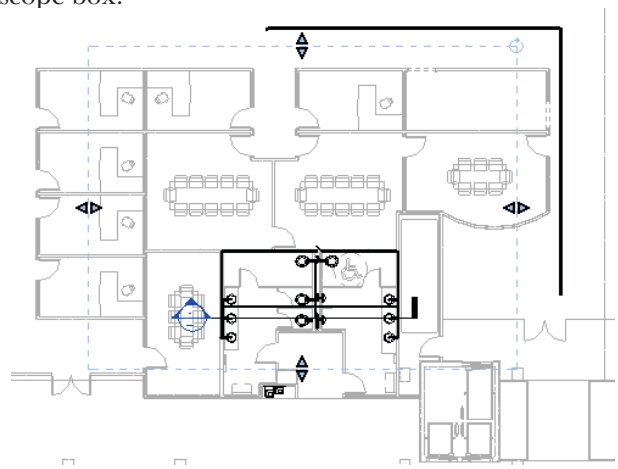


Figure 3-23 *The selected scope box in a plumbing layout*

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Applying the Scope Box

The visibility of datum planes can be controlled by associating them with the scope box. You can select a datum such as a grid, a level, or a reference plane, and then in the **Properties** palette, click in the value column for the **Scope Box** parameter and select the name of the scope box from the drop-down list displayed. Now, choose the **Apply** button to apply the property to the selected datum. The datum will now appear only in those views whose cutting planes intersect the scope box.

Controlling the Visibility of the Scope Box

The scope box can be resized to limit its visibility for certain views. Its visibility can also be controlled for each view. To control the visibility of the scope box, select it; the instance properties of the selected scope box will be displayed in the **Properties** palette. In the **Parameters** area of the palette, choose the **Edit** button displayed in the value field for the **Views Visible** parameter; the **Scope Box Views Visible** dialog box will be displayed. This dialog box lists all view types and view names available in the project. In the **Scope Box Views Visible** dialog box, the **Automatic Visibility** column displays the current visibility of scope boxes. You can click in the value field in the **Override** column for a specific view. On doing so, a drop-down list will be displayed, as shown in Figure 3-24. The drop-down list has three options: **None**, **Visible**, and **Invisible**. You can select any of the options from the drop-down list displayed to override the automatic visibility setting.

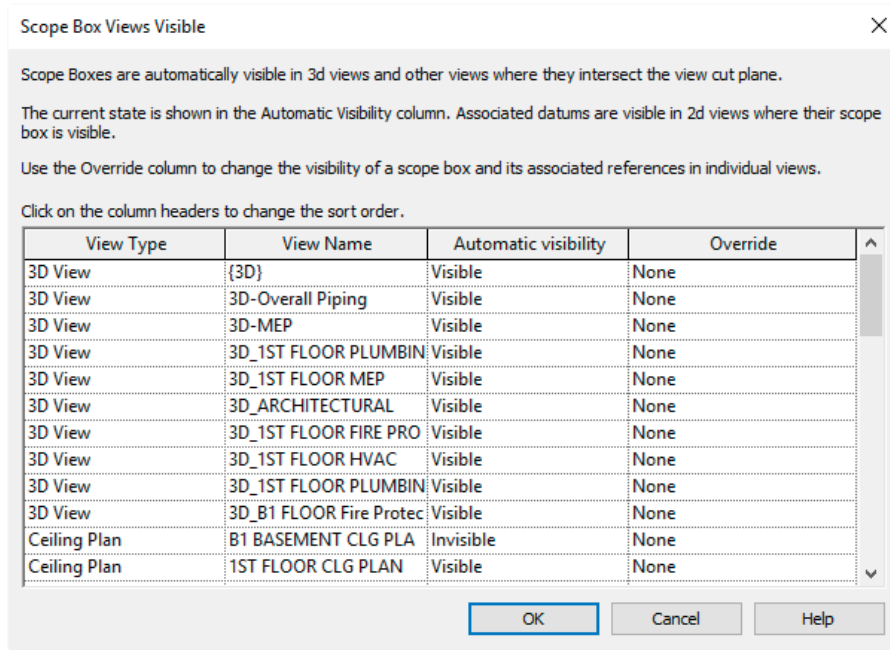


Figure 3-24 *The drop-down list displayed in the* ***Scope Box Views Visible*** *dialog box*

UNDERSTANDING WALL TYPES

Autodesk Revit provides you with several predefined wall types based on their usage. These wall types are discussed next

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Exterior Wall Type

This is the wall type that is primarily used for generating the exterior of the building model. It has predefined wall types, such as **Brick on CMU**, **Brick on Mtl. Stud**, **CMU Insulated**, and so on.

Curtain Wall Type

Apart from the above discussed wall types, Autodesk Revit also has predefined curtain walls or screen walls that consist of panels and mullions.

Autodesk Revit also provides you with the flexibility of creating your own wall type. The walls that you will create can have different functions, which can be modified, depending on their functional usage. In Autodesk Revit, you can create both architectural and structural walls. An architectural wall does not contain analytical properties as the structural walls do. In the next section, various techniques to create and modify architectural walls are discussed.

CREATING ARCHITECTURAL WALLS

In Autodesk Revit, each wall type has specific predefined properties such as composition, material, characteristics, finish, height, and so on. You can select the wall type based on its specific usage in the project. Walls, like most other model elements, can be created in a plan view or a 3D view.

To create an exterior architectural wall, first you need to invoke the **Wall: Architectural** tool and then select the appropriate exterior wall type and specify various properties. To do so, invoke the **Wall: Architectural** tool from the **Build** panel, refer to Figure 3-25; the **Modify | Place Wall** tab will be displayed. To select the type of wall, select an exterior wall type from the **Type Selector** drop-down list in the **Properties** palette, as shown in Figure 3-26. Next, from the **Properties** palette, specify and edit various properties of the wall to be added. Various wall properties and the process to specify them are discussed next.

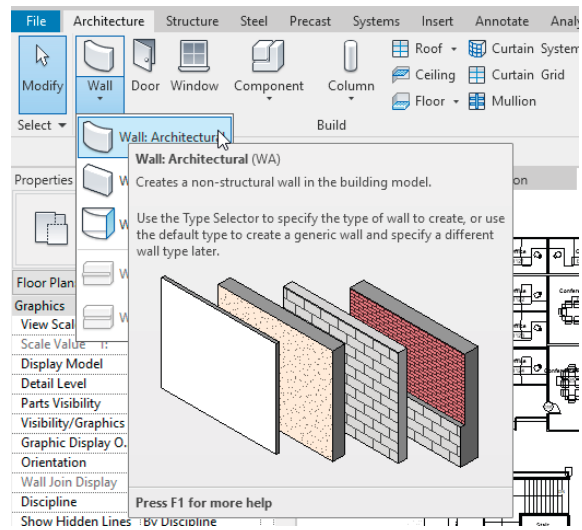


Figure 3-25 *Invoking the* ***Wall: Architectural*** *tool from the* ***Wall*** *drop-down*

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Specifying Architectural Wall Properties



In Autodesk Revit, walls like other elements, has two sets of properties, type and instance. These set of properties control the appearance and the behavior of the concerned element.

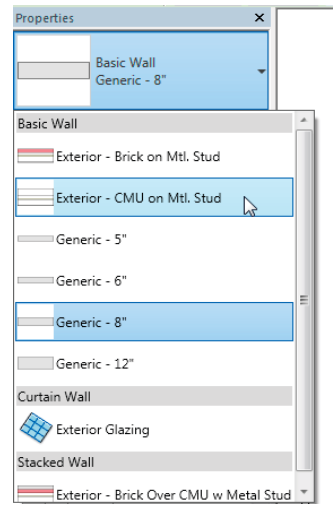


Figure 3-26 *Selecting an exterior wall type from the* ***Type Selector*** *drop-down list*

Specifying Instance Properties

After invoking the **Wall: Architectural** tool, the instance properties of the wall will be displayed in the **Properties** palette. The **Properties** palette also contains the **Type Selector** drop-down list. You can select the family and the type of the proposed wall from this drop-down list. This palette shows various instance properties and their corresponding values for the specified instance of the element. The options in this palette depend on the type and instance of the selected element or the element to be created as well as on the options selected in the **Type Selector** drop-down list. The properties of exterior walls are displayed in different categories such as **Constraints**, **Structural**, **Dimensions**, and **Identity Data**, each representing a set of properties corresponding to the title. You can use the twin arrows on the extreme right of the title to collapse the properties for each title. Some of the important parameters are discussed next.

In the **Properties** palette, the **Location Line** parameter indicates the reference line used for creating a wall. In 3D environment, the location line in a wall refers to a plane that does not get modified, even if the wall parameters are changed. To assign a value to the **Location Line** parameter, click in the value field corresponding to this parameter; a drop-down list will be displayed. Click on the drop-down list to view the available options. The options in the drop-down list are given next.

Wall Centerline	-	Center line of the entire composite wall
Core Centerline	-	Center line of the structural core of the wall
Finish Face: Exterior	-	Exterior face of the wall as the location line
Finish Face: Interior	-	Interior face of the wall as the location line
Core Face: Exterior	-	Exterior face of the core
Core Face: Interior	-	Interior face of the core

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The location line is indicated by a dashed line, which appears while sketching a wall segment. For example, on selecting **Wall Centerline** as the location line parameter, you will notice a dashed line in the middle of the wall, as shown in Figure 3-27. When you select **Finish Face: Interior**, dashed line appears on the interior face of the wall, see Figure 3-28.

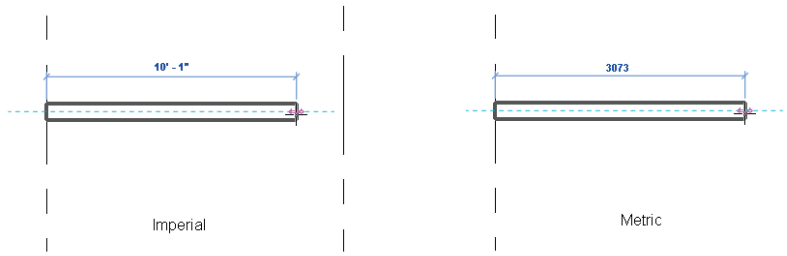


Figure 3-27 *The appearance of a dashed line at the center of the wall*



Note

While developing a design, you may need to modify certain parameters of the exterior wall such as its thickness and composition, based on the final selection of materials and their specifications. Considering this flexibility, the location line parameter enables you to create the walls.

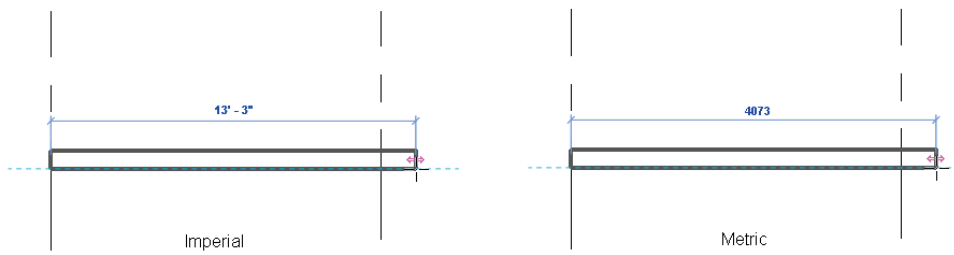


Figure 3-28 *The appearance of a dashed line at the interior face of the wall*

In Autodesk Revit, you can specify the height of walls by applying the base and top constraints with respect to the levels defined in the project. This means, if you set the base and the height parameter of a top story and apply these constraints, all walls will be sketched with the same base and the top. To create a wall segment that is not related to these components and levels, you can type the desired height in the column of the **Unconnected Height** instance parameter. The default value for the unconnected height in Imperial is 20’ 0” or in Metric is 8000 mm. The various instance parameters for walls and their usage are given next. The values of some of the instance parameters will be available only after an instance is created. The instance parameters of the wall are given in the table below.

Instance Parameter	Description
Location Line	Line or reference plane for sketching the wall
Base Constraint	Level or reference plane of the base of a wall
Base is Attached	Check box showing whether or not the base of the wall is attached to any other element

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Base Offset	Height of the wall from its base constraint
Base Extension Distance	Distance of the base of the layers in a wall
Top Constraint	Whether the wall height is defined by specified levels or is unconnected
Unconnected Height	Explicit height of the wall
Top Offset	Distance of the top of the wall from the top constraint
Top Extension Distance	Distance of the top of a layer on a wall
Room Bounding	Whether the wall constitutes the boundary of a room
Related to Mass	Whether the wall relates to a massing geometry
Cross-Section	Whether the wall will be vertical or slanted. Select an option from the drop-down list.
Structural Usage	Defines the specific structural usage of a wall
Length	Indicates the value of the length of a wall
Area	Indicates the value of the surface area of a wall
Volume	Indicates the value of the volume of a wall
Comments	Specific comments that give description of a wall
Mark	To add a unique value or label to each wall
Phase Created	Phase in which a wall is created
Phase Demolished	Phase in which a wall was demolished
Image	Specifies the name of the image of the wall. To specify an image name, click on the Value field; a Browse button will be displayed. Choose the Browse button; the **Manage Images** dialog box will be displayed. Use this dialog box to specify the image for the wall. The specified image will be displayed in the Schedule.

Specifying Type Properties

The type properties of a wall specify the common parameters shared by certain elements in a family. Any changes made in the type properties of a wall element will affect all individual elements of that family in the project. To specify the type properties of an element, invoke the **Wall: Architectural** tool; the **Modify | Place Wall** tab will be displayed. In this tab, choose the **Type Properties** tool from the **Properties** panel; the **Type Properties** dialog box will be displayed. Using this dialog box, you can modify the type properties of the selected wall type such as **Structure**, **Function**, **Coarse Scale Fill Pattern**, and so on.

In Autodesk Revit, in the **Type Properties** dialog box, you can view the analytical properties of the wall such as the **Thermal Mass**, **Thermal Resistance**, and **Heat Transfer Coefficient**. The analytical properties that you can edit are: **Absorptance** and **Roughness**. You can also define the composition of the wall type. To do so, choose the **Edit** button in the **Value** column of the **Structure** parameter; the **Edit Assembly** dialog box will be displayed, as shown in Figure 3-29. In the **Edit Assembly** dialog box, choose the **Preview** button; a preview box will be displayed. The preview box will display sectional detail of the selected wall type.

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In Autodesk Revit, a wall is a composite building element and can consist of several layers. The **Layers** area in the **Edit Assembly** dialog box displays multiple layers of the selected wall, each with a specific function, material, and thickness. The layer on the top of the table represents the exterior side of a wall and the last layer represents the interior face. The **Layers** area, displays the selected wall type, refer to Figure 3-29. In this case, it is **Exterior- Brick on Mtl. Stud**. This wall type has ten layers. Each layer of the composite wall is assigned a specific function and priority based on its usage. The layers available in Autodesk Revit can be broadly classified into the categories given next.

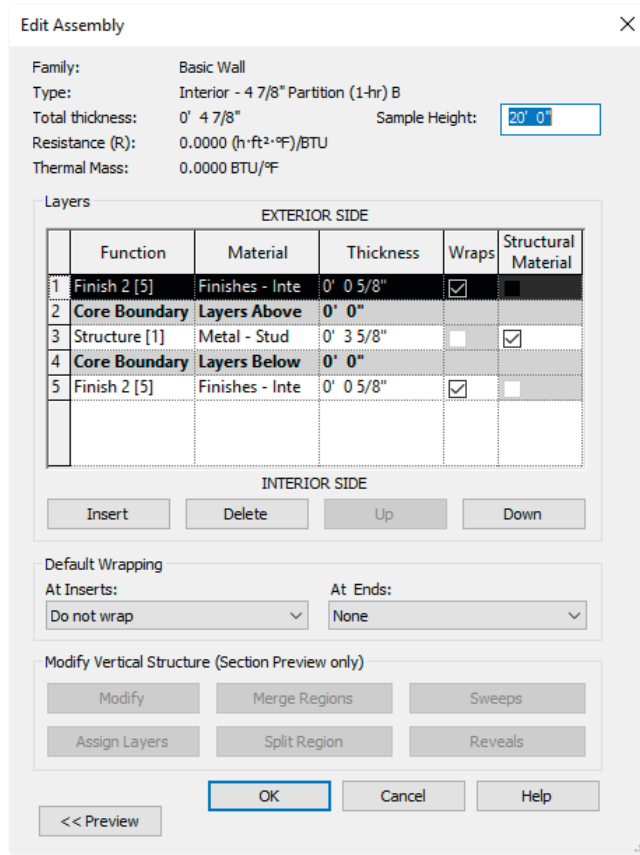


Figure 3-29 *The* ***Edit Assembly*** *dialog box for a wall type*

Structure [1]- Consists of main supporting element of the structure such as concrete, brick, wood, metal stud, and so on.

Substrate [2] - Consists of material that functions as substructure, such as foundation and plywood.

Thermal/Air Layer - Indicates the air cavity or the thermal insulation layer.
Membrane Layer - A zero thickness layer primarily used for the prevention against water vapor penetration.

Finish 1 [4] - Exterior finish such as metal, brick, and stone.

Finish 2 [5] - Interior finish such as paint, gypsum wall board, and so on.

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Note

The numbers placed next to certain layers show the priority set of the layer and enables Autodesk Revit to work out the joinery detail of wall segments at corners and intersections according to the priority. When joined, a higher priority layer takes precedence over a lower priority layer.

In the **Edit Assembly** dialog box, the **Material** column displays the material specification, whereas the **Thickness** column displays the thickness of each layer. The total thickness of this composite wall is the sum of thickness of all layers. In the present case, the total thickness of wall is **1'1 7/8"** in Imperial or **350 mm** in Metric which is given beside the **Total thickness** parameter on the top of the dialog box. You can click on the **View** drop-down list and select **Section: Modify type attributes** to view the section of the wall.

Note

*The **View** drop-down list will only be visible if you choose the **Preview** button in the **Edit Assembly** dialog box.*

Autodesk Revit enables you to add and remove layers by using the **Insert** and **Delete** buttons, respectively provided in the **Layers** area in the **Edit Assembly** dialog box. To shift the layers, choose the **Up** and **Down** buttons. You can also create your own layers. You will learn more about materials, layers, and composite walls in the later chapters. The **Default Wrapping** area in the **Edit Assembly** dialog box has two drop-down lists namely, **At Inserts** and **At Ends**. The options in these drop-down lists allow wrapping of a compound wall at the end and at the inserts (for doors and windows). From the **At Inserts** drop-down list, you can select any of the following options: **Exterior**, **Interior**, **Both**, and **Do not wrap**. Similarly, from the **At Ends** drop-down list, you can select any of the following options: **Exterior**, **Interior**, or **None**. The wrapping in the walls can be viewed in a plan view. After, specifying various options in the **Edit Assembly** dialog box, choose the **OK** button; the dialog box will close. Also, choose the **OK** button again to close the **Type Properties** dialog box.

Sketching Walls

The next step after selecting the wall type from the **Properties** palette is to select the sketching tool. Autodesk Revit provides several sketching tools, such as **Line**, **Rectangle**, and so on to sketch the walls of different shapes. These tools, along with the **Options Bar**, can be invoked from the **Draw** panel in the **Modify | Place Wall** tab, as shown in Figure 3-30.

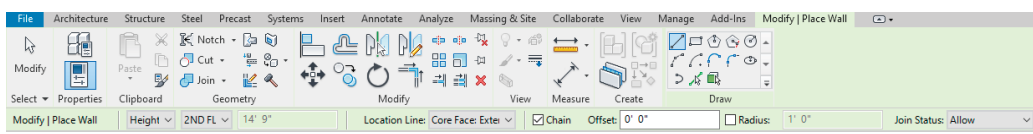


***Figure 3-30** The **Modify / Place Wall** tab*

In the **Modify | Place Wall** tab, you can access different sketching tools from the **Draw** panel and the **Options Bar** in the **Modify | Place Wall** tab. On invoking these tools, you can sketch different wall profiles. The procedures for sketching the straight and circular wall profiles are discussed next.

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Sketching Straight Wall Profiles

You can sketch straight walls using the **Line** tool by specifying the start point and the endpoint of the wall segment. To specify the location of the start point, click in the drawing area and move the cursor, you will notice that a wall segment starts from the specified point and the changing dimension dynamically appears on it. This dimension is called the temporary dimension or listening dimension, and it shows the length and angle of the wall segment at any given location of the cursor, as shown in Figure 3-31.

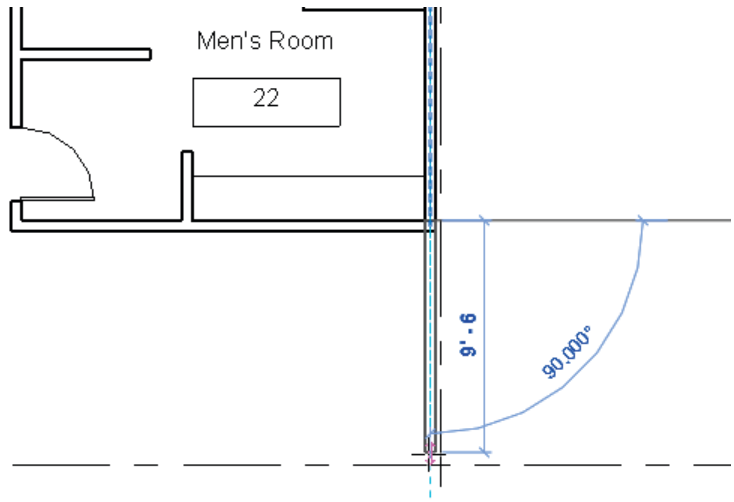


Figure 3-31 *The temporary dimensions displayed while sketching a wall*

Also, notice that the cursor moves in increments by the value set in the **Dimension Snaps** area of the **Snaps** dialog box (See Chapter 2, Setting Snaps). The angle subtended by the wall on the horizontal axis is also displayed and it keeps changing dynamically as you move the cursor to modify the inclination of the wall. Also notice that, on bringing the cursor near the horizontal or the vertical axis, a dashed line will appear on the wall segment. This is called the alignment line and it helps you sketch the components with respect to the already created components. You will also notice that a tooltip is displayed indicating that the wall segment being sketched is horizontal or vertical.

Autodesk Revit provides you with the flexibility of specifying the length of the walls in different ways. The first option is to specify the starting point of the wall, move the cursor in the desired direction and click, when the angle and the temporary dimension attain the required values. The second option is to sketch the wall and then modify its length and angle to the exact value. For example, to sketch a 18'0" in Imperial or 5400 mm in Metric long horizontal wall after specifying the starting point, you can move the cursor to the right until you see a dashed horizontal line parallel to the sketched wall. Click when the temporary dimension shows 20'0" in Imperial or 6000mm in Metric approximately. Note that the length of the wall may not be exactly 18'0" in Imperial or 5400mm in Metric. You can now use the wall controls to modify the dimensions of the wall to its exact value.

To modify the wall, select the wall segment and view its control and properties. As you select the wall segment, it gets highlighted in blue and the symbols appear above the wall segment.

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The exact dimension of the sketched wall is visible in the dimension text of the temporary dimension. The conversion control symbol, which appears below the dimension value, is used to convert the temporary dimension into a permanent dimension. The two blue arrows, that also appear on the upper face of the wall, indicate the flip control symbol for the sketched walls. They appear on the side interpreted as the exterior face of the wall. By default, the walls drawn from the left to right have the external face on the upper side and the walls drawn from the top to bottom have it on the right side. You can flip the orientation of the wall by clicking on the arrows symbol. Alternatively, you can place the cursor over the flip control symbol and notice the change in its color. After the color of the flip control changes, press SPACEBAR to flip the wall. The two blue dots that appear at the two ends of the wall segments are the drag control symbols. You can use them to stretch and resize the walls. To set the wall to the exact length, click on the temporary dimension; an edit box will appear showing the current dimension of the wall segment. Now, you can replace it by typing the exact length. For example, you can enter **9’ 3”** in Imperial or **2775 mm** in Metric in the edit box, as shown in Figure 3-32. Next, press ENTER; the length of the wall will be modified to 9’ 3” in Imperial or 2775 mm in Metric.

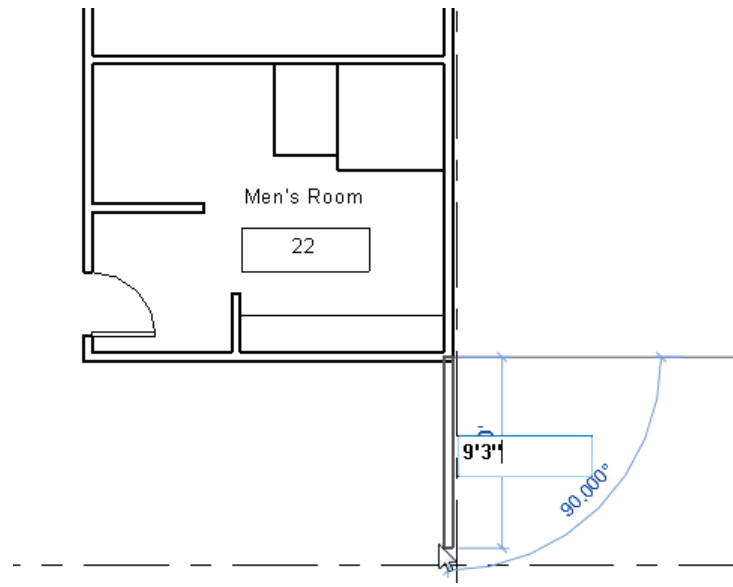


Figure 3-32 *Entering the value of the length in the edit box*

Alternatively, you can create a straight wall by typing the dimension for the length before choosing the endpoint. As soon as you start typing the length, an edit box appears above the dimension line. Enter the value of the length and press ENTER to create a wall segment of the specified length. To sketch a wall at a given angle, sketch it at any angle and then click on the angular dimension symbol; an edit box will appear. In the edit box, you can enter the exact angular dimension from the horizontal axis to which the wall will be inclined.



Note

*The **Project Browser** shows **Level 1** in bold letters. This indicates that the wall has been sketched in that level.*

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On invoking the **Wall: Architectural** tool, you can set various options in the **Options Bar** before you start to sketch the wall. The options that you can specify in the **Options Bar** are related to the following options: level to which the wall height or depth will be constrained, the location line of the wall, the offset distance of the wall if offsetted from the specified location line, and the creation method of the wall. In the **Options Bar**, you can specify the offset distance in the **Offset** edit box. By specifying a value in this edit box, you can create a wall that starts at a specified offset distance from a point defined in an existing element. After entering the offset value and selecting the sketching option, click near the element to define the offset distance. When you move the cursor, the wall will start at the specified distance from the selected point. For example, this option can be used for creating boundary walls that are placed at a specific distance from the building profile.

Also, in the **Options Bar**, you can select the **Chain** check box to ensure that you can create a continuous wall profile with a number of wall segments. It enables you to create a continuous wall with wall segments connected end to end. The end point of the previous wall becomes the start point to the next wall.

Sketching Circular Wall Profiles

The **Circle** tool in the list box can be used to sketch a circular wall profile. To sketch a circular wall profile, invoke the **Circle** tool from the **Draw** panel of the **Modify | Place Wall** tab and click in the drawing area to specify the center point of the circular wall. You will notice that a circular wall profile is extending dynamically with the specified point as the center and the other end attached to the cursor, as shown in Figure 3-33. The temporary radial dimension will also be displayed. Click when the desired value for the radius is displayed. Alternatively, before clicking on the second point, type the value for the radius of the circular profile. As you type, the value will be displayed in the edit box. Press ENTER to complete the profile. Notice that the dimension that you entered is the distance of the center point to the location line of the profile. Alternatively, you can create a circular wall by specifying a value in the Radius edit box in the **Options Bar**. To do so, invoke the **Circle** tool from the **Modify | Place Wall** tab; various options will be displayed in the **Options Bar**. In the **Options Bar**, select the check box preceding the **Radius** edit box to activate it. In the **Radius** edit box, specify a value for the radius of the circle. Now, in the drawing window as you move the cursor, you will find the preview of the circular wall profile with the specified radius. Click on a specified point in the drawing area; a circular wall profile with the specified radius will be created.

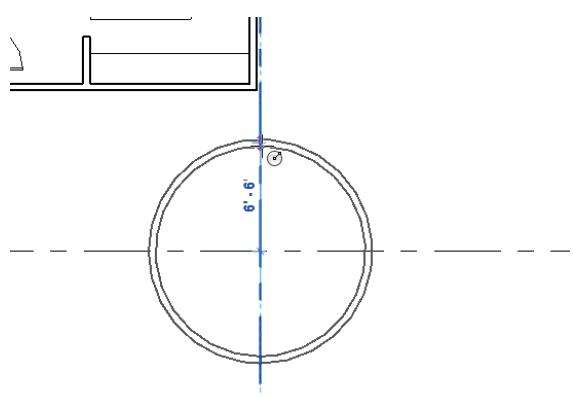


Figure 3-33 *Circular wall profile being created*

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USING DOORS IN A BUILDING MODEL

A door is one of the most frequently used components in a building model. It helps in accessing various exterior and interior spaces in a project. Autodesk Revit provides a variety of predefined door types. You can access these door types by using the options from the **Type Selector** drop-down list of the **Properties** palette. You can also load other door types from the **English-Imperial** folder. A wall acts as a host element for doors. This means that a door can be placed only if there exists a wall. When you add a door to a wall, Autodesk Revit intuitively creates an opening in it.

In Autodesk Revit, the doors are not loaded in any of the default templates. To add doors, you need to add the door types to the current file. To do so, choose the **Load Family** tool from the **Load from Library** panel of the **Insert** tab; the **Load Family** dialog box will be displayed. In this dialog box, you can browse to **English-Imperial > Doors** folder for Imperial or **English > Doors** folder for Metric and select the desired door type(s) from the displayed list of families. After selecting the door types, choose the **Open** button; the **Load Family** dialog box will close and the desired door types will be added in the current project. Now, you can add the doors to the building model as required. The procedure for adding doors to a building model is described next.

Adding Doors

You can add doors to a building model by using the **Door** tool. You can invoke this tool from the **Build** panel. Alternatively, you can type **DR** to invoke this tool. Note that in Revit, the door types are not loaded in the default templates. Therefore, if you are using any of the templates for the project and invoking the door for the first time, the **Revit** window displays the message that no doors family is loaded and prompts to load one. To load a door family, choose the **Yes** button from the **Revit** window; the **Load Family** dialog box will be displayed. Select the desired family(ies) for Imperial from the **English-Imperial > Doors** folder or for Metric from the **English > Doors** folder and choose the **Open** button the **Load Family** dialog box will close and the **Specify Types** dialog box will be displayed. Select the desired type(s) from the **Type** area of the dialog box. Note that you can use the CTRL key to select multiple types from the **Type** area. After selecting the desired type choose the **OK** button in the **Specify Types** dialog box. The selected types of door will be loaded in the project.

Now, to add a door, invoke the **Door** tool from the **Build** panel of the **Architecture** tab; the **Modify | Place Door** tab will be displayed in the ribbon. In this tab, select the desired door type from the **Type Selector** drop-down list in the **Properties** palette. This drop-down list displays the door types loaded in the current project. After selecting a door type, click on the desired location of a wall to add the door. After adding the door to the building model, you can view and modify its properties. To do so, select the door; the instance properties of the door will be displayed in the **Properties** palette, as shown in Figure 3-34.

Now, to modify the type properties of the selected door type, choose the **Edit Type** button from the **Properties** palette; the **Type Properties** dialog box for the selected door type will be displayed, as shown in Figure 3-35. In this dialog box, change the parameters as required and then choose the **Preview** button to view the graphical image of the selected door type.

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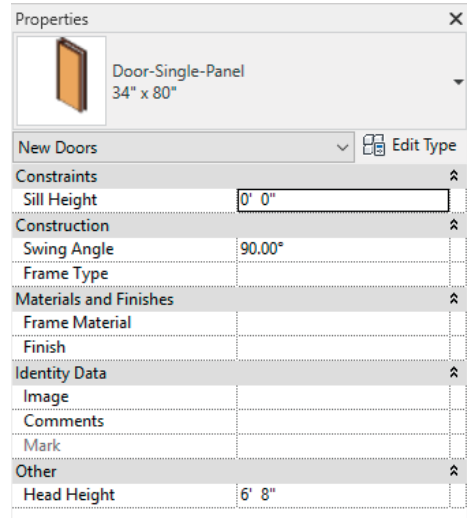


Figure 3-34 *Partial view showing instance properties of a door*

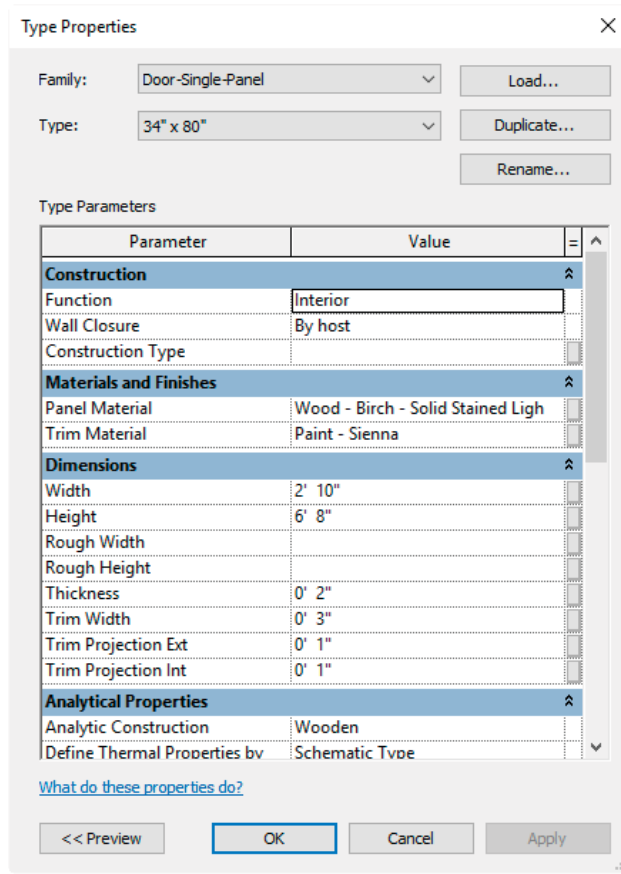


Figure 3-35 *The* ***Type properties*** *dialog box displaying the properties of a door*

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Understanding Door Properties

The **Type Properties** dialog box displays the values of different parameters of a door. The type parameters are arranged under different heads based on their properties such as **Construction**, **Materials and Finishes**, **Dimensions**, **Identity Data**, and **IFC Parameters**. The parameters associated with each property are listed under each head. For example, the **Dimensions** head includes the dimensional type parameters associated with the door type such as, **Height**, **Width**, **Trim Width**, and so on. You have the option of either using the default values for these parameters or modifying them to the desired values. However, before modifying the type properties of a predefined door type, it is recommended to create a copy of the original door type and modify the desired properties of the new door type. The **Duplicate** button available on the top right corner in this dialog box can be used to create a copy of a door type. When you choose this button, the **Name** edit box will be displayed, prompting you to assign a name to the new door type. Enter a name in this edit box and choose the **OK** button; a new door type is created, which inherits the properties of the parent door type. Now, its parameters can be modified, as desired. Use the **Rename** button to give a new name to the selected door type. You can use the **Load** button, provided on the top right corner of the dialog box to load a door type of the required family from the additional libraries.



Note

*Renaming a door type does not alter its properties. For example, in Imperial if you rename **36"x 84"** to **34"x 84"**, its width will still remain 36", irrespective of its name. In Metric, if you rename **0915 x 2134mm** to **0860 x 2134mm**, its width will still remain **0915mm**.*

Door Type Properties

If you change the type properties of a door, the properties of all instances of that door type in the project will also change. The door type properties are described in the table given next.

Parameter Name	Description
Function	Sets the door function value to Interior or Exterior. This value will be used at the time of scheduling.
Wall Closure	Sets the layer wrapping for the door type.
Construction Type	Describes the composition of the door.
Door Material	Refers to the finish material of the door panel which can be selected from the available materials list.
Frame Material	Refers to the finish material of the door frame and can be selected from the available materials list.
Height	Sets the height of the door.
Trim Projection Ext	Thickness of the trim projection at the exterior side.
Trim Projection Int	Thickness of the trim projection at the interior side.
Trim Width	Width of the trim at both the sides.

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Width	Width of the door can be set in this column.
Rough Width	Used for scheduling or exporting.
Rough Height	Used for scheduling or exporting.
Assembly Code	Refers to the assembly code for the door type that can be selected from the hierarchical list.
Keynote	This is a new parameter available for all model elements, detail components, and materials under identity data.
Model	Name to be given to the model door type.
Manufacturer	Name of the manufacturer of the door type.
Type Comments	Additional information or comments to be added to the door type, primarily for including in schedules.
URL	Web link of the door type manufacturer.
Description	Text describing the door type.
Assembly Description	Text describing the assembly of the door type.
Type Mark	Each door can be assigned a unique value that may be generated in a sequence of creation of the door type.
Fire Rating	Fire rating of the door.
Cost	Cost of the door, primarily for costing purpose.

Door Instance Properties

The door instance properties, available in the **Properties** palette, refer to the instance properties of a particular door. On changing these properties, the properties of only that particular instance in the project is changed. The description of various instance parameters is given in the table next.

Parameter Name	Description
Level	Shows the layer to which the door belongs and can be used to move it to a different level.
Sill Height	Refers to the distance or height of the sill of the door from the specified level.
Frame Type	Refers to the type of frame used for the door instance.
Swing Angle	Refers to the swing angle of the door.
Frame Material	Specifies the material used for the frame of the instance.
Finish	Refers to the finish applied to the door and frame.
Image	Specifies the name of the image for the door instance.

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Comments	Describes the door instance.
Mark	Specifies the mark of the selected door.
Phase Created	Specifies whether the door is a part of the new construction or an existing construction.
Phase Demolished	Specifies whether the door is a part of the existing building or a new structure, or none.
Head Height	Refers to the height of the top of the door from the specified level.

Adding a Door to a Wall

Doors can be added to a building model in the plan, section, elevation or a 3D view, by clicking at the desired location in a wall. After invoking the **Door** tool and selecting the door type, move the cursor over the wall on which it is to be added. The '**+**' symbol over the cursor indicates that an element is being added. You will notice that the door symbol appears, when the cursor is moved over the wall. When the cursor comes close to the upper or lower face of the wall, the door symbol appears on it, as shown in Figure 3-36. The door symbol appears on the lower face when the cursor comes near to that face. Also, a temporary dimension appears indicating the distance of the center of the door opening from adjacent walls or wall edges.

Using the temporary dimensions displayed, you can add the door at the desired location. Alternatively, you can first add the door at an approximate location on the wall and then modify its location to the exact dimension. When a door is added, an opening is automatically created in the wall and the edges are also completed. After selecting the door, you will notice that the horizontal and vertical twin arrow symbols appear in the door along with a tag number. To flip the swing-side of the door, click on the twin arrow key that appears parallel to the wall edge. To shift the door to the other side of the wall, click on the twin arrow key that appears perpendicular to the wall edge (vertical, in this case). To move the added door to the exact dimension, click on the particular temporary dimension text and enter the exact value, as shown in Figure 3-37. The door shifts to the desired location.

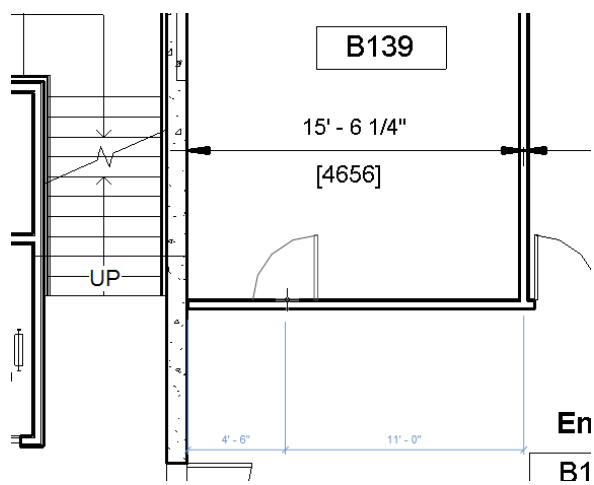


Figure 3-36 *The appearance of the door symbol on the wall*

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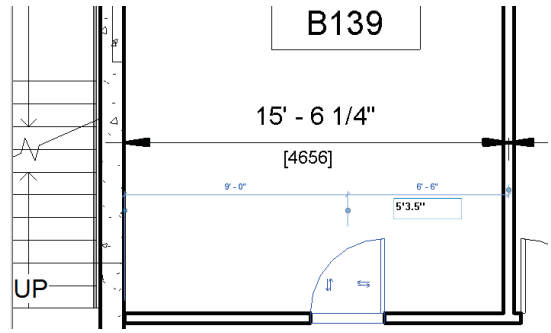


Figure 3-37 *Entering the value in the edit box to position the door*

Note

A door can be placed in any type of wall, regardless of the height of the door. Autodesk Revit displays alert messages if the door is not placed appropriately.

In Autodesk Revit, when doors are inserted, door tags are generated automatically. They assist in marking the doors and later arranging them in the form of a schedule. The door type tag number increments sequentially, when you place a door by using the **Door** tool or when you copy and paste it into the building model. You can, however, give a specific mark or tag to doors individually. To add a tag to the door, ensure that the **Tag on Placement** button is chosen from the **Tag** panel of the **Modify | Place Door** contextual tab. The visibility of door tags can be controlled by using the **Visibility/Graphics Overrides for Floor Plan** dialog box. This dialog box can be invoked by typing **VG**, or by selecting the desired door from the drawing and choosing the **Visibility/Graphics** tool in the **Graphics** panel in the **View** tab. Next, if you want to hide the door tags, choose the **Annotation Categories** tab from the **Visibility/Graphics Overrides for Floor Plan** dialog box and clear the **Door Tags** check box. When you invoke the **Door** tool, the option for adding a horizontal or vertical door tag becomes available in the **Options Bar**. You can set the orientation of the door tags to horizontal or vertical by selecting the **Horizontal** or **Vertical** option from the drop-down list displayed in the **Options Bar**.

To change a door type, select the particular instance; the properties and the type of the selected door will be displayed in the **Properties** palette. In the **Properties** palette, select a new door type from the **Type Selector** drop-down list; the selected door will be replaced with the new door type.

In Autodesk Revit, you can create a new door type by using various tools. To create a new door type, choose the **Model In-place** tool from the **Mode** panel of the **Modify | Place Door** tab; the **Name** dialog box will be displayed. In this dialog box, enter a name in the **Name** edit box and choose the **OK** button; the dialog box will be closed and the **Modify** tab will be displayed along with the various tools in the Family Editor interface. In this interface, you can use various tools from different tabs to create the doors that are specifically designed for that instance. After creating the door choose the **Finish Mode**l button from the **In-Place Editor** panel; the Family Editor interface will be closed and you will return to the Project interface.

Note

*On invoking the **Model In-place** tool, the Family Editor mode will be activated. In this mode, you can use various massing tools from the **Create** tab to create an in-place door assembly.*

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Apart from the door types available in the **Type Selector** drop-down list, you can use other door types from additional libraries. To access them, choose the **Load Family** tool in the **Mode** panel of the **Modify | Place Door**; the **Load Family** dialog box will be displayed. Additional door types are available in the **Doors** sub folder of the **English-Imperial** folder. Select a door type to view its image in the **Preview** area. After selecting the door type, choose the **Open** button. The selected family of doors will be added to the **Type Selector** drop-down list in the **Properties** palette for that project.

ADDING WINDOWS IN A BUILDING MODEL

Windows form an integral part of any building project. Autodesk Revit provides several in-built window types that can be easily used and added to the building model. Like doors, windows are also dependent on the walls that act as their host element. In Autodesk Revit, the windows are not loaded in any of the default templates. To add the windows, you need to add the window families to the current file. To do so, choose the **Load Family** tool from the **Load from Library** panel of the **Insert** tab; the **Load Family** dialog box will be displayed. In this dialog box, you can browse to **English-Imperial > Windows** folder for Imperial or **English > Windows** folder for Metric and select the desired window type(s) from the displayed list of families. After selecting the window families, choose the **Open** button; the **Load Family** dialog box will close and the **Specify Types** dialog box will be displayed. Select the desired type(s) from the **Type** area of the dialog box. Note that you can use the CTRL key to select multiple types from the **Type** area. After selecting the desired type choose the **OK** button in the **Specify Types** dialog box and the desired window types will be added in the current project. Now, you can add the window to the building model as required. The procedure for adding windows to a building model is described next.

Adding Windows

In Autodesk Revit, you can add windows to a building model by using the **Window** tool. To do so, invoke the **Window** tool from the **Build** panel of the **Architecture** tab; the **Modify | Place Window** tab will be displayed. In this tab, select the window type from the **Type Selector** drop-down list in the **Properties** palette. To add a window to a building model, move the cursor over the wall and click to place it either in the upper face or in the lower face. After adding the window, you can view and also change its instance parameters. To do so, select the window from the drawing; the **Properties** palette will be displayed. You can use this palette to view and modify various instance parameters of the selected window such as its Level, Head Height, Sill Height and others. To modify and view the type parameters of the window, choose the **Edit Type** button in the **Properties** palette; the **Type Properties** dialog box will be displayed. In this dialog box, choose the **Preview** button to view the graphical image of the selected window type.

Understanding Window Properties

The **Type Properties** dialog box displays the type parameters for different components of a window such as **Glass Pane Material**, **Sash Material**, **Default Sill Height**, **Width**, **Height**, and so on. You can click in the value column of each parameter and select the required options or use the **Load** button provided on the top right corner of the dialog box to load a window family type from the additional libraries. The **Duplicate** button can be used to create a copy of the window type with a different name. The new window inherits the properties of the parent window type and its parameters can be modified as desired. By using the **Rename** button, you can give a new name to the selected window type.

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Window Type Properties

When you change the type properties of a window type, the properties of all instances of that window type in the project will also change. Various type parameters and their corresponding descriptions are given in the following table:

Parameter Name	Description
Wall Closure	Sets layer wrapping for the window type
Construction Type	Describes the composition of the window
Glass Pane Material	Refers to the finish and material of the glass pane and can be selected from the available materials list
Sash Material	Refers to the material assigned to the sash of the window
Trim Exterior Material	Sets the exterior trim material
Trim Interior Material	Sets the interior trim material
Height	The value used to set the height of the window
Default Sill Height	Distance of the window from the bottom of the wall, the default value is 3'0" in Imperial or 915.0 mm for Metric
Trim Projection - Ext.	The value used to set the exterior projection
Trim Projection - Int.	The value used to set the interior projection
Trim Width - Exterior	The value used to set the width of exterior projection
Trim Width - Interior	The value used to set the width of interior projection
Width	Refers to the width of the window
Window Inset	Refers to the inset of the window from the wall face
Rough Width	The value used for scheduling or exporting
Rough Height	Used for scheduling or exporting
Keynote	This is a new parameter available for all model elements, detail components, and materials under identity data
Model	Name to be given to the window type
Manufacturer	Name of the manufacturer of the window type
Type Comments	Additional information or comments to be added to the window type, primarily for creating schedules
URL	Weblink of the manufacturer
Description	Text describing the window type
Assembly Description	Text describing the assembly
Type Mark	Unique value assigned to each window
Cost	Cost of the window, primarily for costing purpose

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Window Instance Properties

Changing the instance properties of a window, changes the properties of only that instance of the window in the project. The instance properties of a window are given in the table given next.

Parameter Name	Description
Level	Shows the layer to which the window belongs and can be used to move the window to a different level
Sill Height	Refers to the distance or height of the sill of the window from the specified level
Image	Specifies the name of the image of the window type. The specified image will be displayed in the Schedule.
Comments	Description of the window instance not covered in the type properties
Mark	Can be used to specify or modify the mark of the selected window
Phase Created	Specifies whether the window is part of a new construction or an existing construction
Phase Demolished	Specifies whether the window is a part of demolished structure
Head Height	Refers to the height of the top of the window from the specified level

Note that the properties available in the **Type Properties** dialog box may vary depending on the type of window you will select from the **Type Selector** drop-down list in the **Properties** palette.

Adding a Window to a Wall

To add a window to a wall, invoke the **Window** tool from the **Architecture** tab of the ribbon and select the window type from the **Type Selector** drop-down list in the **Properties** palette. Next, move the cursor close to the wall on which it needs to be added. The window symbol appears when the cursor is moved over the wall. When the cursor comes close to the lower face of the wall, the window appears on that face. The window appears on the upper face when the cursor comes near to it, as shown in Figure 3-38. Also, notice a temporary dimension, which indicates the distance of the center of the window opening from the adjacent walls or wall edges. You can also use the temporary dimensions to add the window by clicking at the appropriate location on the wall. Autodesk Revit automatically creates an opening in the wall and the edges are also completed.

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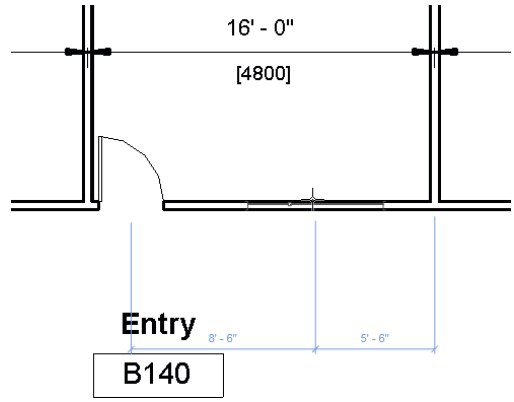


Figure 3-38 *The appearance of the window symbol on the wall*

You will also notice a twin arrow symbol on the window, along with a tag number. Click on the symbol to flip the orientation of the window. The flip arrow symbol will appear on the side that is interpreted as the inner side of the window. You can specify the exact position of the window with respect to the adjacent walls or edges after placing it at the approximate location. To specify the dimensional location of a window, click on the particular temporary dimension text and type the exact dimension. The window will shift to the desired location. Window tags are automatically generated in Autodesk Revit. Unlike doors, however, each window of the same type bears the same tag. Different window types have preassigned marks, which can be changed using the **Type Properties** dialog box. Window tags are used for creating the window schedule.

Note

The window tag numbers increases as you place or copy them in the project. You can also give them a specific tag number individually.

Similar to the door tags, the visibility of the window tags can also be controlled in the drawing. To hide the window tags, invoke the **Visibility/Graphics for Floor Plan** dialog box and choose the **Annotation Categories** tab from it. Next, clear the **Window Tags** check box.

Note

On clearing the ***Window Tags*** *check box in the* ***Annotation Categories*** *area of the* ***Visibility/Graphics for Floor Plan*** *dialog box, the tags become hidden but still remain a part of the project.*

In Autodesk Revit, you can create the windows that are specifically designed for a location or an instance. To do so, choose the **Model In-place** tool from the **Mode** panel of the **Modify |Place Window** tab; the **Name** dialog box will be displayed. In this dialog box, enter the name of the window type in the **Name** edit box and choose the **OK** button; the dialog box will be closed and the **Modify** tab will be displayed. Now, the Family Editor mode will be activated, and in this mode, you can use various tools to create the in-place window. Apart from the window types displayed in the **Type Selector** drop-down list, you can access other window types as well. To add other window types in the **Type Selector** drop-down list, choose the **Load Family** tool from the **Mode** panel of the **Modify | Place Window** tab; the **Load Family** dialog box will be displayed. In this dialog box, add additional window types from the **Library > English-Imperial > Windows** folder for Imperial or **Library > English > Windows** folder for Metric.

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DOORS AND WINDOWS AS WALL OPENINGS

Autodesk Revit also provides in-built opening types for door and windows. These types are available in the **Openings** subfolder of the **Libraries > English-Imperial** folder for Imperial or the **Openings** subfolder of the **Libraries > English** folder for Metric that can be accessed from the **Load Family** dialog box. To invoke this dialog box, choose the **Load Family** tool from the **Load from Library** panel of the **Insert** tab.

To add an opening for door, invoke the **Load Family** dialog box and then from the **Openings** subfolder select any of the following family types: **Passage Opening-Cased** or **Passage Opening-Elliptical Arch**. After selecting any of the family type, choose the **Open** button in the **Load Family** dialog box; the selected family will be loaded in the project. Now, to place the selected opening type in the wall, choose the **Place a Component** tool from **Architecture > Build > Component** drop-down; the **Modify | Place Component** tab will be displayed. In the **Properties** palette, ensure that the desired opening type is selected in the **Type Selector** drop-down list. Next, click in a desired location in the wall to insert the door opening. In the **Properties** palette, you can also edit the width and height of the door opening.

Similar to adding a door opening, you can insert a window opening. To do so, invoke the **Load Family** dialog box and then select any of the two family types from the **Openings** subfolder: **Opening with Trim** or **Opening**. To place the window opening in the wall you will follow the same method as used for inserting the door opening.

OPENINGS IN THE WALL

You can create rectangular openings in a curved or straight wall. To cut an opening in a wall, you can use a plan, elevation, or sectional view. Generally, the sectional or elevation view is preferred as locating and placing such views is easy. To cut a rectangular opening in a wall, open a preferred elevation or a section view in which the host wall of the opening is visible. Next, choose the **Wall: Architectural** tool from the **Opening** panel of the **Architecture** tab and then select the wall that will host the opening. Click in the desired area in the wall to mark the start point or the first corner point of the rectangular opening. As you move the cursor, a rectangle with its temporary dimensions appears. Click at the desired point in the wall to mark the other corner point of the rectangular opening. Now, you can use the temporary dimensions displayed on the opening to modify the placement of the opening. Next, choose the **Modify** button from the **Select** panel to exit the tool. After exiting the tool, you can select the created opening to modify its properties such as its height, top offset, base offset, and so on from the **Properties** palette.

CREATING ARCHITECTURAL FLOORS

You can add a floor to the current level of a building model using the **Floor: Architectural** tool. You can invoke this tool from the **Build** panel of the **Architecture** tab. On invoking this tool, the **Modify | Create Floor Boundary** tab will be displayed. You can use this tab to draw, annotate, and edit a floor boundary for your building model as well as to assign properties to them. The **Draw** panel of the **Modify | Create Floor Boundary** tab consists of various tools that are used to draw the floor sketches. These sketches define the boundary of the floor. To define the boundary of the floor, you can either pick the existing walls or sketch the boundary in the plan view by using lines. You can also sketch the boundary in the 3D view, provided that the work plane is set to the plan view.

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Similar to other model components, the floor tool has associated type and instance properties. Once you sketch the floor, the **Properties** palette will display the instance parameters of floor. The **Type Selector** drop-down list in this palette displays the floors available in Autodesk Revit's library. This palette can be used to modify the instance properties of the floor such as the level at which the floor is to be created, the height offset of the floor from the specified level, and so on. To modify the type properties of a floor, choose the **Edit Type** button from the **Properties** palette; the **Type Properties** dialog box will be displayed, as shown in Figure 3-39.

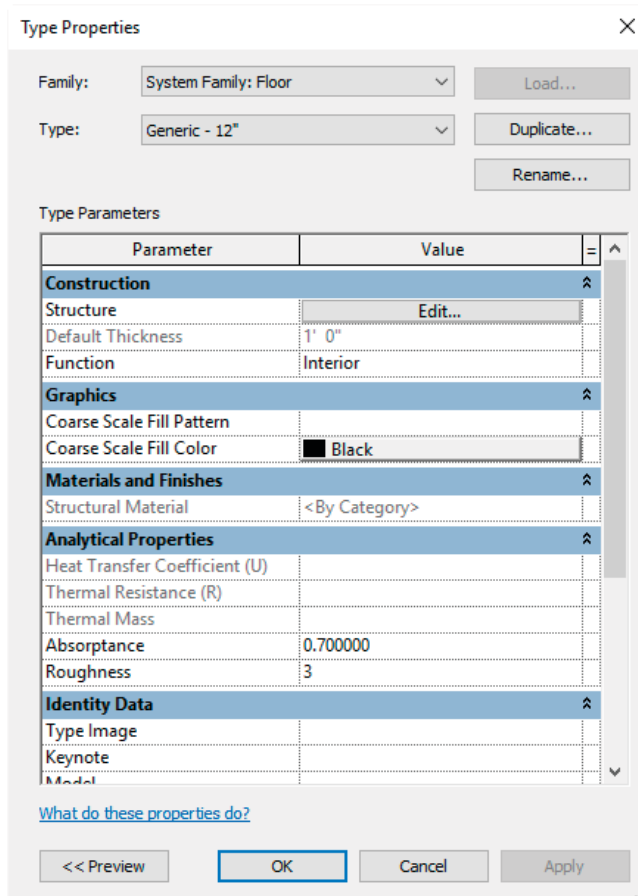


Figure 3-39 *The* ***Type Properties*** *dialog box*

You can set the type parameters for the floor in it. You can also create a new floor type by using the **Duplicate** button. To edit the structural elements of the floor, choose the **Edit** button in the **Value** column for the **Structure** type parameter; the **Edit Assembly** dialog box will be displayed, showing the structure of the floor type with its different layers. In the **Edit Assembly** dialog box, the **Insert** or **Delete** button can be used to customize the new floor type based on the specific project requirement.



Note

The type and instance properties may vary depending on the floor type selected. Autodesk Revit Help provides a detailed explanation of all properties associated with floor types.

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Sketching the Floor Boundary

To create a floor, you need to sketch its boundary. There are two methods to sketch a boundary. The first method is to pick the already created walls using the **Pick Walls** tool to define the floor boundary. The other method is to draw the floor profile using the draw tools such as line, rectangle, polygon, arc, and others from the **Draw** panel of the **Modify | Create Floor Boundary** tab.

By default, the **Pick Walls** tool is chosen in the **Draw** panel of the **Modify | Create Floor Boundary** tab. This tool can be used to sketch the floor for the spaces bound by the connected walls. The **Option Bar** displays the **Offset** edit box, which can be used to specify the offset distance of the floor sketch line from an existing wall. The **Extend into wall (to core)** check box is used to extend the floor to the wall core and assists in creating a joint between the floor and the wall core. If the **Pick Walls** tool is not chosen by default, then invoke this tool and move the cursor near to the wall. You will notice that as the cursor is brought near to the face of the wall, a dashed line appears along with its inner or outer face. You can choose either of the faces of the wall to sketch the floor. Click when the dashed line appears at the appropriate location; a magenta line with flip and drag controls as well as two parallel lines will be displayed on the wall, as shown in Figure 3-40. The flip control can be used to flip the line between the two faces of the wall.

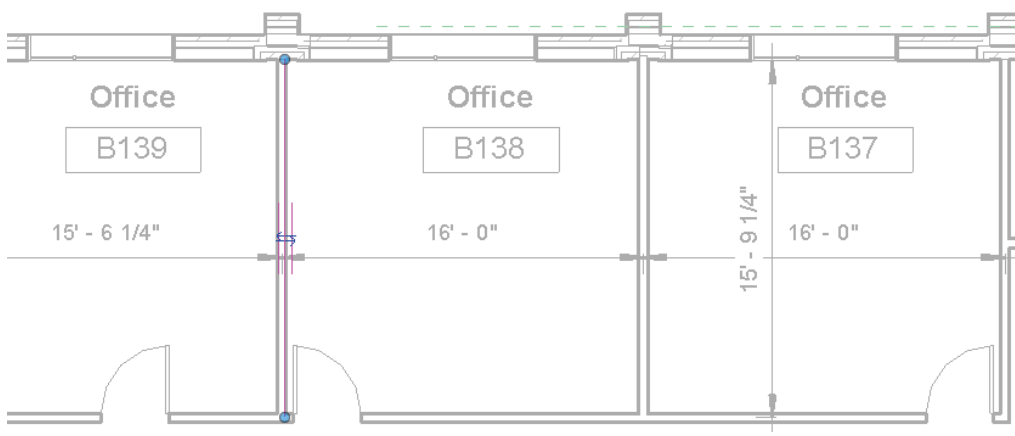


Figure 3-40 *The line with flip and drag control representing an edge of the floor is displayed*

Similarly, you can select other walls to define the floor boundary. The sketched boundary must form a closed profile with all edges connected to each other. After completing the floor boundary, you can edit it by using the drag controls and various tools in the **Modify** panel of the **Modify | Create Floor Boundary** tab. After the floor profile has been sketched, choose the **Finish Edit Mode** button from the **Mode** panel; the floor will be created, as shown in Figure 3-41. As the floor created will not be visible in the plan view, you can use the **Default 3D View** tool from the **View** tab to view it.

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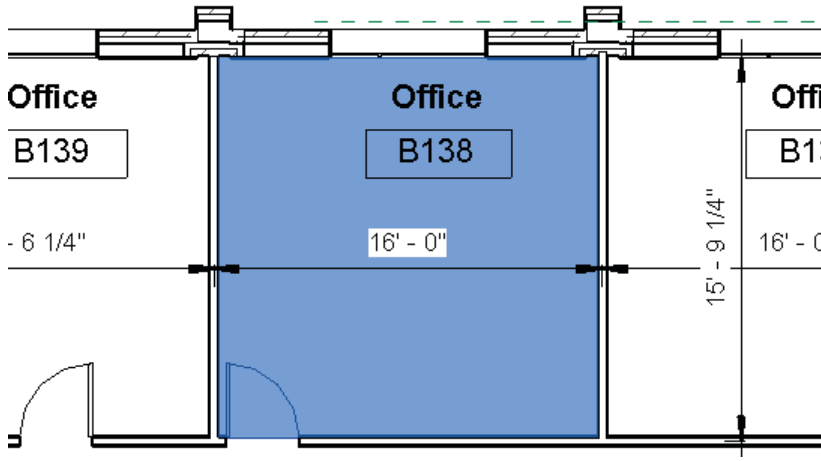


Figure 3-41 *The created floor boundary*

The other option to sketch the floor profile is to draw it using the sketching tools from the **Draw** panel. You can choose the appropriate sketching tool to sketch the floor boundary based on its shape. The functions of the sketching tools are the same as those used for creating a wall. While using the **Line** tool, you can select the **Chain** check box in the **Options Bar** to sketch the lines that are connected end-to-end. Also, you can specify the value in the **Offset** edit box in the **Options Bar** to sketch lines at a specified offset distance from a point on an existing element. Using the editing tools in the **Modify** panel of the **Modify | Create Floor Boundary** tab, you can edit the sketched profile.

In the sketched floor boundary, you can provide slope. To do so, invoke the **Slope Arrow** tool from the **Draw** panel; a list box containing tools to draw the slope arrow will be displayed. The list box contains two tools: **Line** and **Pick Lines**. The **Line** tool in the display panel is chosen by default. You need to specify the start point and endpoint of the arrow in the drawing. After specifying the start point and endpoint, you can modify its instance properties in the **Properties** palette. Using this palette, you can modify the associated properties such as specification method to define the slope arrow, the level at which the tail of the slope arrow will rest, height offset at the tail of the arrow, and more. You can attain the desired slope in the floor using the instance properties in the **Properties** palette.

After you complete the profile and add specifications for the floor, choose the **Finish Edit Mode** button from the **Mode** panel; the floor will be created and the **Modify | Floors** tab will be displayed. In this tab, you can use various modification tools to modify the floor created. This tab consists of nine panels: **Properties**, **Clipboard**, **Geometry**, **View**, **Dimension**, **Create**, **Modify**, **Mode**, and **Shape Editing**.

PLACING CEILINGS

You can add a ceiling to a building model by using the **Ceiling** tool. To do so, invoke this tool from the **Build** panel in the **Architecture** tab; the **Modify | Place Ceiling** tab with various tools for creating the ceiling will be displayed. Since the ceilings are not visible in the floor plan, they are created in the ceiling plan head of each discipline. You can add a ceiling to a project using

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three different methods, by adding automatic ceiling, by sketching the ceiling, and by using the pick walls method.

Creating an Automatic Ceiling

The first method to add a ceiling to a project is by creating an automatic ceiling. To do so, choose the **Ceiling** tool from **Build** panel in the **Architecture** tab; the **Modify | Place Ceiling** tab will be displayed. In this tab, choose the **Automatic Ceiling** tool from the **Ceiling** panel. In the **Properties** palette, select the ceiling type from the **Type Selector** drop-down list. You can select different types of built-in ceiling that can be used from this list. Now, to add the ceiling to the entire room, open the ceiling plan, move the cursor inside the room, and click when the ceiling boundary is displayed. Autodesk Revit will automatically create the ceiling from the center of the room. For example, when you move the cursor inside the room for creating an automatic ceiling, its boundary is highlighted in red, as shown in Figure 3-42. Click to create the ceiling, automatically. If you have created the ceiling in a floor plan, Autodesk Revit will display a warning indicating that the ceiling created will not be visible in it. You can then open the ceiling plan of the corresponding level to view the created ceiling. You can also open the section view through the room to view the cross-section of the ceiling.

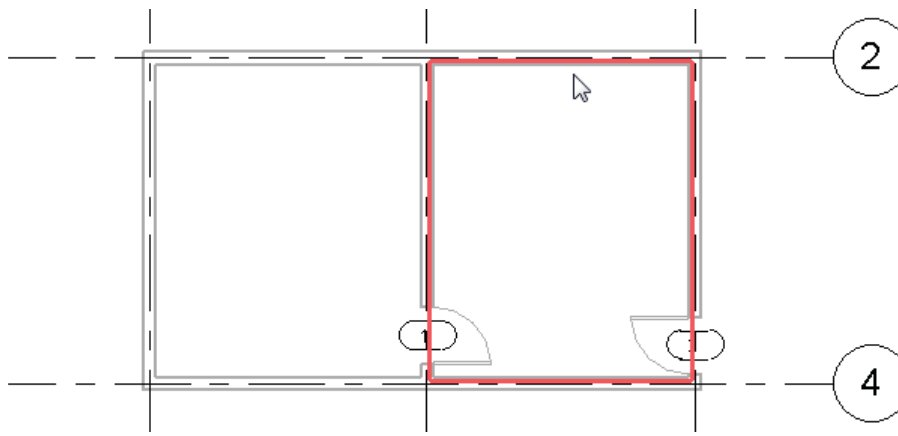


Figure 3-42 *The highlighted ceiling boundary*

Sketching a Ceiling

You can sketch a ceiling boundary to create it. To do so, choose the **Ceiling** tool from the **Build** panel; the **Modify | Place Ceiling** tab will be displayed. In this tab, choose the **Sketch Ceiling** tool from the **Ceiling** panel; the **Modify | Create Ceiling Boundary** tab will be displayed. This tab contains various tools for sketching and modifying the ceiling boundary. To start the sketch of the ceiling boundary, choose the **Boundary Line** tool from the **Draw** panel; a list box containing various drawing tools will be displayed on the right in this panel, as shown in Figure 3-43.

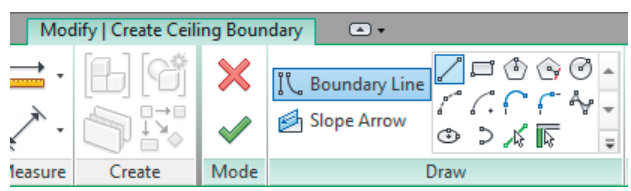


Figure 3-43 *Different sketching tools for ceiling*

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The **Line** tool is chosen by default in the **Draw** panel. You can use this tool and the other drawing and modification tools displayed in the **Modify | Create Ceiling Boundary** tab to complete the sketch. Figure 3-44 shows a ceiling boundary that is sketched using various tools displayed in the **Modify | Create Ceiling Boundary** tab.

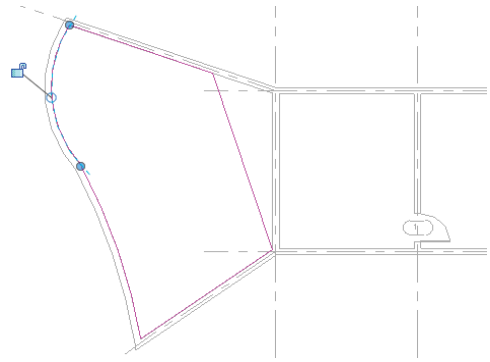


Figure 3-44 *The sketched ceiling boundary*

After completing the sketch, choose the **Finish Edit Mode** button from the **Mode** panel of the **Modify | Create Ceiling Boundary** tab; the ceiling will be created within the sketched profile. Display the section view to view the ceiling in it. The ceiling will appear at a certain height from the floor level, as shown in Figure 3-45.

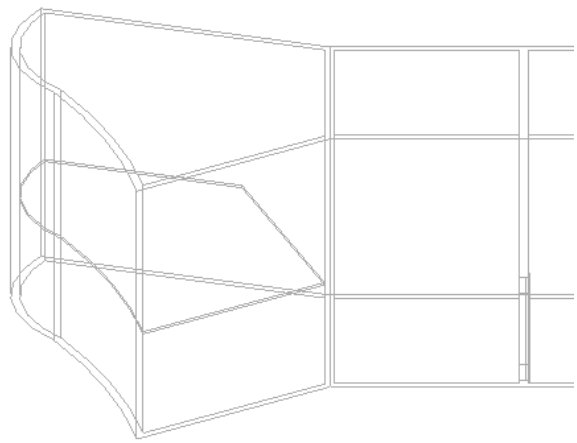


Figure 3-45 *The three dimensional view displaying the ceiling at a height*

Using the Pick Walls Method

The third method to create the ceiling is by picking the wall faces. This is a common method for creating ceilings. To do so, choose the **Ceiling** tool from the **Architecture** tab; the **Modify | Place Ceiling** tab will be displayed. In this tab, choose the **Sketch Ceiling** tool from the **Ceiling** panel; the **Modify | Create Ceiling Boundary** tab will be displayed. In this tab, choose the **Pick Walls** tool from the list box of the **Draw** panel; you will be prompted to pick the walls to define the boundary of the ceiling. Specify the offset value for the ceiling in the **Offset** edit box in the **Options Bar**. Select the **Extend into Wall (to core)** check box, if you want the offset to be measured from the core layer of the walls. Next, pick the walls to create the sketch for the

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ceiling. In the **Properties** palette, select the ceiling type from the **Type Selector** drop-down list. Next, choose the **Finish Edit Mode** button from the **Mode** panel of the **Modify | Create Ceiling Boundary** tab; the ceiling will be created.

Modifying a Ceiling

You can modify a ceiling after it has been created. To modify the ceiling, select it; the **Modify | Ceiling** tab will be displayed. From this tab, you can use various modification and editing tools to make changes on the selected ceiling. To edit the selected ceiling, you can use the editing tools such as **Copy**, **Rotate**, **Move**, and **Mirror**. You can also modify the properties of the selected ceiling based on its sketch. To do so, choose the **Edit Boundary** tool from the **Mode** panel; the **Modify | Ceiling > Edit Boundary** tab will be displayed and the sketch mode will be activated for the selected ceiling in the drawing. Now, you can modify the sketch profile by using the drag controls and other editing tools. Select the edge(s) of the ceiling boundary; the instance properties for the selected edges(s) of the ceiling profile will be displayed in the **Properties** palette. In this palette, you can enter the required values of various instance parameters for the selected edge(s) of the ceiling boundary.

You can view and edit the instance properties of a ceiling. To do so, select the ceiling from the drawing; the instance properties of the ceiling will be displayed in the **Properties** palette. This palette displays the instance parameters of the selected ceiling such as the level, height offset from level, and so on.

Being a level-based element, ceilings are created at a specified distance from the base level. This distance is specified in the **Height Offset From Level** instance parameter in the **Properties** palette. For example, to create a ceiling of 10' height for Imperial or 3000mm for Metric from Level 2, you can select it as the value for the **Level** instance parameter and enter the value **10'** for Imperial or **3000mm** for Metric in the **Height Offset From Level** instance parameter.

The **Edit Type** button in the **Properties** palette is used to invoke the **Type Properties** dialog box. Choose the **Edit Type** button; the **Type Properties** dialog box for the selected ceiling type will be displayed. In the **Type Properties** dialog box, you can create a duplicate type to create a new ceiling type. To do so, choose the **Duplicate** button; the **Name** dialog box will be displayed. In this dialog box, enter a name for the new ceiling type in the **Name** edit box and choose **OK**; the **Name** dialog box will close and new type of ceiling will be created. In the **Type Properties** dialog box, choose the **Edit** button in the **Value** column for the **Structure** type parameter to display the **Edit Assembly** dialog box. This dialog box displays the structure of the ceiling type with its various layers. The **Insert** or **Delete** button can be used to customize the new ceiling type, based on the specific project requirement.



Note

*When you select the created ceiling in the section view and choose the **Edit** button, Autodesk Revit displays the **Go To View** dialog box. You can select the view that you want to open for editing the ceiling boundary sketch.*

CREATING ROOMS

Room is a part of Revit building elements. Revit provides you the flexibility of creating rooms independent of room tags. Rooms can be created only in the plan view. You can also add rooms

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from the room schedules. Rooms and areas have the same graphical representation. Also, Revit forms the basis for creating spaces.

Adding Rooms

You can add rooms in the plan view of a specified discipline by using the **Room** tool. To do so, invoke this tool from the **Room & Area** panel, as shown in Figure 3-46; the **Modify | Place Room** tab will be displayed. Now, move the cursor inside the closed boundary that you need to define as room in the drawing; a symbol with a cross hair graphics attached to the cursor will appear. Notice that the size of this cross hair graphics will change according to the area of the room space of the closed boundary. Before you insert the room, you can select the type of room from the **Type Selector** drop-down list in the **Properties** palette. You can select any of the three options: **Room Tag**, **Room Tag With Area**, and **Room Tag With Volume** from the **Type-Selector** drop-down list. You can select the **Room Tag** option to display the inserted room with the tag only. Similarly, you can select the **Room Tag With Area** or **Room Tag With Volume** option from the **Type Selector** drop-down list to attach the room tag to the room to display the information regarding the area or volume of the room. After selecting the required option from the **Type Selector** drop-down list, choose the **Highlight Boundaries** tool from the **Room** panel of the **Modify | Place Room** tab; the **Autodesk Revit 2021** message box will be displayed informing that the room bounding elements are highlighted in the drawing. Choose the **Close** button to close the message box.

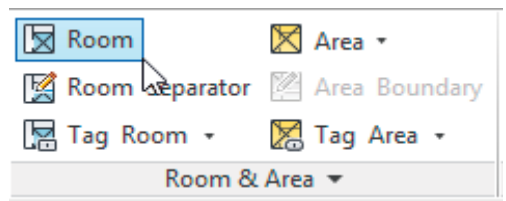


Figure 3-46 *Invoking the* ***Room*** *tool*

To add a room with a room tag, choose the **Tag on Placement** tool from the **Tag** panel. You can specify the level up to which the boundary of a room will extend vertically or in upward direction. To do so, select an option from the **Upper Limit** drop-down list in the **Options Bar**. For example, if you have added a room to the floor plan of **Level 1** and you desire to extend the room to **Level 2**, select the **Level 2** option from the **Upper Limit** drop-down list. You can extend the room boundary above the level specified in the **Upper Limit** drop-down list. To do so, click in the **Offset** edit box in the **Options Bar**. The default value displayed in this edit box is **10'** for Imperial or **3000mm** for Metric. You can enter a positive value to extend the room boundary above the level that you have selected from the **Upper Limit** drop-down list. Similarly, you can enter a negative value to extend the room boundary below the selected level. You can orient the room tag horizontally or vertically with reference to the current view, or align it with the walls and boundary lines present in the building model. To specify the orientation of the room tag, select an option from the drop-down list displayed next to the **Offset** edit box in the **Options Bar**. You can select the **Leader** check box to place the room tag with a leader.

To add a room, click in an area enclosed by the room bounding elements such as walls, as shown in Figure 3-47. The room will be added and the area of the room will be equal to the area enclosed by the walls.

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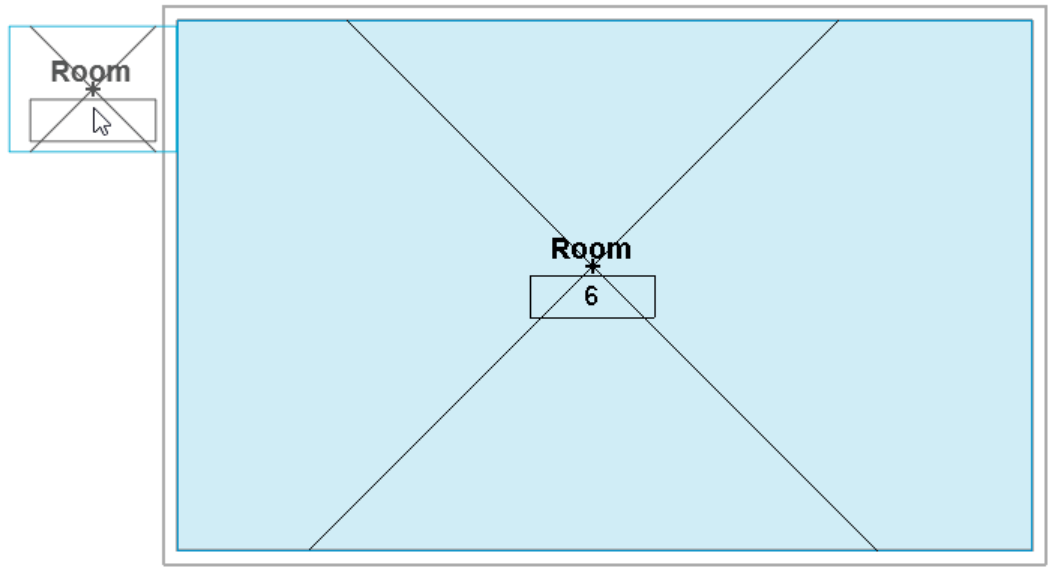


Figure 3-47 *The graphical representation of the room*

You can also add a room in a free space or in an area that is not enclosed completely, and then add walls or other room bounding elements to the room. In such an instance, the room will be created and the area of the room will be equal to the area enclosed by the walls added later. Figure 3-48 shows a room added to the area that is not enclosed and Figure 3-49 shows the room added after enclosing the area by adding a wall segment. On placing a room in a free space or in an area that is not enclosed, Revit will display a warning message that the room is not in a properly enclosed region.

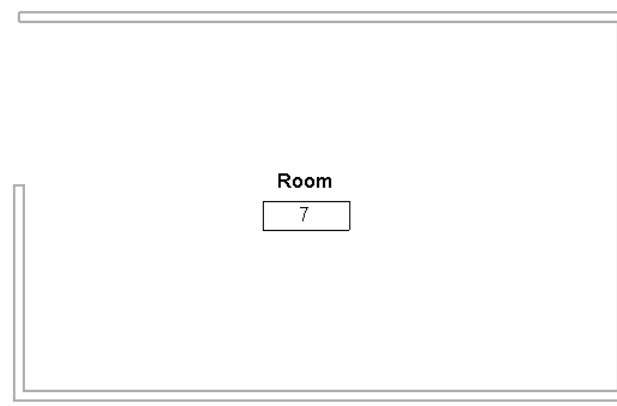


Figure 3-48 *Room added in an open boundary*

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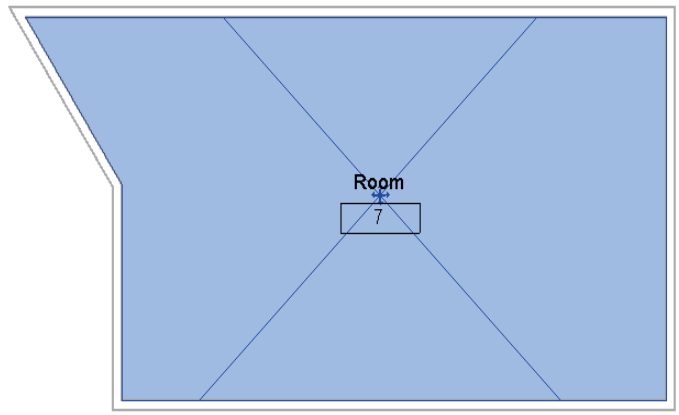


Figure 3-49 *Room created after adding the wall*

Creating Rooms from Room Schedules

Revit provides you with the flexibility to add rooms from the room schedules. You can add a new room in a room schedule and place the same room in the plan view. To do so, invoke the **Room** tool and select the room type from the **Room** drop-down list in the **Options Bar**. Next, select the room tag from the **Type Selector** drop-down list. The room types will be available in the **Room** drop-down list only when you have added rooms in a room schedule. After selecting the room type from the drop-down list, click in the drawing to place the room; the room will be added with a room tag in the drawing.



Note

*If you do not select the room type from the **Room** drop-down list in the **Options Bar**, a new room will be created and numbered after the last number of the room in the schedule.*

Room Bounding Elements

You can use different elements as room bounding elements. These elements define the boundary of the room and help in calculating the area and volume of the room. Walls, roofs, ceilings, curtain systems, floors, columns, and room separation lines can be used as room bounding elements. Revit calculates the area based on the area enclosed by room bounding elements and the room height.

Modifying Room Properties

You can modify the room properties by changing the values of the room parameters in the **Properties** palette. To do so, select the room and click when the crosshair graphics is displayed; the **Properties** palette will be displayed, as shown in Figure 3-50.

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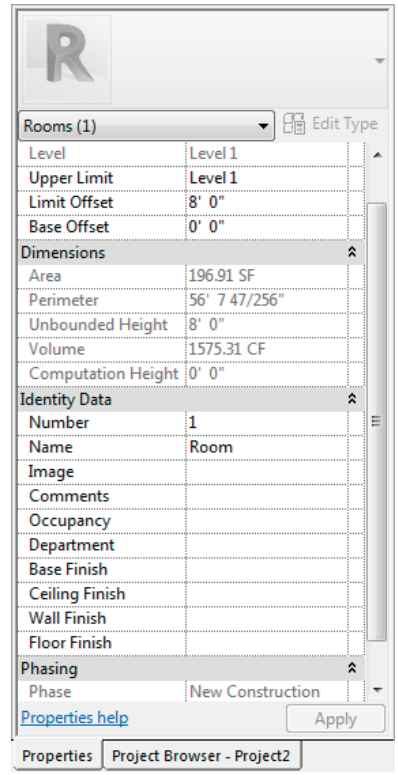


Figure 3-50 *The* ***Properties*** *palette displaying the properties of room*

Understanding Room Instance Parameters

The different instance parameters of a room are described in the table given next.

Instance Parameter	Value and Description
Level	Refers to the base level of the room. Level 1 is the default value.
Upper Limit	Refers to the upper boundary of the room. The specified level the value defines the upper limit of the room. You can select the level from the **Level** drop-down list.
Limit Offset	Refers to the value specified to be added in the level to set the total height of the room. This parameter can also have negative value.
Area	Refers to the total area calculated using the room bounding elements.
Perimeter	Refers to the perimeter of the room.

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Unbounded Height	Total height defined by the sum of the room base level, upper limit and the limit offset.
Volume	Refers to the total volume of the room. The volume is computed only when you select the **Areas and Volumes** radio button in the **Area and Volume Computations** dialog box.
Number	Refers to the room number assigned according to the number of rooms added.
Name	Refers to the room name. The default name is **Room**. You can assign any name to the room.
Comments	You can enter some specific comments or description about the room.
Occupancy	Refers to the type of occupancy for structure. You can specify occupancy as per the requirement. You can define any name for this parameter.
Base/Ceiling Finish	It is a user-defined parameter. In this parameter, you can define any type of finish for the base and the ceiling such as GWB.
Wall/Floor Finish	Refers to the finish for the walls of the room such as metal paints and coatings of the walls and tiles for the floor.
Occupant	Refers to the name of the occupant.
Phase	Refers to the name of the phase in which the room is created.

Calculating Room Volumes

To enable the room volume computations, choose the **Area and Volume Computations** tool from the **Room & Area** panel; the **Area and Volume Computations** dialog box will be displayed. In the **Volume Computations** area of the **Computations** tab, select the **Areas and Volumes** radio button. By default, the **Areas only** radio button is selected in the **Volume Computations** area. Next, choose the **OK** button; the volume computation of the room will be enabled and displayed in its instance properties. To view the computed volume of a room, select it from the drawing; the **Properties** palette will be displayed. In the **Properties** palette, the value in the value column of the **Volume** parameter shows the computed volume of the room.



Note

In Revit, the volume calculations of the room are done considering the finish face of the room-bounding element. When you select a room, the outline and the color fill display the exact periphery and the enclosed area used for calculating the volume of the room.

While computing the room volume, the room volume calculation engine of Autodesk Revit looks up and down from the measurement height to access the vertical limit of the room-bounding

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element. You can set the lower and upper limits of the room bounding elements using the **Properties** palette. The **Base Offset** parameter in the value column in this palette defines the limit of the lower boundary. It is used to limit the extent of the room with no floors or prevent floors to leak from floor openings while computing the volume of the room. The volume is also displayed in the drawing view if the rooms are added in the drawing view with the **Room Tag With Volume** option selected from the **Type Selector** drop-down list.

CUTTING OPENINGS IN A WALL, FLOOR, AND CEILING

In Autodesk Revit, you can create an opening in the wall, floor, structural floor, ceiling, and structural elements such as beams and braces. To do so, invoke any of the tools from the **Opening** panel of the **Architecture** tab, as shown in Figure 3-51. From this panel, you can choose any of these five options, **By Face**, **Wall**, **Vertical**, **Shaft**, or **Dormer** to create an opening. In Revit, to create openings, you need to change the **Discipline** parameter of view to **Architecture**.

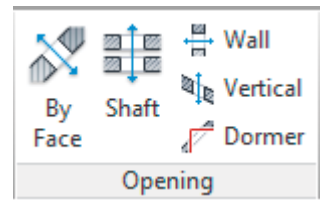


Figure 3-51 *The tools in the* ***Opening*** *panel*

Creating Openings Using the By Face Tool



You can use the **By Face** tool to create openings on the faces of floors, or ceilings in the building model. This tool is useful in a project when you need to cut an opening in a floor for stairway and in the ceiling for a chimney. To do so, invoke this tool from the **Opening** panel; you will be prompted to select a planar face of required floor, ceiling, beam, or column. Select the face on which you want to create the opening; the **Modify | Create Opening Boundary** tab will be displayed. In this tab, you can use various tools to sketch the opening in desired view. Now, open the required view and sketch the opening using the reference planes, as shown in Figure 3-52. After sketching the opening boundary on the selected face, choose the **Finish Edit Mode** button from the **Mode** panel to finish the sketch of the opening and then exit the **Modify | Create Opening Boundary** tab. Figure 3-53 shows the opening created perpendicular to the selected face.

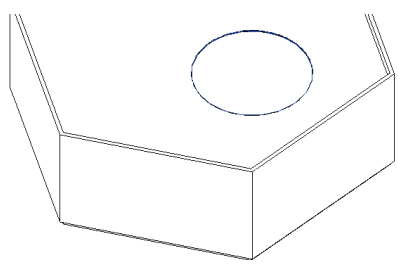


Figure 3-52 *Sketching the opening in the ceiling plan using the reference planes*

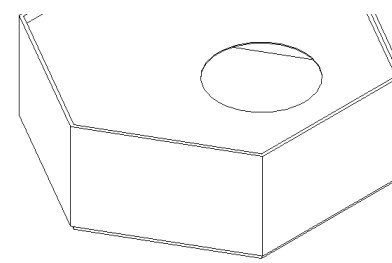
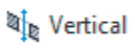


Figure 3-53 *Opening created perpendicular to the selected face*

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Creating Openings Using the Vertical Tool



To cut a vertical opening, choose the **Vertical** tool from the **Opening** panel and select the required ceiling, or floor; the **Modify | Create Opening Boundary** tab will be displayed. You can use various tools from this tab to sketch the boundary of the opening. Sketch the opening in the appropriate view using the sketching tools. After sketching the opening boundary, choose the **Finish Edit Mode** button from the **Mode** panel; a vertical opening will be created in the selected element. You can use the sketching tools to draw a sketch of appropriate size, as shown in Figure 3-54. The opening can also be viewed in the 3D view, as shown in Figure 3-55.

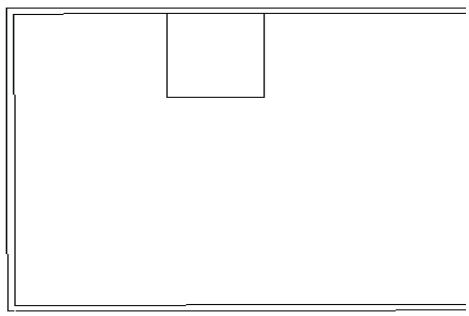


Figure 3-54 *Sketching the opening in the ceiling plan view*

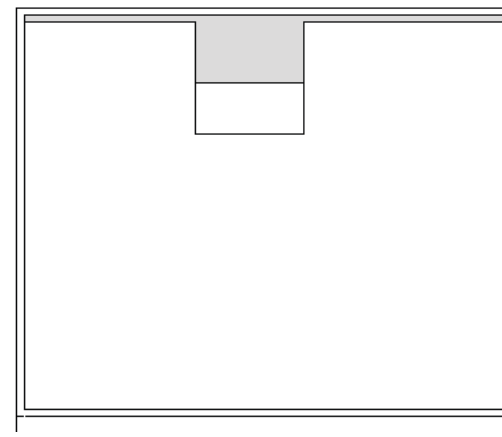


Figure 3-55 *3D view of the opening in ceiling*

Creating Openings Using the Wall Tool



To create a rectangular opening in a wall, choose the **Wall** tool from the **Opening** panel in the **MEP** tab; you will be prompted to select a wall. Select the wall in which you want to cut an opening and then sketch a rectangular opening of the required size by clicking and dragging the cursor.

Creating Openings Using the Dormer Tool



To create a dormer opening in the dormer roof, choose the **Dormer** tool from the **Opening** panel; you will be prompted to select the roof in which you want to create a dormer opening. Select the roof; the screen will enter the sketch mode. Choose the **Pick Roof/ Wall Edges** tool from the **Pick** panel of the **Modify | Edit Sketch** tab and pick the boundary of the dormer to create the dormer opening. Next, choose the **Finish Edit Mode** button from the **Mode** panel; a dormer opening will be created.



Note

The boundary that you will pick for the dormer opening in a roof should be an edge of the selected roof, wall, or both, and should form a closed loop.

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Creating Openings Using the Shaft Tool

To cut an opening up to the entire height of a building, choose the **Shaft** tool from the **Opening** panel; the **Modify | Create Shaft Opening Sketch** tab will be displayed. Choose a suitable sketching tool from this tab to create an opening of the required shape. Next, choose the **Finish Edit Mode** button from the **Mode** panel; the opening will be created passing through the entire height of the building. Make sure that before sketching the opening, you select the required work plane and the view to sketch the opening.

You can also specify the levels that will be cut by the opening. It will help you to restrict the opening to a particular level. To specify the levels, select the opening; the **Modify | Shaft Openings** tab will be displayed. Select a level for the **Base Constraint** parameter in the **Properties** palette to start the opening. Next, select a level for the **Top Constraint** parameter to end the opening. The opening will be cut through the selected levels.

TUTORIALS

Tutorial 1 Office Building I

In this tutorial, you will create the exterior and interior walls, add grids, and modify levels in office building based on the sketch plan shown in Figure 3-56. The dimensions have been given only for reference and are not to be used in this tutorial. The project file and the parameters to be used for creating the walls and for adding grids and modifying levels are given next.

(Expected time: 30 min)

1. Project file-
   For Imperial *Systems Default*
   For Metric *Systems-Default_Metric*
2. Exterior Wall type-
   For Imperial **Generic- 9”**.
   For Metric **Generic- 230mm**.
3. Interior Wall type-
   For Imperial **Generic - 5”**.
   For Metric **Generic - 90mm**.
4. Location line parameter- **Wall Centerline**; Top Constraint- **Up to Level 2**.
5. Rename Level 1 as the Ground Floor
6. Grids to be created in the plan view.
7. File name to be assigned:
   For Imperial *c03_Office_BuildingI_tut1.rvt*
   For Metric *M_c03_Office_BuildingI_tut1.rvt*

The following steps are required to complete this tutorial:

a. Open the required template file.
   For Imperial *Systems Default*
   For Metric *Systems-Default_Metric*
b. Invoke the **Wall: Architectural** tool from the ribbon.
c. Select the required exterior wall type from the **Properties** palette.
   For Imperial **Generic- 9”**
   For Metric **Generic- 230mm**

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d. Select the required interior wall type from the **Properties** palette.
   For Imperial **Generic- 5”**
   For Metric **Generic- 90mm**
e. Modify Top Constraint- **Up to Level: Level 2** and Location Line - **Wall Centerline** as wall properties using the **Properties** palette, refer to Figure 3-57.
f. Invoke the **Rectangle** tool and then sketch the exterior walls based on the given parameters, refer to Figures 3-58 through 3-63.
g. Sketch the interior walls based on the given parameters, refer to Figures 3-63 through 3-69.
h. Modify levels by renaming them, refer to Figure 3-70.
i. Add grids using the **Grid** tool, refer to Figures 3-71 through 3-73.
j. Save and close the project.

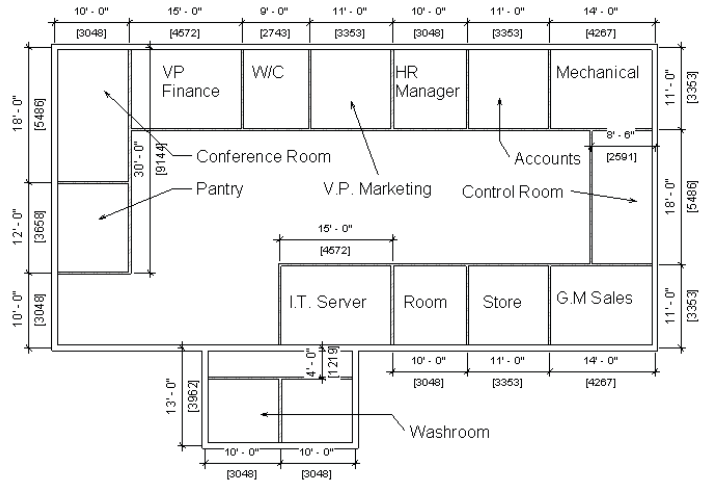


Figure 3-56 *Sketch plan for creating exterior walls for the Office Building*

Opening a New Project and Using the Template File

1. Choose **New > Project** from the **File** menu; the **New Project** dialog box is displayed.

2. In the **New Project** dialog box, choose the **Browse** button and then select the following template:
   For Imperial **Systems-Default**
   For Metric **Systems-Default_Metric**

   Next, choose the **Open** button and then the **OK** button; the desired template file is loaded. Notice that the **Project Browser** now shows several views that are preloaded in the template file.

3. In the **Project Browser**, select **1-Mech** under the **Mechanical** head, if it is not selected by default and right-click to display a flyout. From this flyout, choose **Duplicate View > Duplicate**; **1 - Mech Copy 1** is displayed under the **Mechanical** head.

4. Double click on **1 - Mech Copy 1** to display the corresponding view. Now, in the **Properties** palette, click on the value field corresponding to the **Discipline** parameter. Select the **Architectural** discipline from the drop-down list and choose the **Apply** button to apply the changes.

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5. Now, the **Architectural** head is added under the **Views (Discipline)** in the **Project Browser** and under that head, **1 - Mech Copy 1** is displayed.

6. Select the **1 - Mech Copy 1** under the **Architectural Plan** head and right-click to display a flyout. From the flyout, choose the **Rename** option; the edit box is displayed. Enter **Level 1** in the edit box and choose the **OK** button; the dialog box is closed and the view is renamed to **Level 1**.

7. Repeat the procedure followed in steps 3 through 6 to duplicate another level as **Level 2** from **Mechanical** head into **Architectural** head, as shown in Figure 3-57.

8. In the **Project Browser**, select **East-Mech** under the **Mechanical** head and **Elevations** sub-head of the **Mechanical** head and right-click to display a flyout. From this flyout, choose **Duplicate View > Duplicate**; **East - Mech Copy 1** is displayed under the **Elevations** sub-head in the **Mechanical** head.

9. Double-click on **East - Mech Copy 1** to display the corresponding view. Now, in the **Properties** palette, click on the value field corresponding to the **Discipline** parameter. Select the **Architectural** discipline from the drop-down list and choose the **Apply** button to apply the change.

10. Now, in the **Project Browser** window, **East - Mech Copy 1** is displayed under the **Views (Discipline) > Architectural > Elevations (Building Elevation)**.

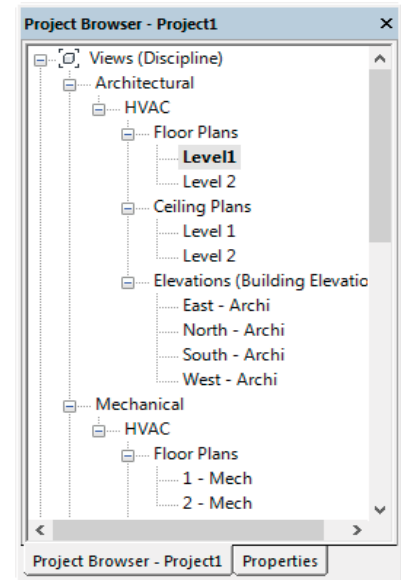


Figure 3-57 *The* ***Properties*** *Palette displaying other views under the* ***Elevations*** *sub-head*

11. Select **East - Mech Copy 1** under the **Architectural Plan** head and right-click to display a flyout. From the flyout, choose the **Rename** option; the edit box is displayed. Enter **East - Archi** in the edit box and choose the **OK** button; the dialog box is closed and the view is renamed to **East - Archi**.

12. Repeat the procedure followed in steps 8 through 10 to add other views under the **Elevations** sub-head, refer to Figure 3-57.

Invoking the Wall: Architectural Tool and Selecting the Wall Type

In this section, you will sketch an architectural wall using the **Wall** tool.

1. Double-click on the **Level 1** view under the **Views (Discipline) > Architectural > HVAC > Floor Plans**; the corresponding view is displayed.

2. Invoke the **Wall: Architectural** tool from the **Architecture > Build > Wall** drop-down; the **Modify | Place Wall** tab is displayed.

3. In the **Type Selector** drop-down list of the **Properties** palette, select the **Generic - 8"** wall type for Imperial or **Generic - 200mm** wall type for Metric unit system.

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4. In the **Properties** palette, choose the **Edit Type** button; the **Type Properties** dialog box is displayed.

5. Choose the **Duplicate** button from the upper right corner of this dialog box; the **Name** dialog box is displayed. Enter **Generic- 9"** for Imperial (**Generic- 230mm** for Metric system) in the **Name** edit box and then choose the **OK** button; the dialog box is closed and the **Generic - 9"** for Imperial system (**Generic - 230mm** for Metric system) is selected in the **Type** drop-down list.

6. Now, choose the **Edit** button from the value field corresponding to the **Structure** parameter; the **Edit Assembly** dialog box is displayed.

7. In the **Edit Assembly** dialog box, click on the value field of the **Thickness** column corresponding to the **Structure[1]** function parameter. Enter **9"** for Imperial or enter **230mm** for Metric and then choose the **OK** button; the **Edit Assembly** dialog box is closed.

8. Now, choose **OK** button; the **Type Properties** dialog box is closed and the **Generic - 9"** wall type is selected in Imperial system or **Generic - 230mm** is selected in the **Type Selector** drop-down list.

Modifying the Properties of the Exterior Wall

After sketching the wall type, you need to modify the instance properties of the wall type using the **Properties** palette.

1. In the **Properties** palette, ensure that the **Location Line** parameter has **Wall Centerline** as the default value. Click in the value field of the **Top Constraint** instance parameter; a drop-down list is displayed. Select **Up to Level: Level 2** from the drop-down list displayed, as shown in Figure 3-58 and choose the **Apply** button.

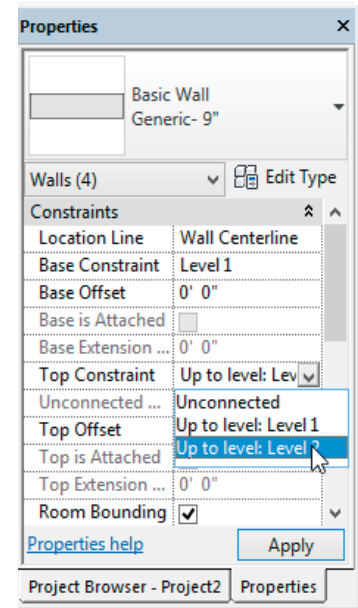


***Figure 3-58** Setting the **Top Constraint** parameter using the **Properties** palette*

Sketching the Exterior Wall Segment

In this section, you will sketch the exterior wall segment.

1. Invoke the **Rectangle** tool from the **Draw** panel of the **Modify | Place Wall** tab.

2. Click between the four elevation symbols in the drawing area to specify the first point. Next, move the cursor toward bottom right to draw a rectangle. On doing so, a rectangle starts creating from a specified point. Now, click to specify the endpoint, as shown in Figure 3-59.

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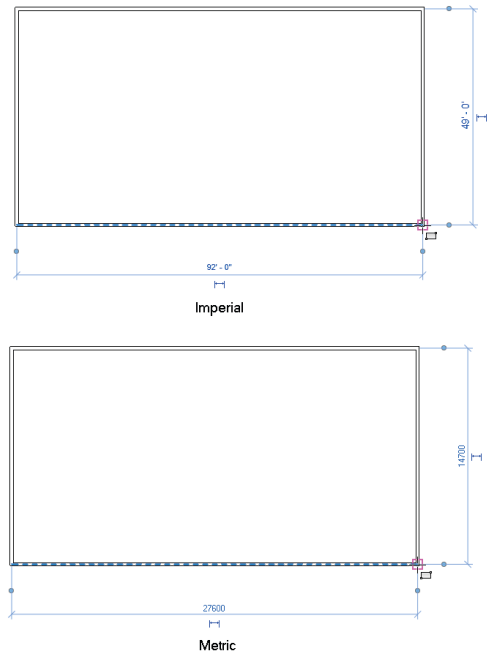


Figure 3-59 *The temporary dimensions being displayed on the sketched wall*

3. Click on the temporary dimension of the horizontal wall displayed; an edit box appears showing the current dimension of the wall segment.

4. Enter **80'** for Imperial or **24000 mm** for Metric in the edit box and then press ENTER; the length of the horizontal wall is modified to the entered value.

5. Similarly, click on the temporary dimension of vertical wall; an edit box appears. Enter **40'** for Imperial or **12000 mm** for Metric in the edit box and then press ENTER; the length of the vertical wall is modified to the entered value. Press ESC twice to exit the **Modify | Walls** tab.

   The external wall profile is drawn with the specified dimensions, as shown in Figure 3-60.

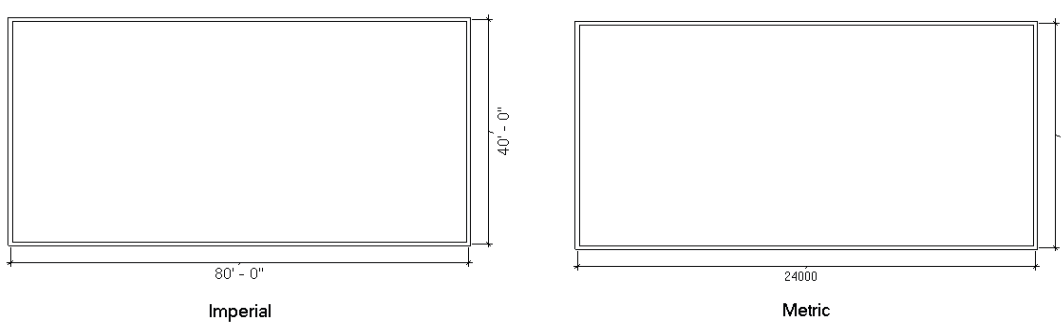


Figure 3-60 *The completed exterior wall segment of Office Building*

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Sketching Other Exterior Wall Segments

In this section, you need to create other exterior wall segments.

1. Choose the **Wall: Architectural** tool from the **Architecture > Build > Wall** drop-down; the **Modify | Place Wall** tab is displayed.

2. Choose the **Line** tool from the **Draw** panel of the **Modify | Place Wall** tab. Ensure that the **Chain** check box is selected in the **Options Bar**. Now, place the cursor to the lower left corner of the wall and move toward right. When temporary dimension appears, enter **20**' for Imperial or enter **6000 mm** for Metric and then press ENTER.

3. Draw **13'0"** line in Imperial system or **3900 mm** line in Metric system from that point in downward direction, as shown in Figure 3-61.

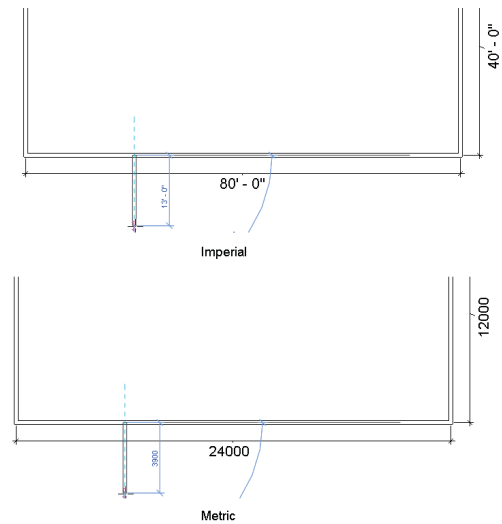


Figure 3-61 *The other exterior wall segment created outside the Office Building*

4. After drawing the line, the wall starts creating dynamically with one end attached to the specified point and the other end attached to the cursor. Move the cursor horizontally toward the right so that you see a dashed horizontal line inside the wall segment. Now, enter **20'0"** for Imperial or **6000 mm** for Metric as the value of the length; an edit box is displayed with the dimension you have entered, as shown in Figure 3-62.

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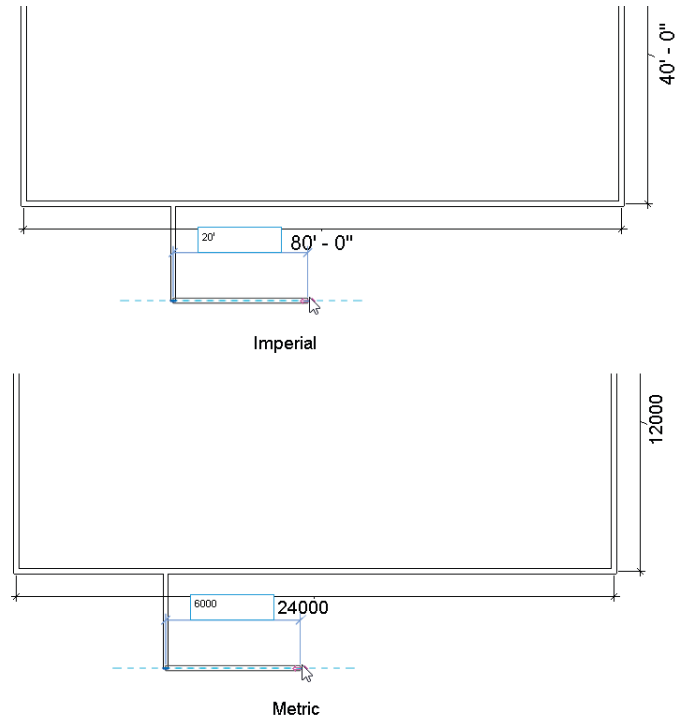


Figure 3-62 *Creating the second exterior wall segment*

5. Now you need to draw the third wall segment. To do so, move the cursor upward and enter **13'** for Imperial or enter **3900 mm** for Metric as the value of the length and press ENTER. The other exterior wall segments are created, as shown in Figure 3-63.

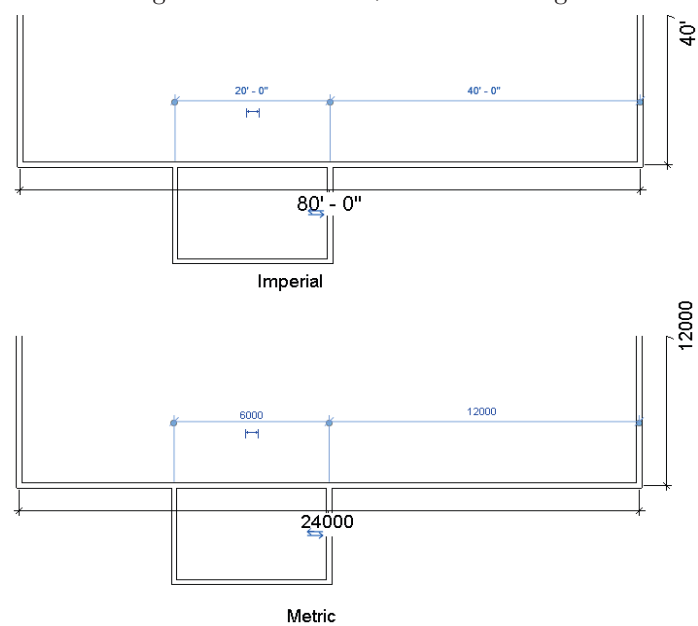


Figure 3-63 *The completed exterior profile of Office Building*

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6. Now, press ESC or choose the **Modify** button to clear the selection.

Selecting the Interior Wall Type

In this section, you will select the interior wall type.

1. Invoke the **Wall: Architectural** tool; the wall instance parameters are displayed in the **Properties** palette. In this palette, select the required wall type from the **Type Selector** drop-down list, as shown in Figure 3-64.
   For Imperial **BasicWall Generic - 5”**
   For Metric **BasicWall Generic - 90mm**

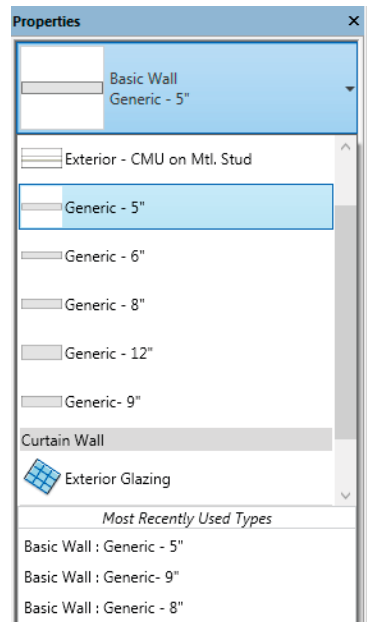


Figure 3-64 *Selecting the interior wall type from the* ***Type Selector*** *drop-down list*

2. In the **Options Bar**, select the **Wall Centerline** option from the **Location Line** drop-down list, if it is not selected by default.

Sketching Other Interior Walls

Next, you will sketch other horizontal or vertical interior walls by specifying their start point and end point using different object snap options.

1. Move the cursor near the top left end of the wall and then start moving the cursor horizontally toward the right. Enter **10’0”** for Imperial or **3000 mm** for Metric when the temporary dimensions and the intersection object snap appear, as shown in Figure 3-65. Now, press ENTER; the starting point of the first interior wall is specified.

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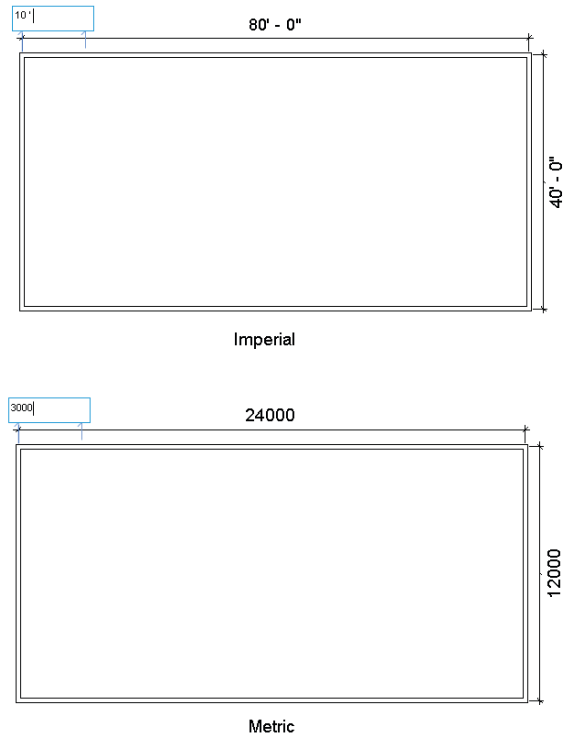


Figure 3-65 *Specifying the distance for starting the first interior wall segment*

2. Next, move the cursor vertically downward and enter **30'** for Imperial (**9000 mm** for Metric) and close the wall segment, as shown in Figure 3-66; the interior wall segment is sketched.

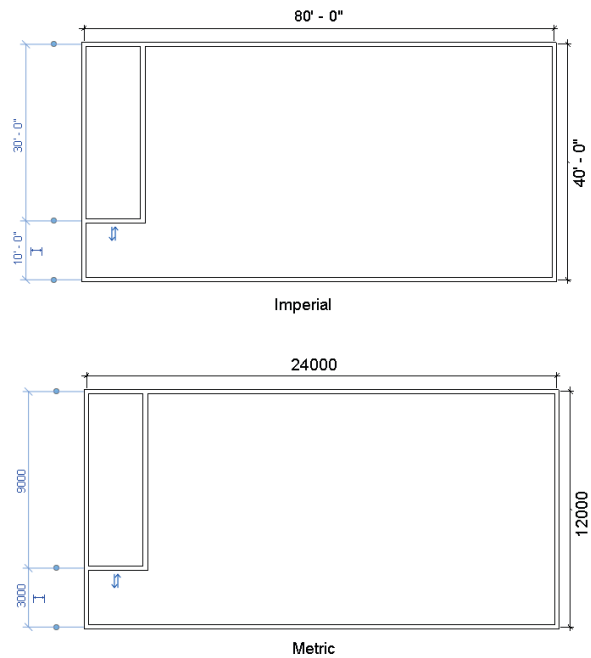


Figure 3-66 *Specifying the first interior wall segment*

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3. To sketch the second interior wall, move the cursor to the upper endpoint of the interior wall you just created and then move the cursor vertically downward. Enter 11'0" for Imperial or 3300 mm for Metric when the temporary dimension and the intersection object snap appears as shown in Figure 3-67.

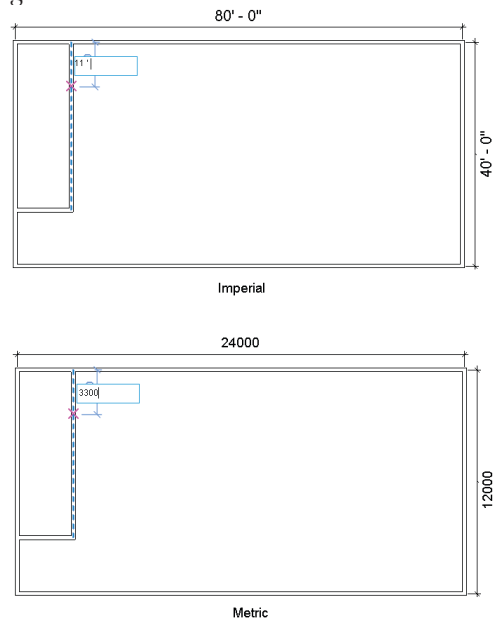


Figure 3-67 *Specifying the starting point of second interior wall segment*

4. Press SHIFT and move the cursor toward right near the right exterior wall segment. Now, click to specify the location of the endpoint of the wall segment; the second interior wall segment is sketched, as shown in Figure 3-68.

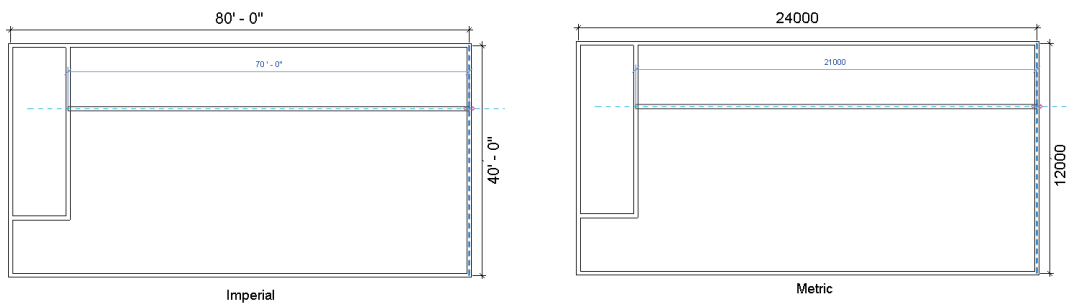


Figure 3-68 *Sketching the second interior wall*

5. To sketch the third interior wall, place the cursor toward the lower right corner of the wall segment and move the cursor upward. Enter **11'0"** for Imperial or **3300** mm for Metric and then press ENTER, as shown in Figure 3-69; the starting point of the interior wall is specified.

6. Next, move the cursor in a horizontal direction toward the left. Enter **50'0**" for Imperial and **15000** for Metric and then press ENTER, as shown in Figure 3-70. Ensure that the **Chain**

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option is selected. Now, move the cursor vertically downward near the lower exterior wall segment; the interior wall segment is sketched, as shown in Figure 3-71.

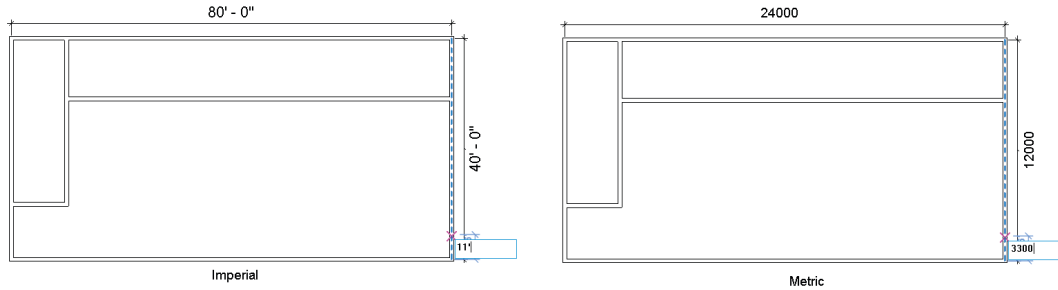


Figure 3-69 *Specifying the distance for starting the first interior wall segment*

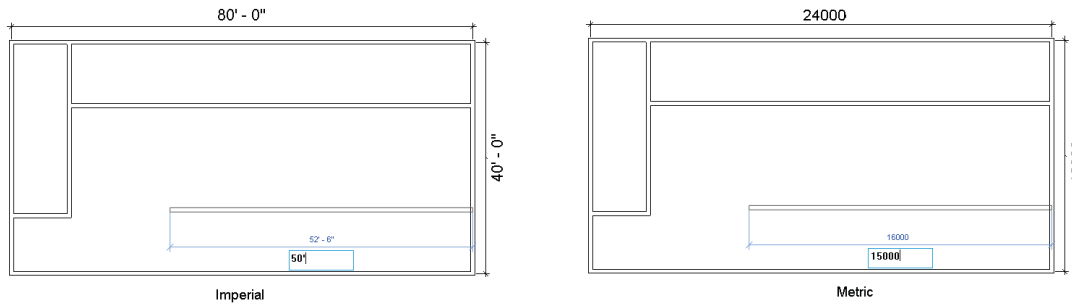


Figure 3-70 *Specifying the distance for starting the interior wall segment*

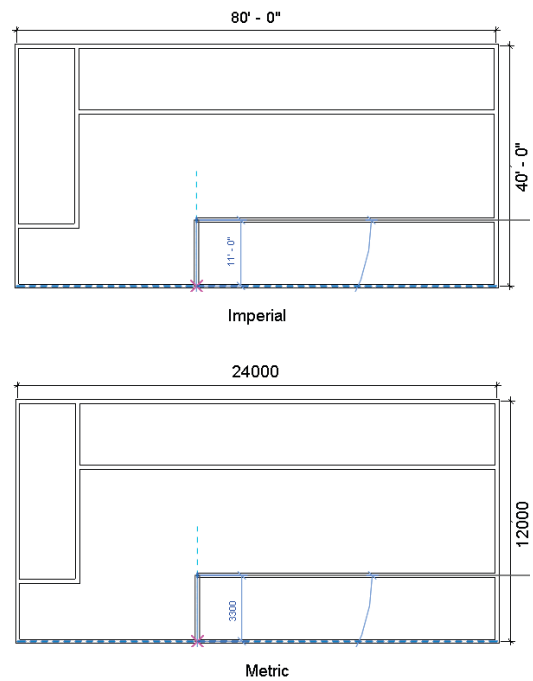


Figure 3-71 *Sketched wall segment*

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7. Similarly, you can draw other interior walls by using the **Line** tool, refer to Figure 3-72.

8. Choose the **Modify** button to exit the tool.

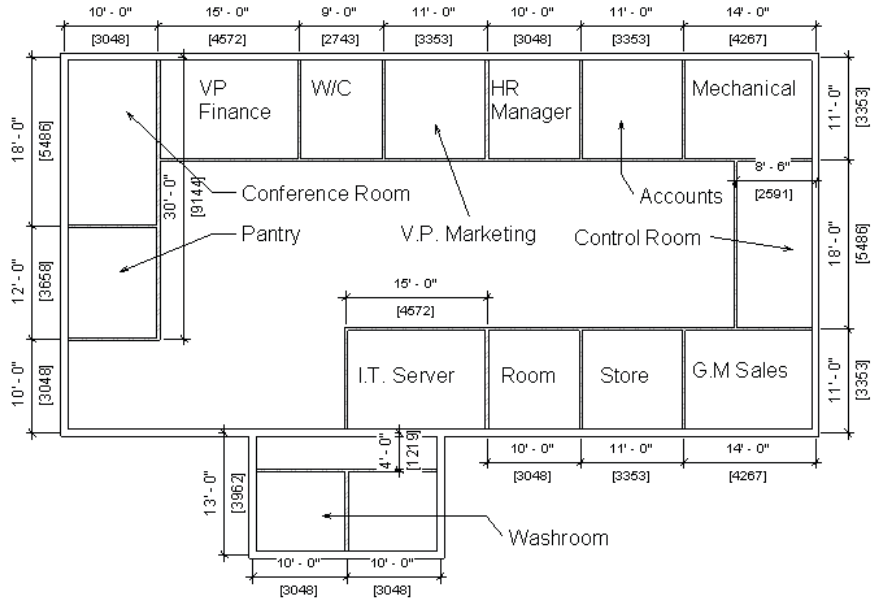


Figure 3-72 *Layout of internal walls for Office Building*

Modifying Levels

In this section, you will invoke the **Level** tool in the elevation view.

1. In the **Project Browser**, double-click on the **North - Archi** under the **Elevations (Building Elevation)** head; the north elevation is displayed within the existing levels in the drawing window.

2. Choose the **Zoom in Region** tool from the Navigation Bar to enlarge the right portion of the elevation showing the levels, refer to Figure 3-73.

3. To rename the levels, move the cursor over **Level 1** in the **Project Browser** and right-click; a shortcut menu is displayed.

4. Choose the **Rename** option from the shortcut menu; the edit box is displayed.

5. In the displayed edit box, enter **Ground Floor** and choose the **OK** button; you are prompted to verify whether you want to rename the corresponding levels and views.

6. Choose the **Yes** button to rename the level and views. The level is immediately renamed in the elevation view.

7. Similarly, rename the **Level 2** as **Roof** , as shown in Figure 3-73.

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Figure 3-73 *Renamed levels and views for the Office Building*

Creating Grid Lines

You can use the plan view to add grids to the project using the **Grid** tool. Grids are automatically numbered as they are created. Now, you will create Grids in the sequence as shown in the sketch plan.

1. Double-click on **Ground Floor** from the **Floor Plans** head in the **Project Browser** to display the ground floor plan in the drawing window.

2. Next, choose the **Grid** tool from the **Datum** panel of the **Architecture** tab; the **Modify | Place Grid** tab is displayed.

3. Now, ensure that the **Line** tool is chosen in the **Draw** panel.

4. Move the cursor near the top left corner of the exterior wall profile till a vertical extension line is displayed. Click to specify the start point of the grid line when the temporary dimension of **3'0"** for Imperial or **900 mm** for metric is displayed from the centerline of the exterior wall, as shown in Figure 3-74.

5. Move the cursor vertically downward and click outside the south wall to specify the endpoint of the grid line, as shown in Figure 3-75.



Note

If grid lines are not visible in the drawing, choose the ***Visibility/Graphics*** *tool from the* ***Graphics*** *panel of the* ***View*** *tab to display the* ***Visibility/Graphic Overrides for Floor Plan*** *dialog box. In the* ***Annotation Categories*** *tab of this dialog box, select the* ***Grids*** *check box; the grid lines will become visible.*

The same procedure can be followed to draw grid lines for the interior walls. As the thickness of the interior wall is 5" or 90 mm, you can specify 2 1/2" or 64 mm as the offset distance to draw grid lines for the interior walls.

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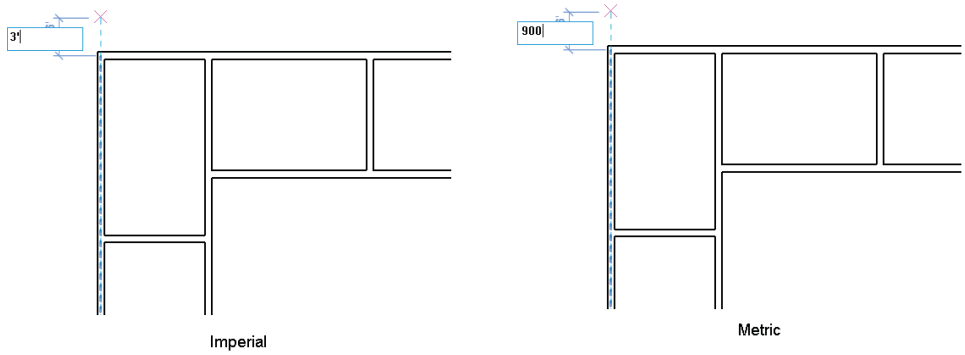


Figure 3-74 *Specifying the start point of the grid line*

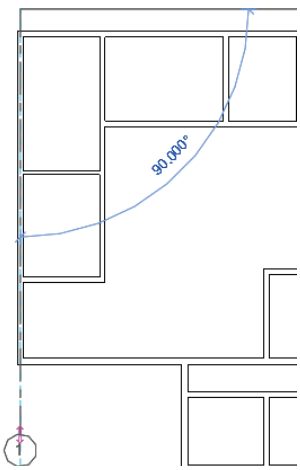


Figure 3-75 *Specifying the grid line drawn at first point*

6. Repeat steps 3, 4, and 5 to create other vertical and horizontal grid lines in the sequence of their numbers using the **Pick Line** tool. After adding grid lines, press ESC twice to exit. Figure 3-76 shows the floor plan after adding grid lines.

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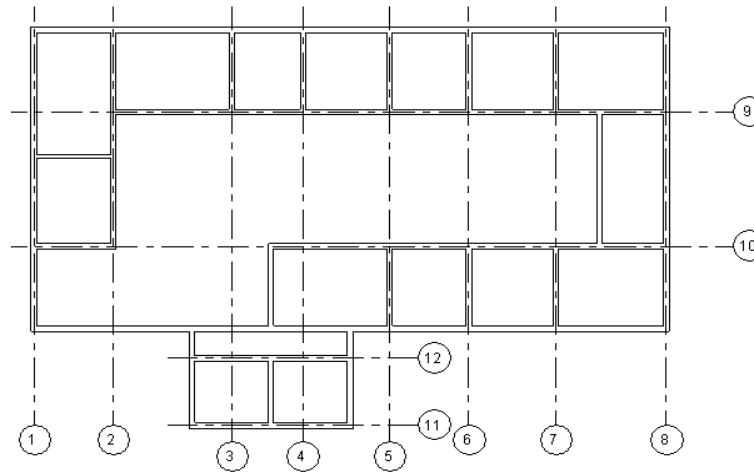


Figure 3-76 *The horizontal and vertical grid lines created for wall centerline*

Note

You can rename a grid by selecting it from the drawing and then entering a value corresponding to the value column for the ***Name*** *parameter in the* ***Properties*** *palette. The entered value will be the new name of the grid.*

This completes the tutorial for creating walls, adding grids, and modifying levels of the building envelope project.

Saving the Project

In this section, you need to save the project and the settings using the **Save As** tool.

1. Choose **Save As > Project** from the **File** menu; the **Save As** dialog box is displayed.

2. In this dialog box, browse to *C:\rmp_2021\c03_rmp_2021_tut* and then enter **c03_Office_BuildingI_tut1** for Imperial or **M_c03_Office_BuildingI_tut1** for Metric in the **File Name** edit box.

3. Now, choose the **Save** button; the **Save As** dialog box closes and the project file is saved**.**

Closing the Project

1. Choose the **Close** option from **File** menu**.**

Tutorial 2 Office Building II

In this tutorial, you will add doors and windows and also add a floor and a ceiling to the *c03_Office_BuildingI_tut1.rvt* project file for Imperial or *M_c03_Office_BuildingI_tut1.rvt* project file for Metric created in Tutorial 1 of Chapter 3. Refer to Figure 3-77 for adding these elements. The dimensions and the text have been given for reference and are not to be added. The project file name and parameters to be used are given next. **(Expected time: 30 min)**

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1. Project File created in Tutorial 1 of Chapter 3.
   For Imperial *c03_Office_BuildingI_tut1.rvt*
   For Metric *M_c03_Office_BuildingI_tut1.rvt*

2. Door types to be used
   For Imperial 1 and 17- **Double - Panel 1**: **72" x 78"**
   2 and 3- **Single - Flush: 30" x 84"**
   4,5 and 6 **Single - Flush Vision: 36" x 84"**
   7- **Single- Glass 1: 36" x 84"**
   8 to 16- **Single - Decorative 2: 36" x 84"**

   For Metric 1 and 17- **M_Door-Exterior-Double 1800 x 2100mm**
   2 and 3- **M_Door-Passage-Single-Flush 750 x 2100mm**
   4,5 and 6 **M_Door-Passage-SingleVision_Lite 900 x 2100mm**
   7- **M_Door-Passage-Single-Full_Lite 900 x 2100mm**
   8 to 16- **M_Door-Passage-Single-Two_Lite 900 x 2100mm**

3. Window types to be used
   For Imperial Fixed- **24" x 48"**
   Fixed- **60" x 48"** (with modified width)

   For Metric M_Fixed- **0610 x 1220 mm**
   M_Fixed- **1524 x 1220 mm** (with modified width)

4. Floor type:
   For Imperial **Generic 12"**, Extents- to wall core.
   For Metric **Generic 300 mm**, Extents- to wall core.

5. Ceiling type:
   For Imperial **Generic**, Level- 8'6" from the floor level.
   For Metric **Generic**, Level- 2590 mm from the floor level.

6. File name to be assigned:
   For Imperial *c03_Office_BuildingII_tut2.rvt*
   For Metric *M_c03_Office_BuildingII_tut2.rvt*

The following steps are required to complete this tutorial:

a. Open the required file and hide the annotation tag such as grids.
   For Imperial *c03_Building-EnvelopeI_tut1.rvt file*
   For Metric *M_c03_Building-EnvelopeI_tut1.rvt file*
b. Add doors by invoking the **Door** tool and selecting the type of door from the **Type Selector** drop-down list, refer to Figures 3-78 through 3-81.
c. Invoke the **Window** tool. Select the window type by using the **Type Selector** drop-down list.
d. Place the windows, as shown in Figure 3-77.
e. Place the windows at the exact location as per the given dimensions, refer to Figures 3-82 through 3-86.
f. Create the floor using the **Floor** tool, refer to Figures 3-88 through 3-90.
g. Create the ceiling using the **Ceiling** tool.

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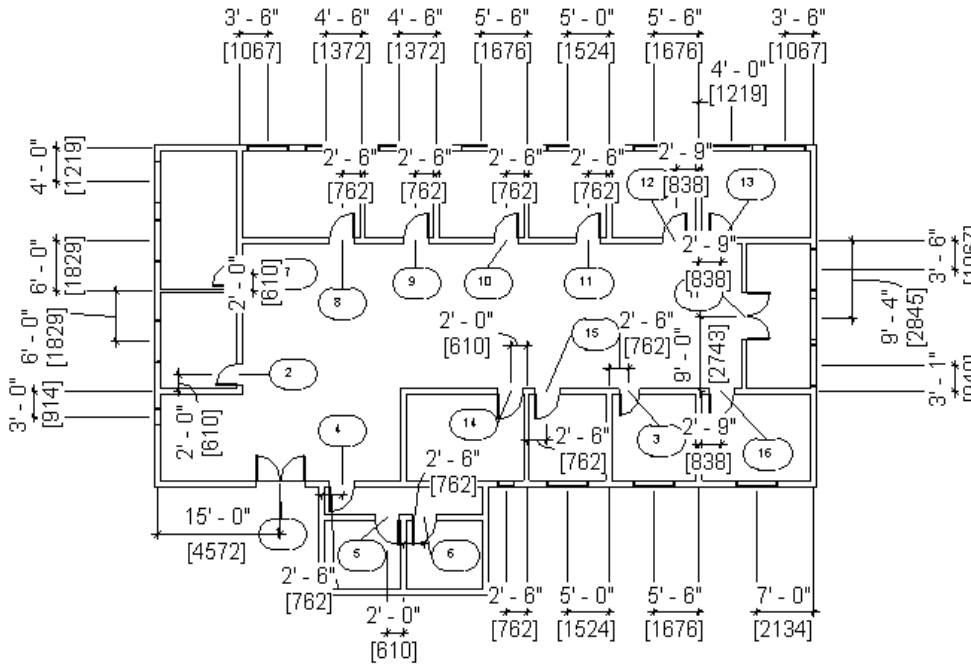


Figure 3-77 *Sketch for adding doors and windows to the Office Building project*

Opening the Existing Project and Hiding Annotation Tags

In this section, you will open the specified project and then hide the annotation symbols and tags such as grids using the **Visibility/Graphics** tool.

1. Choose **Open > Project** from the **File** menu and open the *c03_Office_BuildingI_tut1.rvt* project file for Imperial or *M_c03_Office_BuildingI_tut1.rvt* for Metric created in Tutorial 1 of Chapter 3. You can also download this file from *https://www.cadcim.com*. The path of the file is as follows: *Textbooks > Civil/GIS > Revit MEP > Exploring Autodesk Revit 2021 for MEP*.

2. Now, to hide the annotation symbols and tags such as grids, choose the **Visibility/Graphics** tool from the **Graphics** panel of the **View** tab; the **Visibility/Graphics Overrides for Floor Plan: Ground Floor** dialog box is displayed.

3. Choose the **Annotation Categories** tab from this dialog box, and clear the check box corresponding to the **Grids** under the **Visibility** column.

4. Now, choose the **Apply** button and then the **OK** button; the **Visibility/Graphics Overrides for Floor Plan: Ground Floor** dialog box is closed and the specified settings are applied to the plan view of the Ground Floor.

Adding Doors

In this section, you need to add doors at an approximate location and then modify their location by specifying the exact dimension. You will use the **Load Family** tool to load the desired door type in the project.

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1. Invoke the **Door** tool from the **Build** panel of the **Architecture** tab. Alternatively, type **DR**; the **Revit** window is displayed prompting you to load the door family, as no door family is loaded in the Revit.

2. Choose the **Yes** button; the **Load Family** dialog box is displayed.

3. In the **Load Family** dialog box, load doors for Imperial from **English-Imperial>Doors** and for Metric, load doors from **English>Doors :**

   For Imperial
   1- **Double-Panel 1: 72" x 78"**
   2- **Single-Flush: 30" x 84"**
   3- **Single-Flush Vision: 36" x 84"**
   4- **Single-Glass 1: 36" x 84"**
   5- **Single-Decorative 2: 36" x 84"**

   For Metric
   1- **M_Door-Exterior-Double 1800 x 2100mm**
   2- **M_Door-Passage-Single-Flush 750 x 2100mm**
   3- **M_Door-Passage-SingleVision_Lite 900 x 2100mm**
   4- **M_Door-Passage-Single-Full_Lite 900 x 2100mm**
   5- **M_Door-Passage-Single-Two_Lite 900 x 2100mm**

4. On invoking the **Door** tool, the properties of the door to be added are displayed in the **Properties** palette. In the palette, select the desired type of door from the **Type Selector** drop-down list.

   For Imperial **Single-Flush: 30" x 84"**
   For Metric **M_Door-Passage-Single-Flush 750 x 2100mm**

5. Before placing the door, ensure that the **Tag on Placement** tool is not selected in the **Tag** panel of the **Modify | Place Door** tab.

6. Move the cursor close to the interior wall of the pantry area to display the door symbol, as shown in Figure 3-78. Notice that as you move the cursor, the side of the door is changed. Click on the interior wall; the door is created at the specified location along with a tag on it.

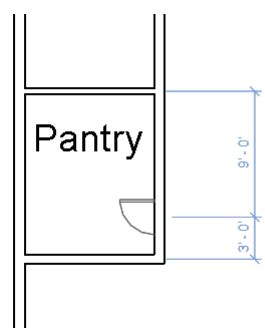


Figure 3-78 *Specifying the location of the pantry door*

7. To move the door to the exact location, choose the **Modify** button in the **Select** panel of the **Modify | Place Door** tab and select the door added to the drawing; the selected door gets highlighted in blue and the controls and the related temporary dimensions are displayed in it.

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8. Since the location of the door is given with reference to the side interior wall, click on the lower temporary dimension, and then enter **2'0"** for Imperial or **600 mm** for Metric, as shown in Figure 3-79. Next, press ENTER; the door moves to the specified location.

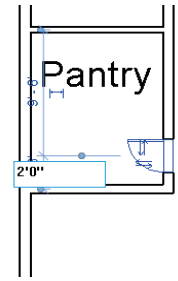


Figure 3-79 *Moving the door to the exact location*

9. Choose the **Modify** button from the **Select** panel and then select the door inserted in the drawing; the door gets highlighted and its controls are displayed. Next, flip the door swing, as shown in Figure 3-80.

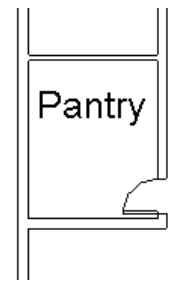


Figure 3-80 *Flipping the door*

10. To place the door type at the entrance, invoke the **Door** tool from the **Build** panel; the **Modify | Place Door** tab is displayed.

11. In the **Type Selector** drop-down list, select the desired door type, as specified in the project parameters.

For Imperial	**Double - Panel 1: 72" x 78"**
For Metric	**M_Door-Exterior-Double 1800 x 2100mm**

12. Move the cursor near the exterior wall side near to the washroom, as shown in Figure 3-81, and click to add the entrance door close to this location.

13. Choose the **Modify** button and select the door and then click on the right side dimension to set it to **5'0"** for Imperial or **1500 mm** for Metric, as specified in Figure 3-81.

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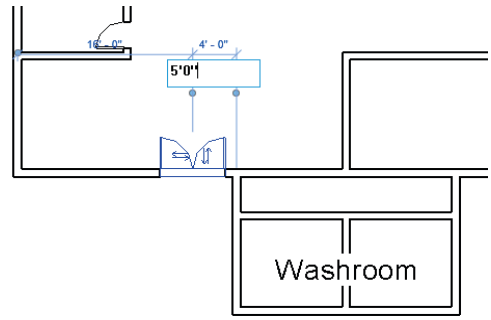


Figure 3-81 *Using the dimension to place the door at the exact location*

14. Add the other types of door in other areas at a specified distance from the internal wall, refer to Figure 3-77.

Tip

Doors and door openings can also be added to 3D view, sections, and elevations. However, you need to choose an appropriate view to place the door. You can use the temporary dimensions to place the door at the exact location. If the door is not placed correctly, Autodesk Revit alerts you about the conflict and prompts you to take an appropriate action.

Adding Windows

In this section, you will add windows to the building envelope project.

1. Invoke the **Window** tool from the **Build** panel of the **Architecture** tab; Revit window is displayed prompting you to load a family as no window family is loaded. Choose the **Yes** button; the **Load Family** dialog box is displayed.

2. In the **Load Family** dialog box, select the **Fixed** family type from the **Windows** folder of the **English-Imperial** folder or **M_Fixed** for Metric from the **English** folder. Next, choose the **Open** button; the dialog box is closed.

3. Click on the **Type Selector** drop-down list to view the in-built window types. To create the window number 1, select the desired window type from the drop-down list.

   For Imperial **Fixed 24" x 48"**
   For Metric **Fixed 0610 x 1220 mm**

4. Move the cursor close to the exterior wall of the reception to display window symbol, as shown in Figure 3-82. Add the window by clicking on the inner face of the exterior wall; the window is created at the specified location.

5. To move the window to the exact location, choose the **Modify** button from the **Select** panel and then select the window from the drawing; it gets highlighted in blue and its controls are displayed.

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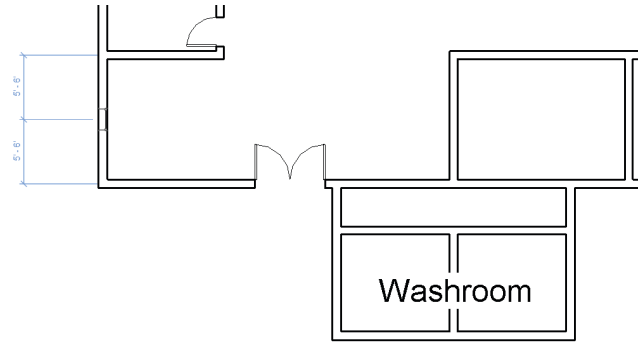


Figure 3-82 *Adding the window at the Reception area*

6. Click on the upper temporary dimension and enter **3'0"** for Imperial or **900 mm** for Metric, as shown in Figure 3-83. Press ENTER; the window is moved to the specified location. Similarly, add other windows of the same type near the internal wall of the I.T. Server room (mentioned in Tutorial 1) by invoking the **Window** tool from the **Build** panel, refer to Figure 3-77.

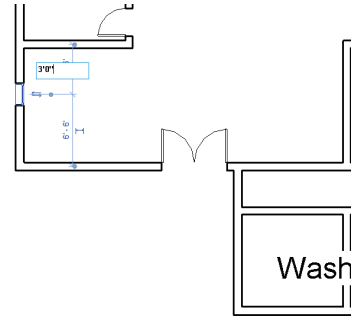


Figure 3-83 *Specifying the exact location of the window*

7. After adding the window in internal wall of the IT Server room, you need to move it to the exact location. To do so, select the window; it is highlighted in blue. Click on the left temporary dimension; an edit box is displayed. Enter **2'0"** for Imperial or **600 mm** for Metric in the edit box, as shown in Figure 3-84, and then press ENTER; the window is moved to the desired location. Press ESC and exit.

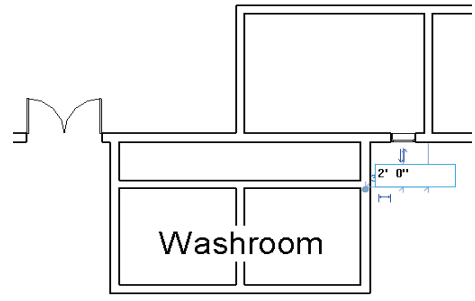


Figure 3-84 *Specifying the location of the IT Server window*

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Now, you need to add the windows of type 2 in the drawing. These windows have a modified width of 5'0" in Imperial or 1500 mm for Metric. To add these windows, select the **Fixed: 24" x 48"** window type in Imperial system, **Fixed: 0610 x 1220 mm** window type in Metric system and then create its duplicate. Modify its width to 5'0" for Imperial or 1500 mm for Metric by using the **Type Properties** dialog box and add the window at the desired location.

8. Invoke the **Window** tool from the **Build** panel of the **Architecture** tab; the **Modify | Place Window** tab is displayed.

9. In the **Type Selector** drop-down list, select the **Fixed: 24" x 48"** window type for Imperial or **Fixed: 0610 x 1220 mm** window type for Metric. Next, choose the **Edit Type** button in the **Properties** palette; the **Type Properties** dialog box is displayed.

10. In this dialog box, choose the **Duplicate** button; the **Name** dialog box is displayed. In the **Name** edit box, enter **60" x 48"** for Imperial or enter **1524 x 1220 mm** for Metric and then choose the **OK** button.

11. In the **Value** field for the **Width** type parameter, enter **5'0"** for Imperial or **1524mm** for Metric and then choose the **Apply** and **OK** buttons to close the **Type Properties** dialog box and return to the drawing window.

    Notice that the **Fixed: 60" x 48"** window type in Imperial or **Fixed: 1524 x 1220 mm** window type in Metric is added to the **Type Selector** drop-down list.

12. Move the cursor near the exterior wall of the pantry and click to place the window, as shown in Figure 3-85. Press ESC twice to exit.

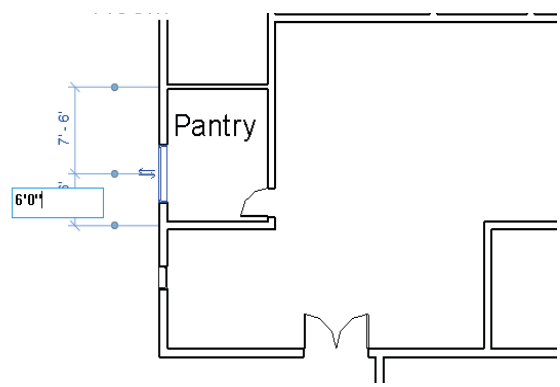


Figure 3-85 *Specifying the location of the bedroom window*

13. Now, select the added pantry window; the window gets highlighted in blue color and its controls are displayed. Click on the temporary dimension displayed at the bottom and enter **6'0"** for Imperial or **1800 mm** for Metric to specify the location of the pantry window, refer to Figure 3-85; the window is moved to the desired location. Similarly, add the windows of the same type to the walls of the other rooms and specify their respective locations based on the given sketch plan, refer to Figures 3-86.

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This completes the tutorial of adding doors and windows to the *Building Envelope II* project. The Level 1 plan should look similar to the plan shown in Figure 3-86.

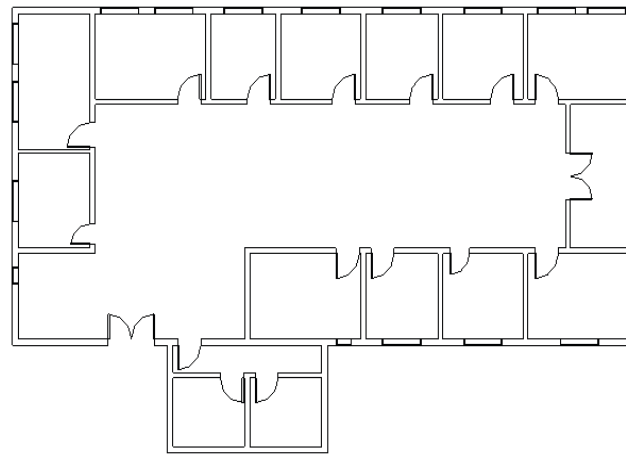


Figure 3-86 *Complete project plan with doors and windows*



Note

You can place doors and windows at nearby position, refer to Figure 3-86.

14. To view the plan in 3D, choose the **Default 3D View** tool from **View > Create > 3D View** drop-down; the 3D view of the project is displayed, as shown in Figure 3-87.

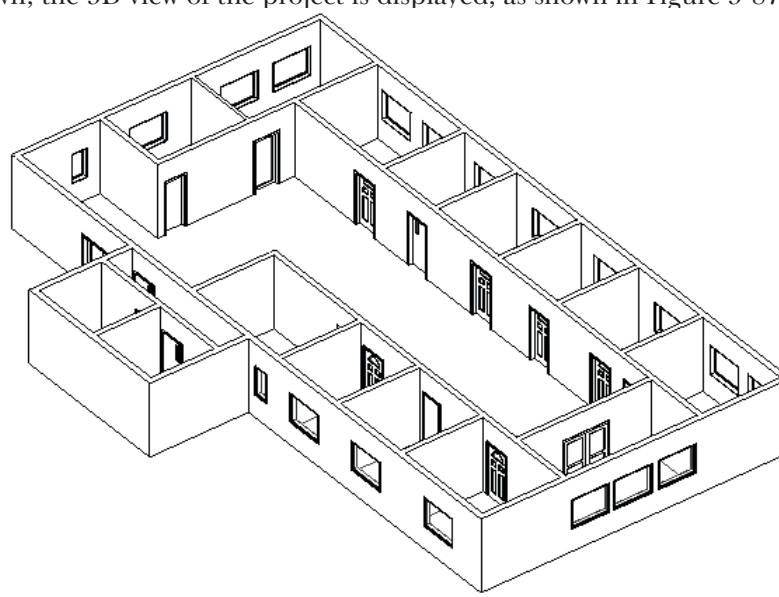


Figure 3-87 *3D view of the project*

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Creating the Floor

In this section, you will add floor to the building using the **Floor** tool.

1. Double-click on the **Ground Floor** under the **Floor Plans** head; the corresponding view is displayed.

2. To add a floor to the building, choose the **Floor: Architectural** tool from **Architecture > Build > Floor** drop-down; the **Modify | Create Floor Boundary** tab is displayed along with the **Options Bar**. Notice that the drawing area fades when you invoke the **Floor** tool, which indicates that you are in the sketch mode.

3. In the **Options Bar**, select the **Extend into wall (to core)** check box, if it is not selected. Also, notice that the **Pick Walls** tool is chosen by default in the **Draw** panel.

4. Move the cursor near the center of the north wall of the building plan; the wall is highlighted. Now, click to draw the line.

5. Similarly, move the cursor near the west wall of the building plan and click when the wall is highlighted. On doing so, a sketched boundary appears in magenta color.

6. Repeat the procedure followed in steps 3 and 4 and sketch the boundary of the floor on other walls, as shown in Figure 3-88.

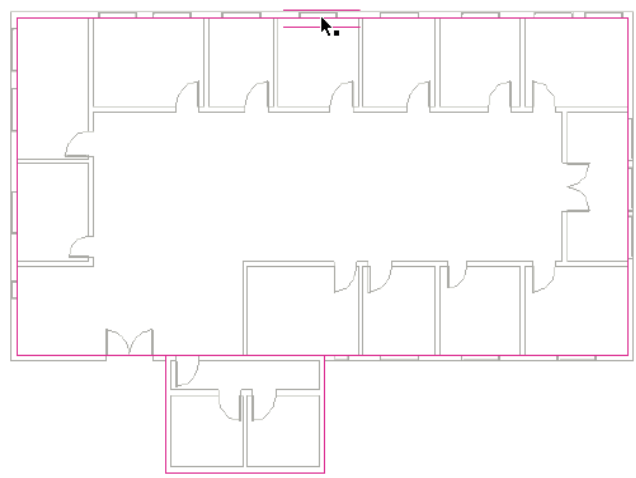


Figure 3-88 *The floor boundary sketched using the* ***Pick Walls*** *tool*

7. After sketching, you will notice that the floor boundary intersects at the interior wall of washroom. To separate the floor boundary, choose the **Split Element** tool from the **Modify** panel of the **Modify | Create Floor Boundary** tab.

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8. Now, split the boundary at the corners where line intersects and then select the split element and press DELETE.

9. Next, choose the **Finish Edit Mode** button from the **Mode** panel to complete the sketching of the floor.

10. By default, **Floor : Generic 12"** option for Imperial (**Floor : Generic 300mm** for Metric) from the **Type Selector** drop-down list in the **Properties** palette is selected, as shown in Figure 3-89.

11. Choose the **Modify** button from the **Select** panel of the **Modify | Floor** tab to exit the **Floor: Architectural** tool. The floor is created for the project, as shown in Figure 3-90.

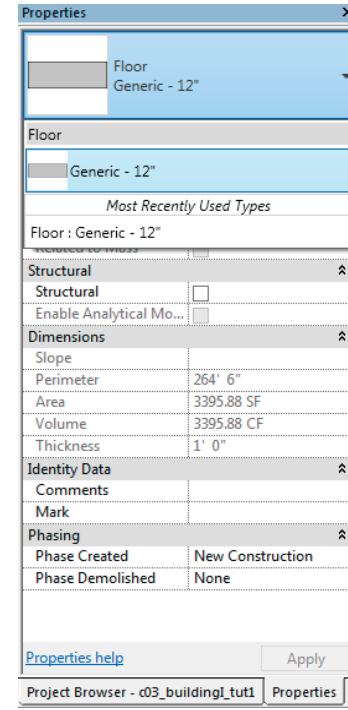


Figure 3-89 *Selecting the* ***Generic 12"*** *floor type*

Creating the Ceiling Head under Architectural Head

1. In the **Project Browser**, select **1-Ceiling Mech** under the **Mechanical** head and right-click to display a flyout. From this flyout, choose **Duplicate Views > Duplicate**; the **1 - Ceiling Mech Copy 1** option is displayed under the **Mechanical** head.

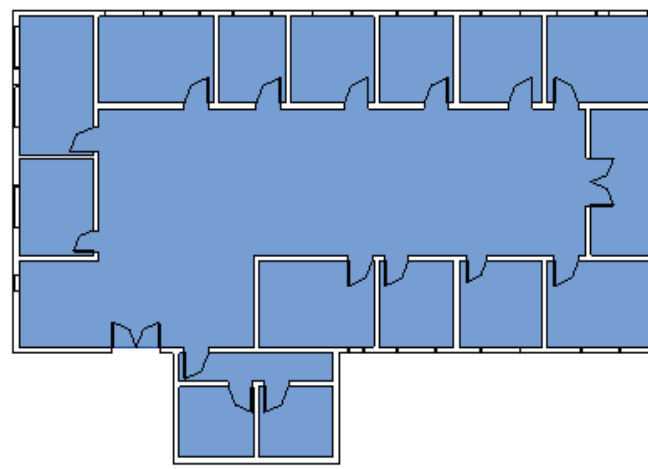


Figure 3-90 *The* ***Generic 12"*** *type of the floor created*

2. Double click on **1 - Ceiling Mech Copy 1** to display the corresponding view. Now, in the **Properties** palette, click on the value field corresponding to the **Discipline** parameter. Select the **Architectural** discipline from the drop-down list and choose the **Apply** button to apply the changes.

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3. In the **Project Browser**, **1 - Ceiling Mech Copy 1** is displayed under the **Architectural** head.

4. Select **1 - Ceiling Mech Copy 1** under the **Architectural Plan** head and right-click to display a flyout. From the flyout, choose the **Rename** option; the edit box is displayed. Enter **Level 1** in the edit box and choose the **OK** button; the dialog box is closed and the view is renamed to **Level 1**.

5. Repeat the procedure followed in steps 1 through 5 to add another level as **Level 2** from **Mechanical** head into **Architectural** head.

Creating the Ceiling

After creating the floor for the project, you need to add a ceiling to it. You will use the **Ceiling** tool to create the ceiling.

Before creating the ceiling, transform the current view to the ceiling plan view of the first floor.

1. Double-click on **Level 1** from the **Ceiling Plans** head in the **Project Browser**.

2. Invoke the **Ceiling** tool from the **Build** panel of the **Architecture** tab; the **Modify | Place Ceiling** tab is displayed.

3. To assign a type to the ceiling, click on the **Type Selector** drop-down list in the **Properties** palette and then select the **Generic** option from it.

   Next, you need to define the exact height of the ceiling.

4. In the **Properties** palette, click on the value field of the **Height Offset From Level** instance parameter and enter **8'6"** for Imperial or **2590 mm** for Metric. Next, choose the **Apply** button; the new height is assigned to the ceiling.

5. Next, move the cursor on any of the enclosed space and click to create a ceiling. Note that the created ceiling is not distinctly visible in the ceiling plan because the ceiling type selected has a plain board finish.

6. Repeat step 5 to create individual ceilings for every enclosed space in the *Office Building II* project. After creating all the ceilings, press ESC twice.

7. Choose the **Default 3D View** tool from the **3D View** drop-down of the **Create** panel in the **View** tab; the 3D view of the project with the ceiling created is displayed. You can move the cursor over the ceiling of the room to highlight and display it, as shown in Figure 3-91.



Note

*If the 3D view is in halftone grey, you need to change the discipline of the 3D view to **Architecture** or **Coordination** from the instance properties displayed in the **Properties** palette.*

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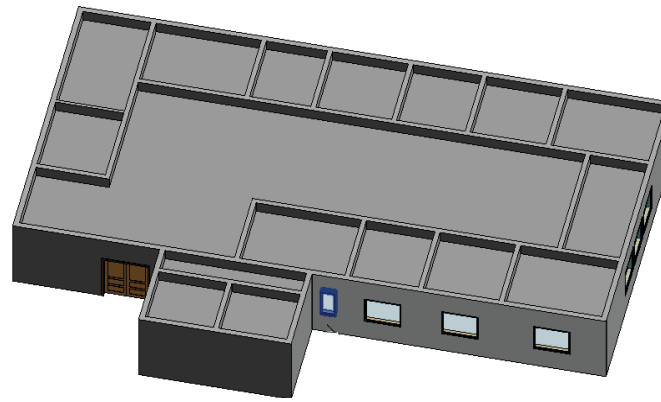


Figure 3-91 *Displaying the ceiling of the Office Building II project*

Saving the Project

In this section, you need to save the project and the settings using the **Save As** tool.

1. To save the project with the settings, choose **Save As > Project** from the **File** menu; the **Save As** dialog box is displayed.

2. In this dialog box, browse to *C:\rmp_2021\c03_rmp_2021_tut* and then enter **c03_Office_BuildingII_tut2** for Imperial or **M_c03_Office_BuildingII_tut2** for Metric in the **File Name** edit box.

3. Now, choose the **Save** button; the **Save As** dialog box closes and the project file is saved.

Closing the Project

1. To close the project, choose the **Close** option from the **File** menu.

Self-Evaluation Test

Answer the following questions and then compare them to those given at the end of this chapter:

1. Using the _____ button in the **Properties** palette, a copy of an existing door type can be created.

2. You can select a wall type from the _____ drop-down list.

3. The _____ tool can be used to attach walls to the floor.

4. Using the _____ tool, you can create grids by picking elements.

5. The _____ type parameter indicates the height of a door.

6. You can control the visibility of a level head. (T/F)

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7. You cannot copy or array grids. (T/F)

8. After creating a wall type, you can modify its properties. (T/F)

9. You can add doors and windows in plan view only. (T/F)

10. You can use the **By Face** tool to cut openings on the faces of floors and ceilings. (T/F)

Review Questions

Answer the following questions:

1. Which of the following keys needs to be held to add elements to a selection?

   (a) TAB (b) CTRL
   (c) SHIFT (d) ESC

2. Which of the following parameters of a door is an instance property?

   (a) **Level** (b) **Thickness**
   (c) **Door Material** (d) **Fire Rating**

3. Which of the following sketching tools can be used to create a curved wall?

   (a) **Rectangle** (b) **Fillet Arc**
   (c) **Line** (d) **Polygon**

4. You can create a radial grid pattern using the **Grid** tool. (T/F)

5. Levels, once created, cannot be modified. (T/F)

6. You can create an opening in the ceiling using the **Cut** tool. (T/F)

7. The **Chain** option can be enabled or disabled without exiting the **Wall: Architectural** tool. (T/F)

8. The location line parameter is an instance property of a wall. (T/F)

9. Walls can be attached to the floors using the **Join Geometry** tool. (T/F)

10. Door tags increase automatically as you add doors to a project. (T/F)

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EXERCISE

Exercise 1 Residential Building

Create the exterior and interior walls of a residential building and then add doors and windows to them. Create floor and ceiling and then add grids to the walls of the Residential building, refer to Figure 3-92. Do not add dimensions or texts as they are given only for reference. Figure 3-93 shows the three dimensional view of the residential building with the added floors and ceilings. The project parameters for this exercise are given next. **(Expected time: 1 Hour)**

1. Project File -
   For Imperial **Systems-Default**.
   For Metric **Systems-Default_Metric**.

2. Discipline - **Architectural**.

3. Rename Level 1 - First Floor, Level 2 - Second Floor.

4. Exterior wall type -
   For Imperial **Basic Wall - Exterior Brick on Mtl. Stud**.
   For Metric **Basic Wall - Exterior Brick on Mtl. Stud**.
   .
5. Interior wall type -
   For Imperial **Basic Wall: Generic- 5”**.
   For Metric **Basic Wall: Generic- 90 mm**.

6. Height of wall - **Top Constraint - Upto Level 2**.

7. Door type to be used:
   For Imperial Main door - **Double - Glass 2 - 36” x 84”**
   Bedroom doors - **Single - Flush 30” x 84”**
   Washroom door - **Single Flush Vision - 36” x 84”**
   For Metric Main door - **Double - Glass 2 - 1830 x 1981mm**
   Bedroom doors - **Single - Flush 0762 x 2134mm**
   Washroom door - **Single Flush Vision - 0915 x 2134 mm**

8. Window type to be used:
   For Imperial **Fixed with Trim - 36” x 24”**
   For Metric **Fixed with Trim - 0915 x 0610 mm**

9. Floor type -
   For Imperial **Floor: Generic- 12”**.
   For Metric **Floor: Generic- 300mm**

10. Ceiling type - **Generic**.

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11. File name to be assigned:
For Imperial *c03_Residential-Building_exer1.rvt*
For Metric *M_c03_Residential-Building_exer1.rvt*

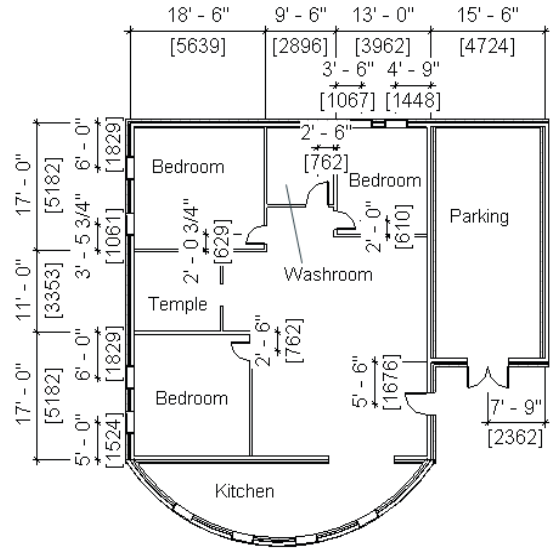


Figure 3-92 *Sketch plan of walls with doors and windows, and floor and ceiling added to the building*

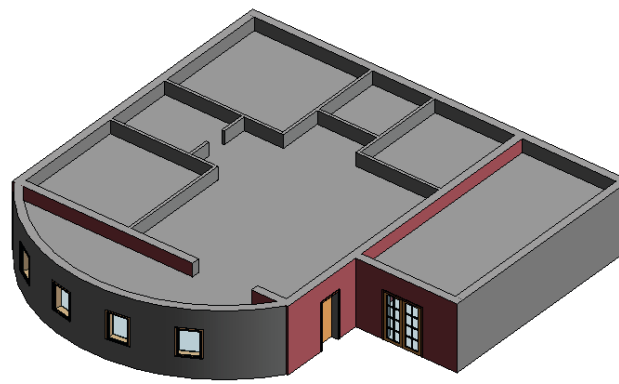


Figure 3-93 *Three dimensional view of residential building with added floors and ceilings*

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Answers to Self-Evaluation Test

1. Duplicate, 2. Type-Selector, **3. Attach Top/Base**, **4. Pick Line**, **5. Height**, **6.** T, **7.** F, **8.** T, **9.** F, **10.** T