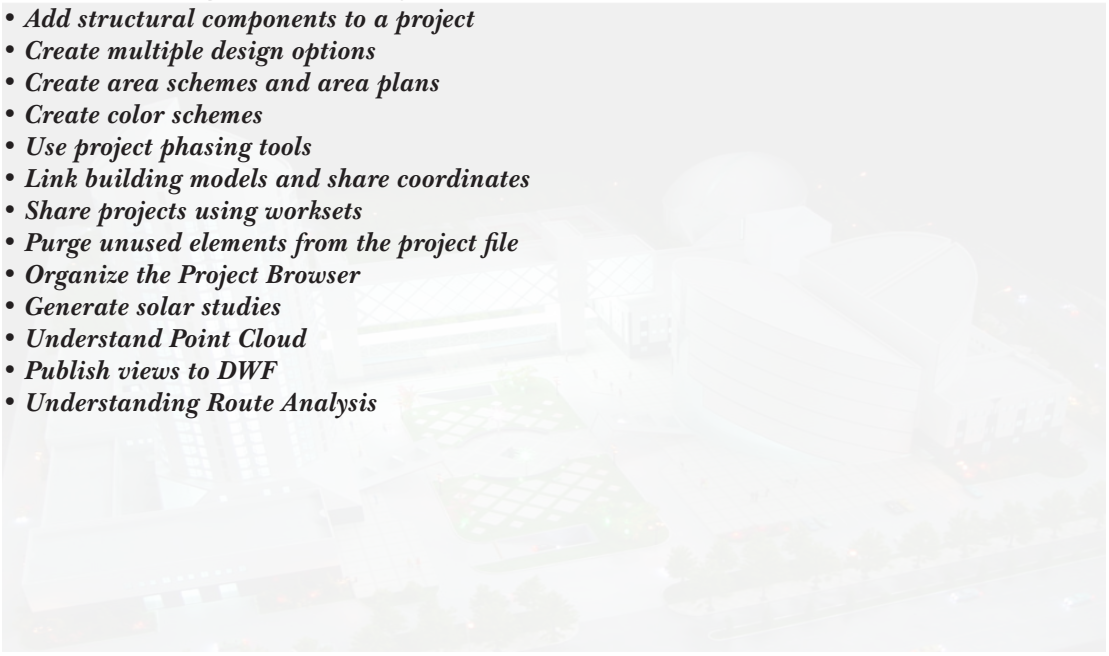
Chapter 16

Using Advanced Features

Learning Objectives

After completing this chapter, you will be able to:

- *Add structural components to a project*
- *Create multiple design options*
- *Create area schemes and area plans*
- *Create color schemes*
- *Use project phasing tools*
- *Link building models and share coordinates*
- *Share projects using worksets*
- *Purge unused elements from the project file*
- *Organize the Project Browser*
- *Generate solar studies*
- *Understand Point Cloud*
- *Publish views to DWF*
- *Understanding Route Analysis*



INTRODUCTION

This chapter describes the advanced features of Revit such as adding structural components, creating design options using the phasing tools, and worksharing methodology. With the help of these advanced features, you can easily add structural components to a building model using various tools and in-built components. You can also create various design options based on the project requirement, and also use the area analysis tools to analyze and generate area plans for the building model.

In this chapter, you will learn to represent the phase-wise development of a project, link independently developed projects to each other, and share their coordinates using the project sharing and linking tools. Also, the concept of worksets, which enables multiple users to work on a single project and interoperability of Revit Architecture with other program such as Autodesk 3ds Max has been discussed in the chapter.

CREATING STRUCTURAL COMPONENTS

Structural components describe the structural system of a building project. The use of some of these elements, such as walls, floors, roof, stairs, and so on has been discussed in the earlier chapters. The structural components may or may not comprise the basic structural support system of a building project. For example, in a multistory building project, steel framing components can form the basic support system and the walls can be non-load bearing. Therefore, it may be necessary to specify and differentiate between the structural and architectural components for some projects.

You can add structural components before or after creating the building model. For example, you can first generate an architectural building model for a multistory building and then add structural components to it, or you can generate the building model over a framework of structural components. The structural property of a wall is represented by its **Structural Usage** instance parameter, and the wall function is represented by its **Wall Function** type parameter. For instance, by default, the **Basic Wall: Generic- 8" Masonry** wall has the value **Non-bearing** for the **Structural Usage** instance parameter. For load bearing structures, you can convert this non-bearing wall into a bearing wall by changing its **Structural Usage** instance parameter to any of the following parameters: **Bearing**, **Shear**, or **Structural combined**.

The structural components that can be created in a Revit building model are broadly classified into the following three categories:

Structural Walls	Walls used for foundation, retaining, or as shear walls
Structural Columns	Structural components for vertical support
Structural Beams and Braces	Components providing connecting ties
Structural Foundations	Components providing support to the superstructure of the building

Figure 16-1 shows the structural components for a project.

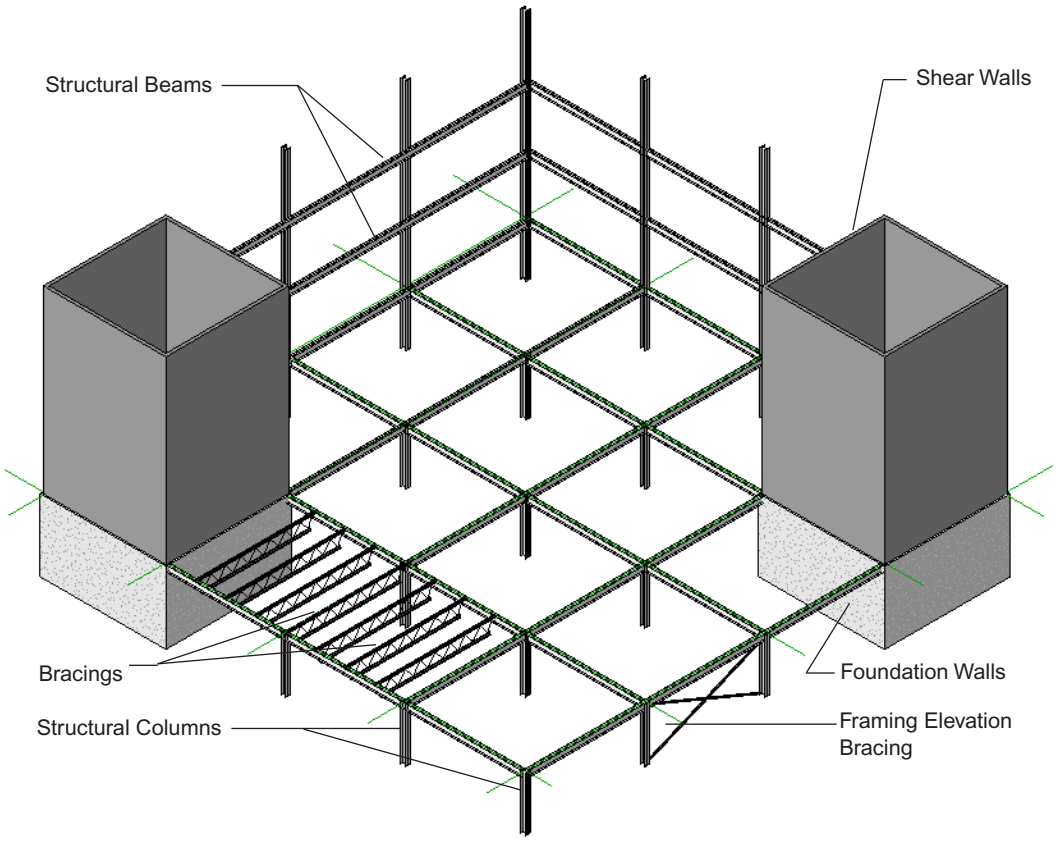


Figure 16-1 *The structural elements for a project*

Creating Structural Walls

There are four types of functions that can be assigned to a parametric wall. The functions that can be assigned to the wall are interior, exterior, retaining, and foundation. The interior or exterior wall functions have been described in the earlier chapters. A structural wall differs from a non-structural wall only in its structural usage. The four structural usage options are:

Non-bearing	Walls supporting only their own weight or are used to divide spaces
Bearing	Walls supporting a vertical load in addition to their own weight
Shear	Walls supporting a lateral thrust of shear
Structural combined	Walls serving more than one purpose



Tip

*While using structural elements, you can choose the **Structural Settings** button (represented by an inclined arrow) from the **Structure** panel of the **Structure** tab; the **Structural Settings** dialog box will be displayed. In this dialog box, you can set the parameters to control the representation of structural elements in a project file. You can also use the Structural-Default.rte template file that contains the view properties and range settings specifically for working with the structural elements.*

Sketching Retaining Walls

To sketch a retaining wall, invoke the **Wall: Structural** tool from **Structure > Structure > Wall** drop-down; the **Modify | Place Structural Wall** tab will be displayed. In the **Properties** palette, select the **Basic Wall: Retaining -12" Concrete** option (for Metric **Basic Wall: Retaining -300mm Concrete**) from the **Type Selector** drop-down list. After selecting the retaining wall option from the **Type Selector** drop-down list, you can sketch a retaining wall in the plan or 3D view. You can also convert a sketched interior, exterior, or foundation wall into a retaining wall. To do so, select the wall and choose the **Edit Type** button in the **Properties** palette; the **Type Properties** dialog box will be displayed. The **Function** type parameter in the **Type Properties** dialog box describes the current function of the wall. Click in the **Value** column of the **Wall Function** type parameter and select the **Retaining** option from the drop-down list. Then choose **Apply** and **OK** buttons, the structural wall is modified to the retaining wall.



Note

When you use a retaining wall or modify the function of a wall to make it a retaining wall, it is automatically set to non-room bounding.

Sketching Foundation Walls

Foundation walls can be sketched by choosing the **Wall: Structural** tool and then selecting the foundation wall type from the **Type Selector** drop-down list. By default, the **Basic Wall: Foundation - 12" Concrete** option is selected from the drop-down list. The foundation wall can be sketched in the plan or 3D view. Note that if the foundation walls are sketched in the plan view, a warning that the foundation walls are not visible in the view in which they were sketched. This warning is displayed because the foundation walls, unlike any other non-structural wall, are created with the current level as the top constraint. This means that they are sketched downward and are not visible in the current level. To view the sketched foundation walls, change the **View Range** instance property of the current view. To do so, click on the view name in the **Project Browser**; the instance properties of the selected view will be displayed in the **Properties** palette. In the **Properties** palette, choose the **Edit** button in the **Value** column of the **View Range** instance parameter; the **View Range** dialog box will be displayed. In the **Primary Range** section of the **View Range** dialog box, change the **Bottom** and **View Depth** parameters to **Level Below** to enable the visibility of the foundation walls in the current view.



Note

*The **Structural Usage** parameter for a sketched foundation wall is automatically set to **Bearing**.*

You can modify the instance and type properties of a foundation wall after you create it. To do so, select the foundation wall from the drawing; the instance properties will be displayed in the **Properties** palette, as shown in Figure 16-2. You can modify the height of the foundation wall by entering a value in the **Base Offset** parameter. The type properties of the foundation wall can be modified by using the **Edit Type** button in the **Properties** palette.

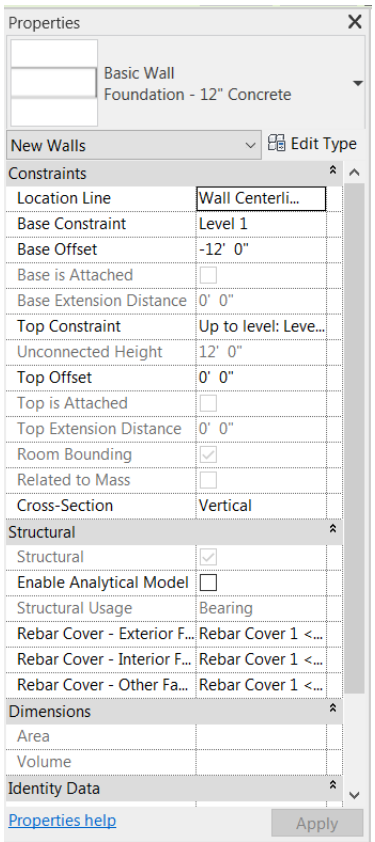


Figure 16-2 *The instance properties of a typical foundation wall*

Creating Structural Columns

Structural columns can be placed in the plan or 3D view. You can place a single structural column or multiple structural columns by selecting the grid intersection. To add a structural column, invoke the **Column** tool from the **Structure** panel of the **Structure** tab; the **Modify | Place Structural Column** tab will be displayed, as shown in Figure 16-3. In this tab, you can choose the **Load Family** button from the **Mode** panel and then load the additional structural columns

from the **Structural Columns** folder in the **English-Imperial** folder. Based on the material specification, four subfolders **Concrete**, **Precast Concrete**, **Steel**, and **Wood** have been provided to load the structural columns from the column families.

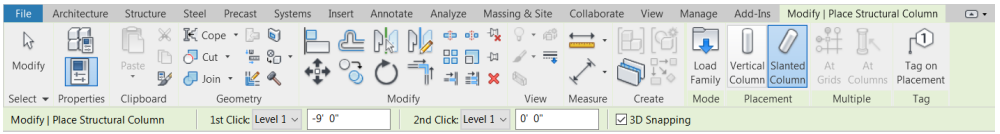


Figure 16-3 *The* ***Modify / Place Structural Column*** *tab*

Select the desired type from the **Type Selector** drop-down list in the **Properties** palette and add the structural columns to the building model. Note that before you add the structural columns, you should set up a structural grid. Now, to add a single structural column after setting up the structural grid, move the cursor near the grid intersection; the cursor will snap to the intersection. Click to add the column; the selected structural column will be attached to the cursor. To add a column aligned to an inclined grid, press SPACEBAR; the column toggles parallel and perpendicular to the highlighted grid, refer to Figure 16-4. You can press the SPACEBAR repeatedly until the desired alignment is displayed, and then click to add the column at the desired alignment. You can also select the **Rotate after placement** check box available in **Options Bar** to enable the rotation of the structural column after its placement. You can select the **Height** or **Depth** option from the first drop-down list available in the **Options Bar**. Set the level or constraint for the column height using the other drop-down list. To specify the depth or height of the column based on the project requirement, select the **Unconnected** option from the other drop-down list.

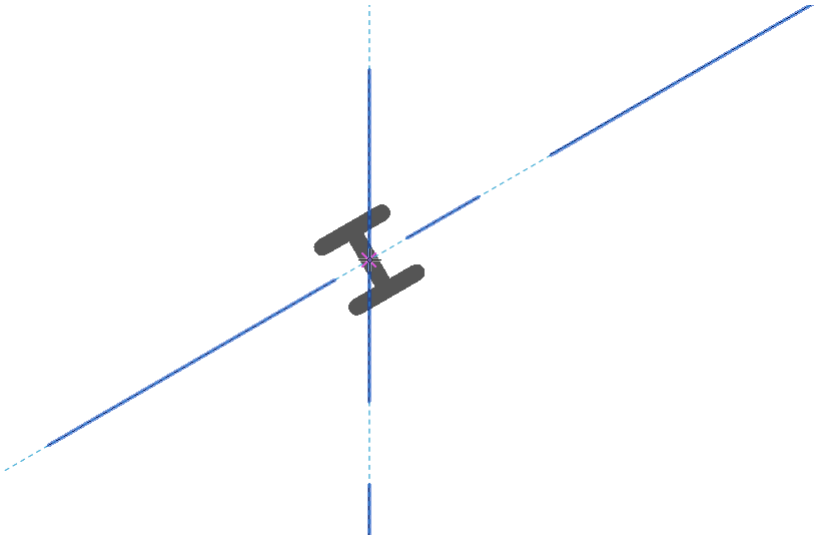


Figure 16-4 *Adding a structural column at an inclined grid intersection*



Note

Like structural walls, structural columns are also placed from top to bottom. To view them in the current plan view, modify the ***Bottom*** *clip plane setting for the* ***View Range*** *parameter.*

Adding Multiple Structural Columns

To add multiple columns at grid intersections, choose the **At Grids** tool from the **Multiple** panel of the **Modify | Place Structural Column** tab; the **Modify | Place Structural Column > At Grid Intersection** tab will be displayed and you will be prompted to select the grid lines to place the structural columns at grid intersections. Select the desired grid lines; the selected grid lines will be highlighted and the columns will be displayed at intersections, as shown in Figure 16-5. Next, choose the **Finish** button from the **Multiple** panel; the multiple structural columns will be added to the selected grid intersections.

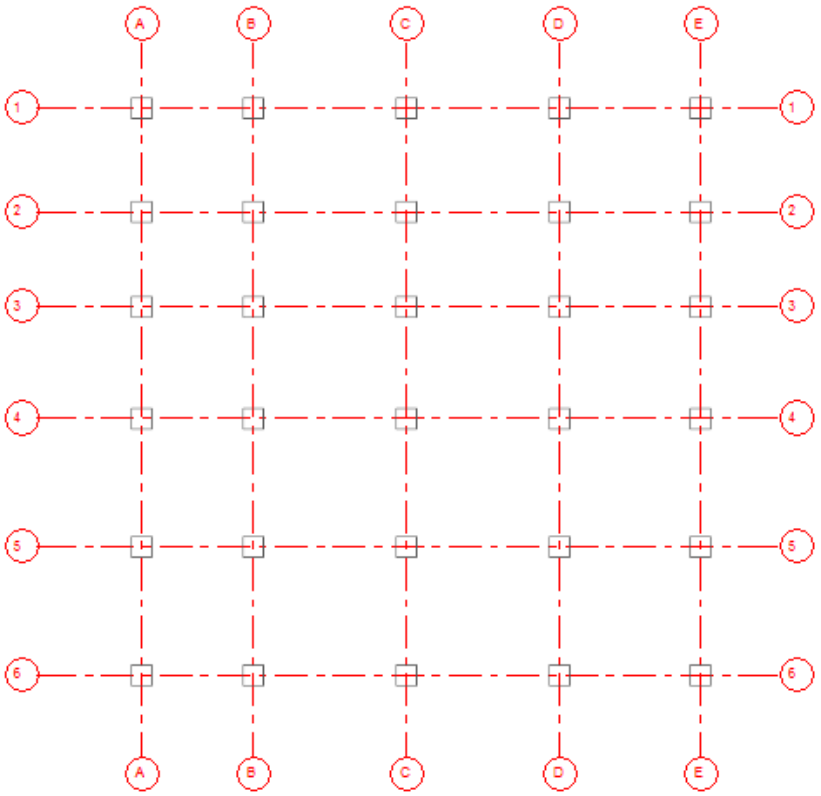


Figure 16-5 *Multiple structural columns added to a grid*

Adding Structural Columns inside Architectural Columns

The **At Columns** tool available in the **Multiple** panel of the **Modify | Place Structural Column** tab enables you to add structural columns inside the existing architectural columns. After invoking this tool, select an individual architectural column or multiple architectural columns; the structural columns automatically snap to the center of the architectural columns. Choose the **Finish** button from the **Multiple** panel of the **Modify | Place Structural Column > At Architectural Columns** tab to complete the process.

Adding Structural Beams and Braces

Beams are structural components that connect the columns or the structural walls. Beams can be joined to the structural bearing walls if their structural usage property is set to bearing or structural combined. You can add beams individually or by selecting the grids along which they are required.

To add a structural beam, invoke the **Beam** tool from the **Structure** panel of the **Structure** tab. After invoking this tool, select the beam type from the **Type Selector** drop-down list in the **Properties** palette. To load additional beams, choose the **Load Family** button from the **Mode** panel of the **Modify | Place Beam** tab; the **Load Family** dialog box will be displayed. In this dialog box, the **Structural Framing** folder will display various files related to various types of concrete, steel, and wooden beam families. Choose the required family and then choose the **Open** button to load the family in the **Type Selector** drop-down list. Now, in the **Modify | Place Beam** tab, you can choose the **On Grids** tool from the **Multiple** panel to select multiple grids along which the required beams can be placed. The **Placement Plane** drop-down list available in the **Options Bar** can be used to select the level for adding beams. The options in the **Structural Usage** drop-down list in the **Options Bar** can be used to select the usage of the beam. By default, **Automatic** is selected in this drop-down list. As a result, Revit determines the usage based on the structural components that the beam connects. The **Chain** check box can be used to add a chain of beams. Select the **3D Snapping** check box to snap to different points in a 3D view. To sketch a beam, specify the start point and the endpoint for the beam in the drawing area.

Braces are diagonal members that connect beams and columns. They can be created by snapping the cursor to the structural components. Usually, braces are placed in framing elevation views. These views show the general arrangement and sizes of structural components as an arrangement of lines and are quite similar to interior views. To create a framing elevation view, invoke the **Framing Elevation** tool from **View > Create > Elevation** drop-down. Now, select a structural grid from the drawing; the framing elevation of that section will be created. You can view the elevation from the **Elevations (Interior Elevations)** head in the **Project Browser**. After opening a framing elevation view from the **Project Browser**, you can add braces to the columns. To do so, invoke the **Brace** tool from the **Structure** panel of the **Structure** tab. Select the brace type from the **Type Selector** drop-down list in the **Properties** palette. You can choose the **Load Family** button from the **Mode** panel of the **Modify |Place Brace** tab to load additional braces from the **Structural Framing** folder. Move the cursor to the desired location in the framing elevation and use the snap options to sketch the braces. The braces are displayed as lines in the framing elevation. You can view the added braces and other structural components in the 3D view.



Tip

*When you load families of structural elements using the **Load Family** button, the **Load Family** dialog box displays a type catalog. This enables you to select and load only specific family types. This decreases the file size, and also reduces the number of entries in the **Type Selector** drop-down list. Also, once the structural elements have been added to a level, you can use the **Copy** and **Paste** tools from the **Clipboard** panel to copy the elements to multiple levels.*

Cutting Openings in Beams, Braces, and Columns

Revit allows you to cut openings in structural members such as beams, braces, and columns. You can cut an opening in a structural member after selecting planes. Every structural member (Beam, Brace, and Column) shows two planes: horizontal and vertical. These planes are perpendicular to each other, as shown in Figures 16-6 and 16-7. You can also lay ducts and pipes passing through the beams and columns by creating the openings of the corresponding shape. You can create different shapes of openings using different sketching tools.

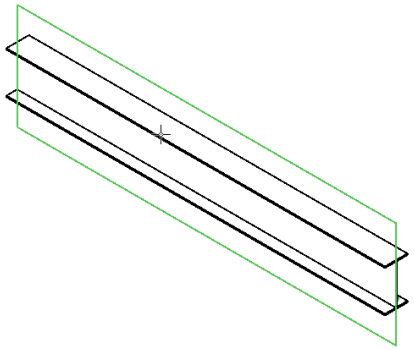


Figure 16-6 *The vertical plane of the beam*

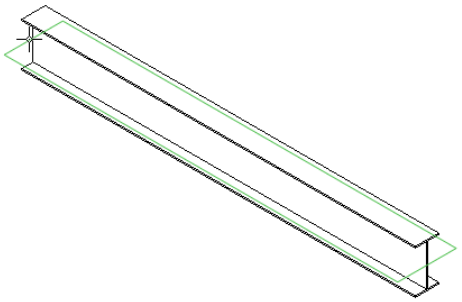


Figure 16-7 *The horizontal plane of the beam*

To cut an opening, choose the **By Face** tool from the **Opening** panel of the **Architecture** tab; you will be prompted to select a planar face of the member. Move your cursor over the member; the planes will be highlighted in green. To select the required plane, click in the drawing when the plane is highlighted; the screen will enter the sketch mode. Draw an opening in the structural member using any sketching tool available in the **Draw** panel of the **Modify | Create Opening Boundary** tab. In Revit, you can also create a rectangular opening with a fillet. To do so, invoke the **Rectangle** sketching tool in the **Draw** panel and select the **Radius** check box from the **Options Bar**. Specify the radius for the fillet in the **Radius** edit box and sketch the opening in the member. Next, choose the **Finish Edit Mode** button from the **Mode** panel. Figure 16-8 shows a circular opening and a rectangular opening with a fillet in structural beams.

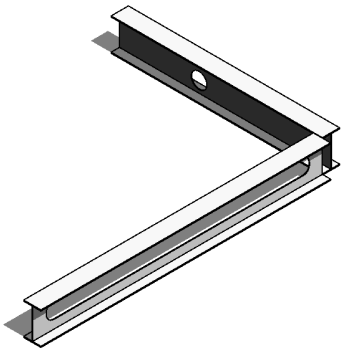


Figure 16-8 *Structural beams with a circular opening and a rectangular opening with a fillet*

GENERATING MULTIPLE DESIGN OPTIONS

In Revit, the **Design Options** tool provides you with the flexibility of choosing several alternatives for your design. As a designer, you need to come up with multiple design ideas, so that you can select the best option that suits the functional, aesthetical, and economical requirement of your project. Therefore, you need to develop and evaluate several design options and then execute the best possible design option for your project.

The **Design Options** tool helps you speed up your project by providing you the options to create and develop several alternatives of a single model. For example, you can use the **Design Options** tool to develop three options of a Kitchen for a residential layout, featuring different materials and space utilization. In such a case, you can create individual details and documentations like drawings, schedules, cost summaries based on the quantity of materials, and so on for these three design options that you have created for the existing kitchen project. These drawings and documentations help you select the best option that meets your project requirement.

To use the **Design Options** tool, first you need to create an option set and then the option in the basic building model. The option set refers to a set of alternatives devised for creating a particular design or subject. For example, if you have three design options for building a kitchen on the first floor of a residential project, then they will form one option set with three different options. You can name the option set as Kitchen_FF and its design options as Island_Kitchen, Closed_L_Shaped Kitchen, and Closed_U_Shaped Kitchen. One of the design options can be made the primary design option in the specified option set. You can have a number of design options in a single design option set.

The purpose of using design options is to enable you to develop and study multiple design alternatives for a single model and pick the best one for the final layout. You can delete or archive the rejected design options once you have picked up the right one.

Generating Design Options for a Project

The **Design Options** tool is used to generate design options for a project. Invoke this tool from the **Design Options** panel in the **Manage** tab; the **Design Options** dialog box will be displayed. To generate a new design option set, choose the **New** button in the **Option Set** section of the **Design Options** dialog box; a new option set will be added to the left pane. Next, to add a new option in this option set, choose the **New** button from the **Option** section. You can also rename an option set by using the **Rename** button in the **Option Set** section. Figure 16-9 shows various design options in the **Design Options** dialog box.

After creating the design option sets and options, you can add building components for each option. To do so, select the design option in the **Design Options** dialog box and then choose the **Edit Selected** button from the **Edit** area. Next, choose the **Close** button to close the **Design Options** dialog box; any element introduced in the building model will be added to the selected option. You can also cut and paste components from the main model to a design option. After editing the building model and completing the design option, you can again choose the **Design Options** tool to view the design. The **Now Editing** text box in the **Design Options** dialog box displays the name of the option to be edited. The **Finish Editing** button is used to complete the editing of a design option. After creating multiple design option sets, you can assign the desired option set as the primary option set by selecting it and choosing the **Accept Primary** button in the **Design Options** dialog box.

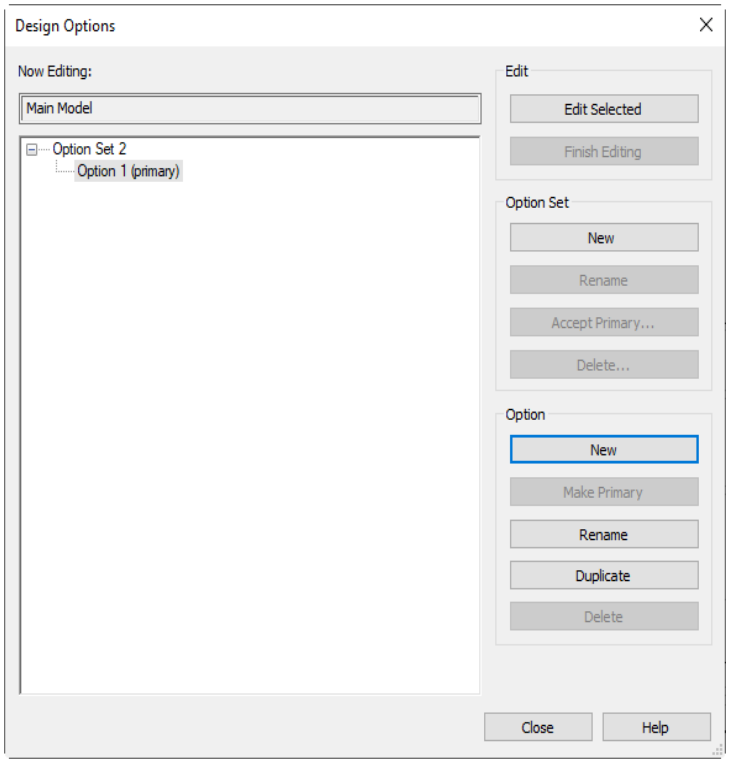


Figure 16-9 *The* ***Design Options*** *dialog box with the design option sets and design options created*

Presenting Design Options

After creating the design options, you can compare and present them to clients. To do so, create multiple copies of the view of a design option, and set the visibility setting for each view. You can use the **Visibility/Graphics** tool to control the visibility of a design option in each view. Select the view from the **Project Browser** and right-click. Next, choose **Duplicate View > Duplicate** from the shortcut menu; the copy of the view will be created. You may create a number of copies of the view based on the number of design options generated. Use the shortcut menu to rename each view based on the design option it represents.



Tip

While using the ***Design Options*** *tool, you need to keep in mind that the view-specific elements such as dimensions and text cannot be added to the design options. Also, you need to be careful in keeping all dependent elements in the same design option.*

Next, choose the **Manage** tab and then select the required design option from the **Active Design Option** drop-down list in the **Design Options** panel; the selected design option will be displayed in the view. This process needs to be repeated for each view in which you want to show a different option. You can then add the appropriate views to the sheet and present the design options to the client. You can also use the **Pick to Edit** tool from the **Design Options** panel to select the design option that requires editing.

USING AREA ANALYSIS TOOLS

The area analysis tools are used to analyze and represent different area types. These tools can also be used to create area schemes such as gross building area, rentable area, and area plans. You can access these tools from the **Area** drop-down in the **Room & Area** panel of the **Architecture** tab, as shown in Figure 16-10.

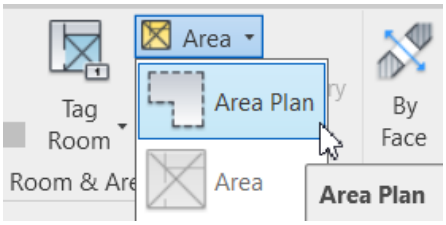


Figure 16-10 *Various tools in the* ***Area*** *drop-down*

Note

You can also generate area schemes for the design options developed for a project.

Area Schemes

Area Schemes are the standards that you set to calculate the area of an enclosed boundary with a specific space. You can use the **Area** tool from the **Area** drop-down to differentiate the spaces based on their usage. You can create and implement various types of area schemes in your current project based on the local standards that are followed for the area calculation.

You can create multiple area measurement schemes. To do so, invoke the **Area and Volume Computations** tool from the **Room & Area** panel of the **Architecture** tab; the **Area and Volume Computations** dialog box will be displayed. In this dialog box, choose the **Area Schemes** tab; the options in this tab will be displayed, as shown in Figure 16-11.

By default, the following two areas are created in the **Area Schemes** tab:

Gross Building Total built-up area of the building

Rentable Area measurements based on the calculated floor area using the standard rules

The **Gross Building** area scheme cannot be modified. However, you can modify the **Rentable** area scheme. You can also add a new area scheme by choosing the **New** button then, add description or rename it using the **Description** column. You can then proceed to create its area plan. You can use the **Delete** button in the **Area Schemes** tab of the **Area and Volume Computations** dialog box to delete an existing area scheme.

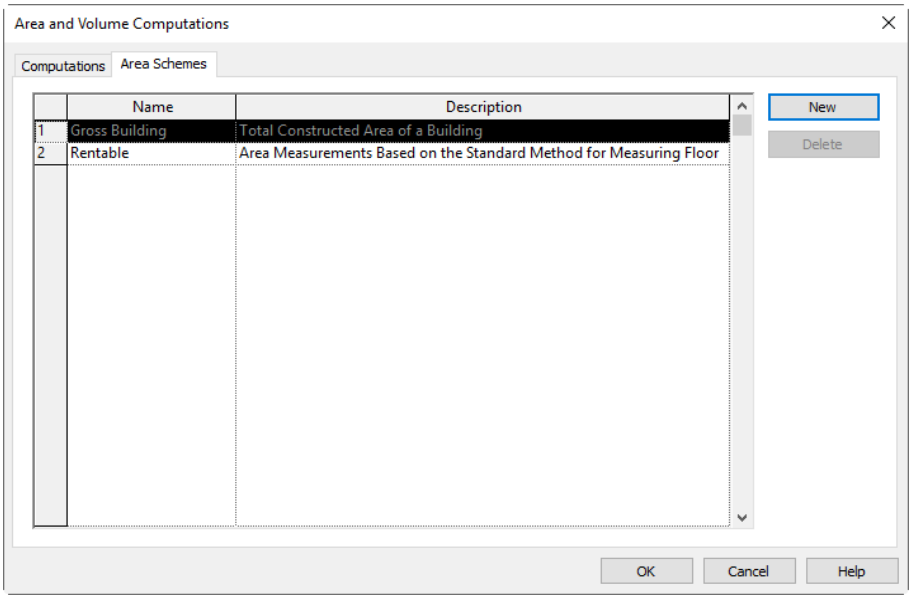


Figure 16-11 *The **Area and Volume Computations** dialog box*

Area Plans

The **Area Plan** tool is used to create area plans. Area plans are views that describe the subject of the area scheme. You can create a number of area plans for a single area scheme. For example, a rentable area scheme can be created for a commercial project and then you can create the area plans showing the rentable area for each level. Each area plan has distinct area boundaries, tags, and color fills.

To create an area plan, invoke the **Area Plan** tool from **Architecture > Room & Area > Area** drop-down; the **New Area Plan** dialog box will be displayed, as shown in Figure 16-12. In this dialog box, the **Type** drop-down list displays the available area schemes. The **Area Plan views** list box displays the existing levels for which the area plans can be created. To create area plans for more than one level, select multiple levels in this dialog box. When you select multiple levels, Revit creates separate area plans for each level and groups them by the area scheme in the **Project Browser**. If the **Do not duplicate existing views** check box is selected, Revit will use the same views to generate the area plans. If you clear this check box, Revit will create the copies of the views. After specifying all options in the **New Area Plan** dialog box, choose the **OK** button; the **Revit** message box will appear and you will be prompted to choose the method for specifying the area boundary. You can choose the **Yes** button to automatically create an area boundary associated with the external walls or choose the **No** button to manually sketch the area boundary lines. When you choose the **Yes** button, Revit places the boundary lines along the exterior walls of the building model, thus forming a closed loop. In the **Gross Building Area** scheme, the boundary line will be placed on the exterior face of the exterior walls, whereas in case of the **Rentable Area** scheme, the boundary line will be placed on the interior face of the exterior walls. Finally, the created area plan will be added in the **Project Browser** under the **Area Plans** head.

The area scheme is also mentioned along with the area plan title. You can create area boundaries either by picking the walls or by manually sketching the boundary lines. To sketch an area boundary, invoke the **Area Boundary** tool from **Architecture > Room & Area** drop-down; the options to sketch the area boundary will be displayed in the **Draw** panel of the **Modify | Place Area Boundary** tab. In the **Options Bar**, the **Apply Area Rules** check box is selected by default. As a result, the area rules will be applied to the area boundary and Revit Architecture will automatically change the position of the wall boundary when you change the area. On clearing the **Apply Area Rules** check box, the **Offset** edit box and the **Lock** check box will be displayed. You can enter the desired offset distance for the area boundary line in the **Offset** edit box and select the **Lock** check box to lock the position of the area boundary. After creating the area boundary line, you need to create the area for the boundary line. To do so, invoke the **Area** tool from the **Room and Area** panel of the **Architecture** tab; the **Modify | Place Area** tab will be displayed. Move the cursor inside the area boundary line; the area boundary will be displayed along with a tag. In the **Tag on Placement** panel of the **Modify | Place Area** tab, the **Tag on Placement** tool is chosen by default. As a result, the area tag will be displayed along with the area boundary. If you do not need the area tag to be displayed along with the area boundary, do not choose the **Tag on Placement** tool. On choosing the **Tag on Placement** tool, you can set various options in the **Options Bar**. From the drop-down list located at left of the **Options Bar**, you can select the **Horizontal**, **Vertical**, or **Model** option. After selecting the desired option, you can select the **Leader** check box to attach a leader along with the tag. From the **Area** drop-down list, either select an existing area or select the **New** option to create a new area. After selecting the desired options from the **Options Bar**, click inside the area boundary; the area will expand to the extents of the boundaries and the new area will be created.

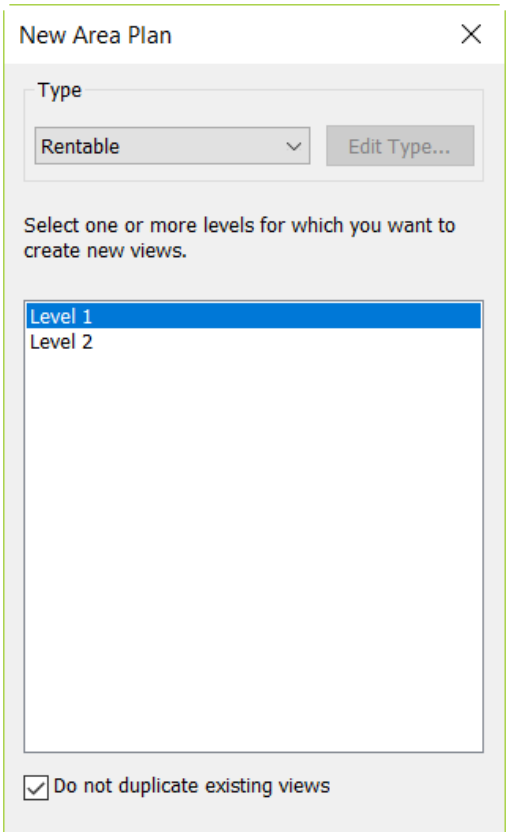


***Figure 16-12** The **New Area Plan** dialog box*

If you have placed an area without a tag, you can place the tag using the **Tag Area** tool. To do so, invoke the **Tag Area** tool from **Architecture > Room & Area > Tag Area** drop-down. On doing so, the **Modify | Place Area Tag** tab will be displayed. In the **Properties** palette, select the desired area tag type from the **Type Selector** drop-down list and then choose the **Edit Type** button to display the **Type Properties** dialog box. In this dialog box, select a suitable option for the **Leader Arrowhead** parameter from the drop-down list displayed in the **Value** field corresponding to it. Next, choose **OK**; the **Type Properties** dialog box will be closed and the specified parameter will be assigned to the tag. Now, in the **Options Bar**, you can select the **Leader** check box to display the leader line along with the area tag annotation. After specifying

the options in the **Modify |Place Area Tag** tab, move the cursor within a closed space in the area boundary, Revit will automatically calculate its area. At this stage, click to add the area tag. Figure 16-13 shows an example of area boundaries and area tags added to a residential project. You can click on the area tag and rename each space.

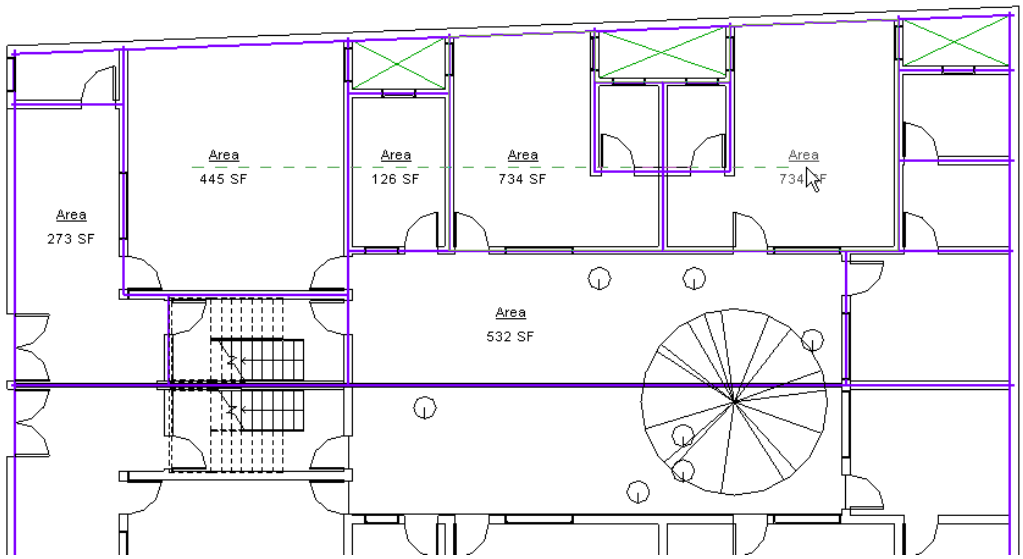


Figure 16-13 *The area boundaries and the area tags added to a residential project*

Number Parameter for Areas

The **Number** parameter is an instance parameter. It can be accessed in the **Properties** palette of the selected area. Whenever you add an area to a project, the area is automatically numbered. This new parameter can also be added to schedules. You can modify the value of the **Number** parameter of any area in the **Properties** palette. If you assign the same values to the **Number** parameter of two rooms, a warning message will be displayed.

Area Schedules

Once you have added area tags to the spaces and renamed them appropriately, you can proceed to create area schedules. To do so, invoke the **Schedule/Quantities** tool from **View > Create > Schedules** drop-down; the **New Schedule** dialog box will be displayed. In this dialog box, the **Category** list box displays the area schemes created in the project. Select the desired area scheme from this list and ensure that the **Schedule building components** radio button is selected. Choose the **OK** button in the **New Schedule** dialog box; the **Schedule Properties** dialog box will be displayed. Select and add the parameters to be included in the scheduled fields from the **Available fields** area, as shown in Figure 16-14.

You can also use the **Fields**, **Filter**, **Sorting/Grouping**, **Formatting**, and **Appearance** tabs available in the **Schedule Properties** dialog box to set the properties of the area schedule. Next, choose the **OK** button; the **Modify Schedule/Quantities** tab will be displayed and the created schedule will be displayed in the drawing area. Add it to the drawing sheet for the presentation of the area schemes. Figure 16-15 shows an example of an area schedule.

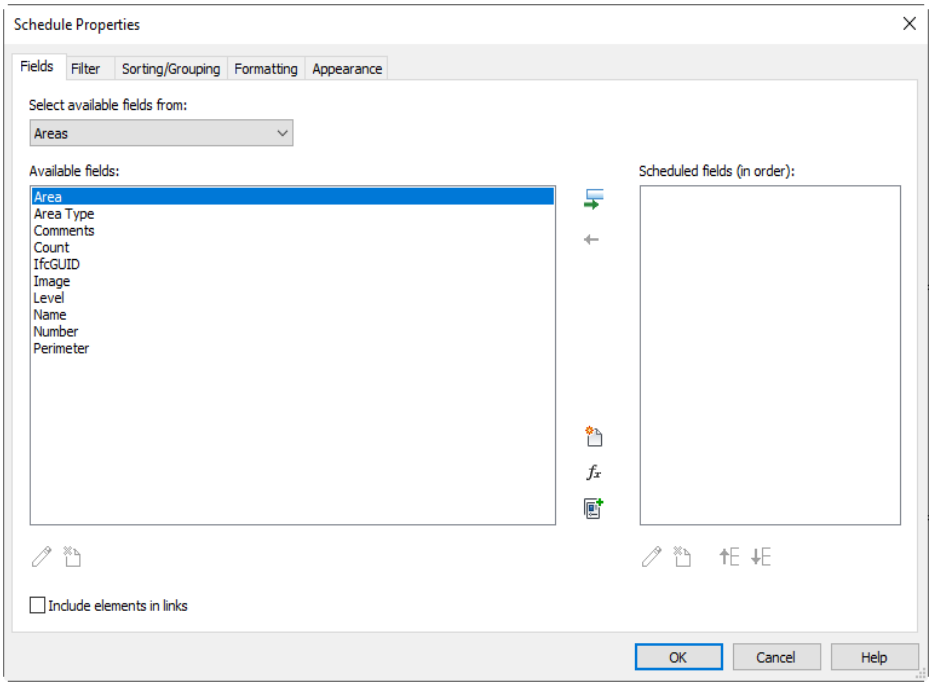


Figure 16-14 *The* ***Schedule Properties*** *dialog box*

Area Schedule (Area Scheme 1)		
Level	Name	Area
Level 1	Living Room	445 SF
Level 1	Kitchen	126 SF
Level 1	Bed Room	734 SF
Level 1	Patio	532 SF
Level 1	Front Open	273 SF
Level 1	Washroom	80 SF
Level 1	Closet	80 SF
Level 1	Bed Room 2	176 SF
Level 1	Shaft 3	47 SF
Level 1	Shaft 2	57 SF
Level 1	Shaft 1	43 SF
Level 1	Utility	45 SF
Level 1	Stairs	128 SF

Figure 16-15 *An example of a created area schedule*

COLOR SCHEMES

Color schemes are used to represent and categorize different areas in the project graphically by using color codes. In other words, color schemes are used to color the rooms and areas in a view. You can create color schemes and then apply them to different plan views. You can create different color schemes for the first and second floors of a building. A color scheme can be created based on a specific category such as Gross area, Rentable area, or an instance property of the room or

area such as room perimeter, number, or name. You can also create a color scheme depending on the utilization of different rooms in a building. For example, you can assign different colors to represent areas such as office, storage, or accounts. Then, you can add a color scheme legend to help you identify different areas by the colors assigned to them.

Creating Color Schemes

Before creating a color scheme, the rooms and areas should be defined in the plan view. You can create a color scheme based on any parameter of a room or an area. For example, if you want to create a color scheme for rooms on the basis of room number, room area, or names, make sure that the rooms are numbered and named in the plan view.

To create a color scheme, choose the **Color Schemes** tool from the **Room & Area** panel in the **Architecture** tab; the **Edit Color Scheme** dialog box is invoked, as shown in Figure 16-16. Alternatively, you can display the **Edit Color Scheme** dialog box by choosing the **<none>** button displayed in the value column corresponding to the **Color Scheme** parameter in the **Properties** palette for the current view. Now, in the **Schemes** area of the **Edit Color Scheme** dialog box, select the category for the color scheme from the **Category** drop-down list. Next, choose the **Duplicate** button in the **Schemes** area; the **New color scheme** dialog box will be displayed. Specify the name for the color scheme in the dialog box and choose the **OK** button; the name will be added in the **Schemes** area. Enter a title for the color scheme legend in the **Title** edit box in the **Scheme Definition** area. Next, select the parameter for the color scheme from the **Color** drop-down list; a message prompting you to make a new color scheme will be displayed. Choose the **OK** button to continue. Note that the options in the **Color** drop-down list will vary depending on the category selected.



Note

*Make sure you select the correct parameter from the **Color** drop-down list to create a color scheme. The values for the parameters should be predefined. For example, if you select the **Area** parameter to create a color scheme for a plan view, then the areas must be predefined and tagged in the view.*

In the **Edit Color Scheme** dialog box, the **By value** radio button is selected by default. As a result, the color schemes are created based on the values of the selected parameter. Select the **By range** radio button to create a color scheme based on certain ranges of parameter values. The **By range** radio button will be available only when you select **Area** or **Perimeter** from the **Color** drop-down list in the **Scheme Definition** area. On selecting the **By range** radio button, the **Edit Format** button will be enabled and the unit format used for the parameter will be displayed on the right. Choose the **Edit Format** button; the **Format** dialog box will be displayed. The **Use Project Settings** check box is selected by default. Clear the **Use project settings** check box in the **Format** dialog box; the options in the dialog box will be enabled. Select the required values for the **Units** and **Rounding** options to set the format of the **Area** and **Perimeter** units. Choose the **OK** button; the scheme definition values will be added in the columns. You can modify the values in the columns as required. The columns displayed in the **Scheme Definition** area are discussed next.

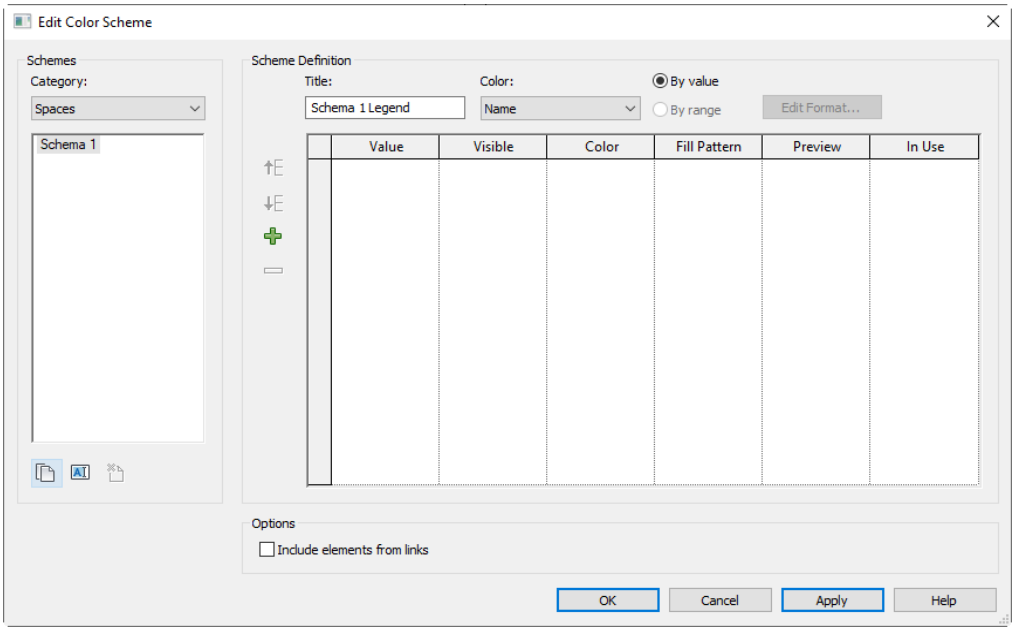


Figure 16-16 *The* ***Edit Color Scheme*** *dialog box*

At Least

This column specifies the lowest value of a range.

Less Than

This column specifies the least value of a range and cannot be modified.

Caption

This column specifies the legend text for the range. Click in the column and edit the text.

Visible

This column indicates the visibility of the value in the color scheme legend. By default, the **Visible** check box is selected indicating that the values are visible in the legend. Clear the check box in the column to make the value invisible in the color scheme legend.

Color

This column specifies the color assigned to the range/ class interval. Click on the default color value in the **Color** column; the **Color** dialog box will be displayed. Select the required color and choose the **OK** button; the selected color will be applied to the range/ class interval and displayed in the column.

Fill Pattern

This column specifies the fill pattern assigned to a value by default. Click on the default value in the column and click on the down arrow displayed on the right. Select the suitable fill pattern from the drop-down list displayed.

Preview

This column displays the preview of the color and pattern used for a particular range.

In Use

This column indicates that if a particular value from a range of values is in use in the project, you cannot modify the values in this column.

To move a row up or down in the **Scheme Definition** area, choose the **Move Rows Up/Down** buttons on the left. These buttons will be available only after selecting the **By Value** radio button. To add a new value to the color scheme, choose the **Add Value** button on the left; the **New Color Scheme entry** dialog box will be displayed. In this dialog box, enter a name in the **Name** edit box; a new scheme will be added. By default, the check box displayed in the value column corresponding to the **Visible** column remains selected. As a result, the added color schemes will be applied to rooms. You can clear this check box if you do not want to apply color schemes to rooms and areas from the linked files. Choose the **OK** button after creating the color scheme.

Applying a Color Scheme

To apply a color scheme in the required plan view, you can use the **Properties** palette of the current view. In the **Properties** palette of the current view, choose the **<none >** button in the value column of the **Color Scheme** parameter; the **Edit Color Scheme** dialog box will be displayed. In this dialog box, select the required color scheme and choose the **OK** button. The colors will be applied to the areas or rooms based on the color scheme selected.

Now, to apply the color scheme in the project view, click on the value field corresponding to the **Color Scheme Location** parameter in the **Properties** palette; a drop-down list will be displayed. You can select any one of the options from **Background** and **Foreground**. On selecting the **Foreground** option, all the elements in the area or room such as furniture or walls, except the columns, will be colored. On selecting the **Background** option only the background or the floor will be colored.

Adding Color Scheme Legends

The color scheme legends help you identify different rooms and areas through different colors assigned to them. The color scheme legends are included in the **Annotation Tag** category. You can place multiple color scheme legends anywhere in the plan view. The color scheme legend belongs to the annotation category and is affected by the Annotation crop region. If you do not want to place the color scheme legend on the view, you can exclude it by adjusting the Annotation crop region of that view.

To add a color fill legend, choose the **Color Fill Legend** tool from the **Color Fill** panel of the **Annotate** tab; the **Modify|Place Color Fill Legend** tab will be displayed. In this tab, select the color scheme from the **Type Selector** drop-down list and then click in the drawing area to place the legend; the color scheme legend will be placed in the drawing view. Figure 16-17 shows a floor plan view with a color scheme and the color scheme legend for the rooms. The color scheme is created based on the area occupied by each room.

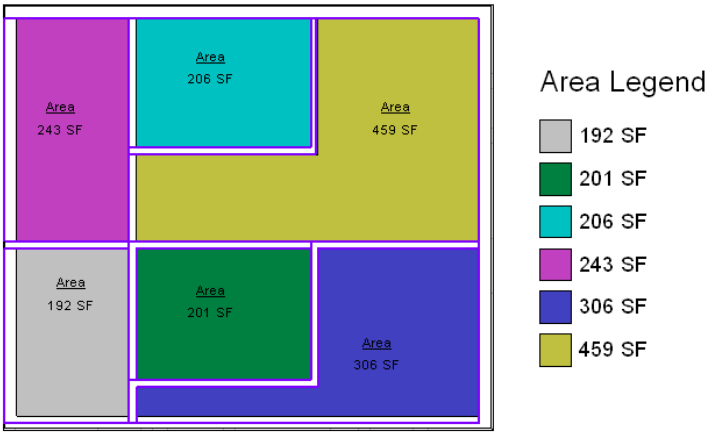


Figure 16-17 *Color scheme with a color scheme legend representing different areas*

You can drag and stretch the color scheme legend by using the drag symbol displayed after selecting the color scheme legend. Figure 16-18 shows an example of using a color fill scheme based on the occupancy of the building.



Figure 16-18 *An example of color scheme based on the occupancy of the building*

Modifying Color Scheme

To modify a color scheme, select the existing color scheme legend and choose **Scheme > Edit Scheme** from the **Modify Color Fill Legends** tab; the **Edit Color Scheme** dialog box will be displayed. Modify the colors, fill patterns, title, parameter, and other values as required and choose the **Apply** button to view the changes. Choose the **OK** button to retain the changes.

Modifying Color Scheme Legends

To modify the color scheme legends, select the existing color scheme legend and drag the blue circular drag control to move the color swatches into new columns. Next, drag the cursor down to move the color swatches into one column. To modify the type properties of the selected color scheme legend, choose the **Edit Type** button in the **Properties** palette; the **Type Properties** dialog box will be displayed. In this dialog box, you can modify various parameters related to the text, swatches, and various elements in the **Color Fill** legend. After modifying the parameters, choose the **OK** button to close the dialog box. You can also hide the title of the color scheme legend by clearing the **Show Title** check box in the **Type Properties** dialog box.

MASKING REGIONS

While working in an architectural project, sometimes it becomes difficult to demarcate between different visible elements due to overlapping of lineworks. Therefore, to reduce the congestion of lineworks and interference of unwanted elements in your drawing, it is necessary to hide or obscure them in the view.

You can overcome the problem of overlapping and congestion of lineworks by using the **Masking Region** tool. By using this tool, you can add the masking regions to a project, detail family, or model family. The **Masking Region** tool has an advantage over the **Region** tool in a way that it can help maintain the visual display of Revit family information and maintain the visual accuracy after the files are imported or exported to other AutoCAD based applications. Masking region can be used in 2D model as well as for 2D and 3D Revit families including detail elements and annotations.

To add a masking region to a project, open the required plan view and then invoke the **Masking Region** tool from **Annotate > Detail > Region** drop-down; the **Modify | Create Masking Region Boundary** tab will be displayed and the screen will enter into the sketch mode. Sketch the masking region and then choose the **Finish Edit Mode** button from the **Mode** panel; the **Modify | Detail Items** tab will be displayed. In this tab, you can edit the boundary of the masking region by choosing the **Edit Boundary** tool from the **Mode** panel**.**

You can add a masking region to a detail family or a model family in the family editor. To do so, open the detail family or the model family in the family editor and then choose the **Masking Region** tool from the **Detail** panel of the **Annotate** tab; the **Modify | Create Masking Region Boundary** tab will be displayed. You can use various sketching tools from the **Draw** panel of this tab to sketch the masking region. Note that the masking region should be a closed loop geometry. After sketching the masking region, you can control its visibility in any model family when the model family is loaded into the project and placed in the drawing. To do so, you can use the instance properties of the masking region displayed in the **Properties** palette. In this palette, clear the **Visible** parameter check box to hide the masking region in a view or select the check box to make it visible in the project. To set the detail level at which the masking region will be displayed, choose the **Edit** button in the **Value** column for the **Visibility/Graphical Overrides** parameter; the **Family element visibility settings** dialog box will be displayed. Set the detail level for the masking region in the **Detail Levels** area of the dialog box and then choose the **OK** button. To set the masking region at the detail plane of the view, select the **Draw in Foreground** check box in the **Properties** palette. To draw the masking region on the work plane on which it is sketched, clear the **Draw in Foreground** check box.

Adding Masking Regions to a Project

To mask or obscure any element in a project, open the floor plan view and choose the **Masking Region** tool from **Annotate > Detail > Region** drop-down; the screen will enter the sketch mode. Choose the required sketching tool from the **Draw** panel, select the line type from the **Line Style** drop-down list, and then sketch the masking regions in the closed loops. After sketching the masking regions, choose the **Finish Edit Mode** button from the **Mode** panel of the **Modify |Create Masking Region Boundary** tab. Figure 16-19 shows the plumbing fixtures such as tub and sink masked in the drawing.

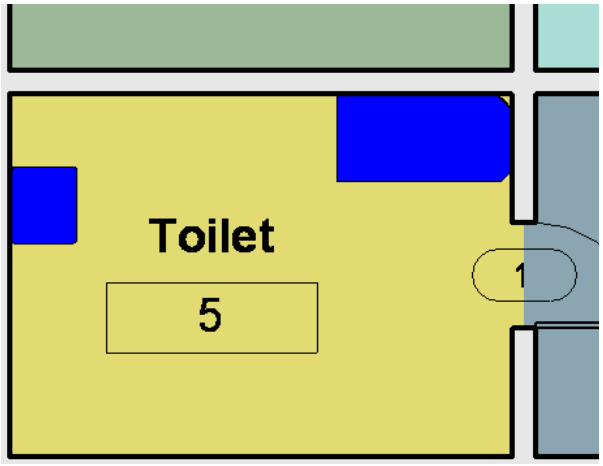


Figure 16-19 *Masking regions added to tub and sink*

Adding Masking Regions to a Detail Family

While creating and defining a detail family, you can add a masking region to it so that when you load it into a project, it can obscure or hide the elements which are interfering with it. To add a masking region to a detail family, open the floor plan view and choose the **Masking Region** tool from the **Detail** panel of the **Annotate** tab, while you are working in the **Revit Family Editor**. On doing so, the **Modify | Create Masking Region Boundary** tab will be displayed for sketching and editing the masking region. Next, choose the required sketching tool from the **Draw** panel. Then, sketch the masking region over the detail family in a closed loop. Next, in the **Properties** palette, you can clear the check box in the **Value** column for the **Visible** instance parameter to disable the masking region boundaries. As a result, when you load the family into the project, the masking region will not be visible.

Masking regions help in improving the visibility of the detail family in a project. For example, if you are creating a detail family elevation for a display unit, you can add a masking region to it. The shape of the masking region needs to fit the geometry of the model over which it is being used, in such a way that it obscures the visibility of other elements like walls and fixtures behind it, when the detail family is placed in the elevation of your project.

Adding Masking Regions to a Model Family

You can create and define a masking region for a model family in the same way as you do for the detail family. While creating a masking region for a model family, you can control the position of the plane where it is drawn by using the **Draw in Foreground** instance parameter in the **Properties** palette of the masking region. If you clear the check box in the value column of the **Draw in Foreground** instance parameter, then you can draw the masking region at the work plane where the model family was created. If you select this check box, then you can draw the masking region at a plane of the model family that is nearest to you in the view.

CREATING DISPLACED VIEW

In Autodesk Revit 2022, the **Displace Elements** tool is used to create a displaced view of an element or group of elements. The element or group of elements of which a displaced view is created is called the displacement set. The displaced view of element is used to see the internal parts of the building which are obstructed due to roofs, and walls of the building. This helps the designer to view the 3D model of the building more closely. This tool is used to move the displacement set along the X, Y, and Z axes upto a specified distance away from a model.

To create displace views in a project choose **{3D}** from the **3D View** in the **Project Browser** and then use the **View Cube** tool from the drawing and align the current view to front view. After aligning, select all the elements above the ground floor; the **Modify | Multi Select** tab will be displayed. In this tab, choose the **Displace Elements** tool from the **View** panel as shown in Figure 16-20; the **Modify | Displacement set** tab will be displayed. Also, in the drawing area, the xyz icon will be displayed. The xyz icon help drag the selected elements in X, Y, or Z directions. On doing so, the element will get displaced to the desired direction. Alternatively, in the **Properties** palette**,** you can enter desired value in the value field corresponding to the X, Y, or Z instance parameter. Now, choose the **Modify** button in the **Select** panel to clear the selection. After displacing element, trace the path of the displaced element. To do so, choose the **Path** tool from the **Displacement Sets** panel; the cursor will change its shape. Move the cursor on the building element in the displacement sets, a dotted line will appear. Click to add the path. Figure 16-21 shows the path of the building added in the displacement sets. Now, you can modify the inside elements if required. After modifying, the inside elements of a building, you can reset the building model. To do so, choose the **Reset** button from the **Displacement Sets** panel; the building will reset to its original position.

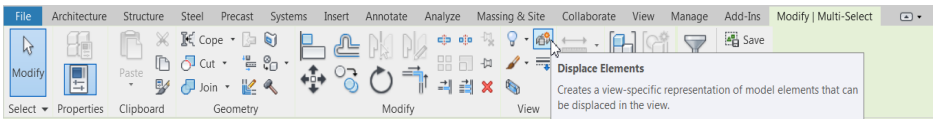


Figure 16-20 *The* ***Displace Elements*** *tool in the* ***Modify / Multi Select*** *tab*

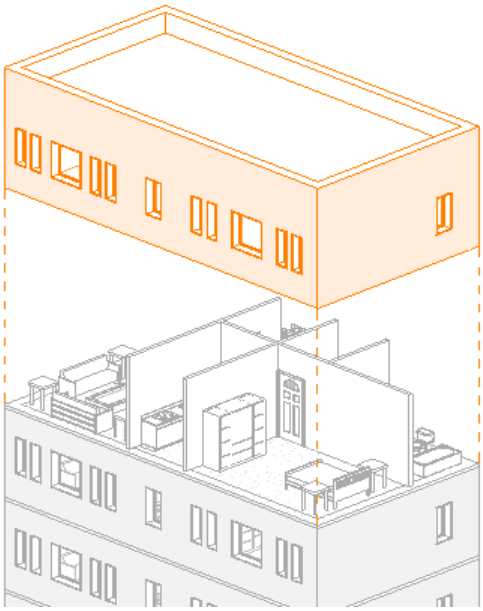


Figure 16-21 *The highlighted path added in a building model*

USING PROJECT PHASING TOOLS

In some architectural projects, building works need to be carried out in phases. Phases represent the time periods over which a project is to be executed. One of the examples of such a project is building a large institutional complex that requires the construction work of different buildings within the stipulated time. Another example can be an interior renovation project, in which certain building components may need to be constructed and demolished over a number of stages or phases. Revit enables the architects and the interior designers to represent phases in the views of a building model. Using the phasing tools, you can generate 3D views that show the phase-wise addition or demolition of building components and the resulting building model as well.

Understanding Phasing Concepts

To use the phasing tools in Revit, you first need to understand the basic concepts of the working of these tools and their usage. You can create any number of phases for a project and specify them for the building elements. Revit allows you to specify phasing for views and also for the building components. Each new building component added to a project has the **Phase Created** and **Phase Demolished** instance parameters associated with it. These instance properties can be modified. The **Phase Created** instance parameter indicates the phase during which the element will be added and the **Phase Demolished** instance parameter shows the phase in which it will be demolished. By default, you can assign one of the following values for these instance parameters in a building element:

New	Element created in the current phase
Existing	Element created in an earlier phase and continues to exist in the current phase

Demolished Element created in an earlier phase and demolished in the current phase
Temporary Element created and demolished in the current phase

Creating Phases and Setting Phase Filters

When you open a new project, by default, it has two predefined phases, **Existing** and **New Construction**. You can specify any number of additional phases in a project. To do so, choose the **Phases** tool from the **Phasing** panel of the **Manage** tab; the **Phasing** dialog box will be displayed, as shown in Figure 16-22. This dialog box displays two predefined phases. You can rename these phases by clicking in the **Name** column and then entering a new name.

The **Before** and **After** buttons in the **Insert** area of the **Phasing** dialog box are used to add new phases before and after a selected phase. The new phases added can suitably be renamed and arranged according to their time period, from the past to the future.

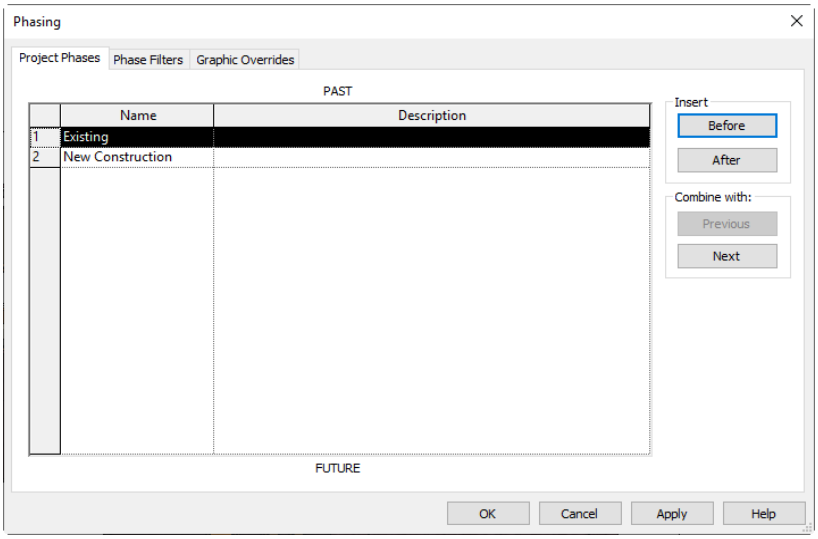


Figure 16-22 *The* ***Phasing*** *dialog box*

You can choose the **Previous** or **Next** button from the **Combine with** area of the **Phasing** dialog box to combine the selected phase with the previous or next phase in the **Project Phases** list. The phases cannot be rearranged after they have been created. The appearance of building components in various phases can be controlled by setting phase filters. A phase filter is a tool that determines the visibility of a building element in a view, based on its phase condition. The **Phase Filters** tab in the **Phasing** dialog box displays the preloaded phase filters. The description of these filters is given next.

Show All Shows the new, existing, demolished, and temporary components in that particular phase. Components demolished in the earlier phases are not displayed
Show Complete Shows the components in the last phase
Show Demo+New Shows the demolished and new components
Show New Shows the elements added to a particular phase
Show Previous+Demo Shows the existing and demolished components

Show Previous+New Shows the existing and new components
Show Previous Phase Shows all components from the previous phase

You can use the **New** button to add new phase filters and set the parameters for the same. Set the parameters for the display of components in different phases using the **Graphic Overrides** tab.

Specifying Phases for Project Views

To create project views for different phases, you need to create the copies of the project view. Right-click on the name of the project view in the **Project Browser**, and then choose **Duplicate View > Duplicate** from the shortcut menu to create a duplicate view. Open each project view and set its phasing parameters. Click on the project view and then from the **Properties** palette select appropriate options from the drop-down lists corresponding to the **Phase Filter** and **Phase** parameters. Revit applies the rules for the specified phase filter and displays the components that belong to the selected phase, in the current project view. This procedure can be adopted for all copies of the project view. You can display components for each phase of a project.

Using the Demolish Tool to Specify Phases for Building Elements

Choose the **Demolish** tool from the **Phasing** panel of the **Manage** tab to demolish components. When you demolish a component, it appears as a dashed line in the view in which it was demolished. Set the appropriate phase filter to display the demolished components in other project views. When you select an element from the drawing area, the value for the **Phase Demolished** parameter in the **Properties** palette indicates the phase in which the component was demolished. You can prepare demolition plans for the building elements in each phase.

LINKING BUILDING MODELS AND SHARING COORDINATES

Some large projects may require you to develop independent building models and later combine them into a comprehensive project. For example, in a large educational campus project, you may need to independently develop the building models of the administrative building, academic complex, faculty residences, student accommodation, and so on, and later add them into a single host project file. You can do so by using Revit's linking and sharing coordinates tools that enable you to link models and share their coordinates within a single host project file. These tools also enable you to work on building models in other project files. When you link projects, you need to share the coordinates of the host model with the linked model so that the linked files retain their positions. To do so, invoke the **Acquire Coordinates** tool from **Manage > Project Locations > Coordinates** drop-down and then select the linked project in your drawing. On selecting the linked project, the origin of the linked project's shared coordinate becomes the origin of the host project's shared coordinates. Revit Architecture provides the flexibility and easy management of the linked models by enhancing the linking of the models and organizing the linked files in the **Project Browser**. You can easily access the linked files, the nested link files, and the Link Manager from the **Project Browser**. The nested Revit links are also listed under the **Revit Links** head with the host link in the **Project Browser**.

Linking or Importing Models

To link or import one project to the other, open the host project file and choose the **Insert** tab, options in this tab will be displayed, as shown in Figure 16-23. You can choose the options from the **Import** or **Link** panel of the **Insert** tab depending upon the file format to be imported or linked. Before you import or link any file, make sure that the file contains the data and geometry that are compatible with Revit Architecture. To link *.dwg, .dwf, .skp, .dgn,* and other files, choose the **Link CAD** tool from the **Link** panel of the **Insert** tab; the **Link CAD Formats** dialog box will be displayed, as shown in Figure 16-24. In this dialog box, select the file type from the **Files of type** drop-down list. Next, browse to the required location and select the file. The options in this dialog box are discussed next.

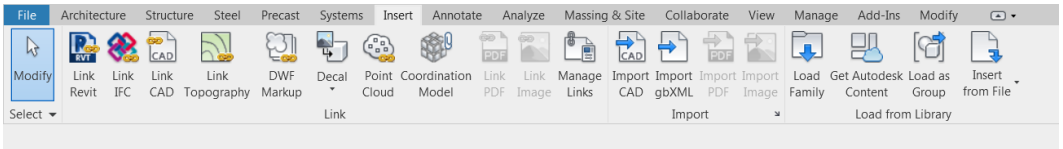


Figure 16-23 *The linking and the importing options in the* ***Insert*** *tab*

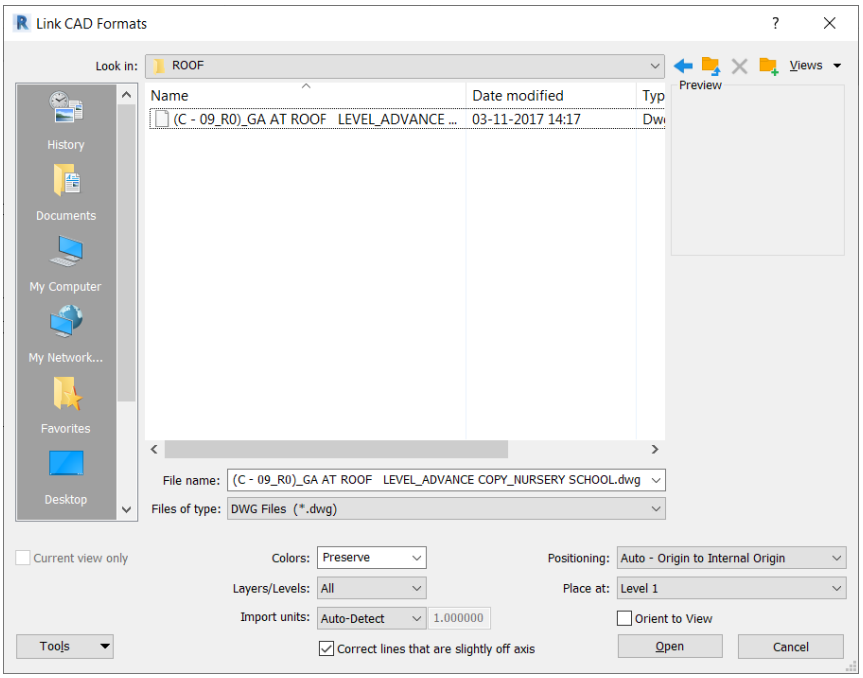


Figure 16-24 *The* ***Link CAD Formats*** *dialog box*

Linking or Importing Files

In Revit Architecture, you can link or import the CAD files to the current project. If a CAD file is linked to a project, all changes made in it will simultaneously be updated in the project. However, if you import a file in a project, it will remain unchanged, irrespective of any changes made in the file linked to the project.

To link a CAD file to a project, choose the **Link CAD** tool from the **Link** panel of the **Insert** tab of the ribbon; the **Link CAD Formats** dialog box will be displayed. Select the desired CAD file and then choose **Open**; the selected CAD file will be displayed and linked to the Revit project file. Similarly, you can import a CAD file to a project. To do so, choose the **Import CAD** tool from the **Import** panel of the **Insert** tab; the **Import CAD Formats** dialog box will be displayed. Select the desired CAD file and choose **Open**; the selected file will be imported to the Revit file.

While importing or linking a CAD file to your project, you can control its availability either in all views or only in the current view. If you select the **Current view only** check box in the **Import CAD Formats** or **Link CAD Formats** dialog box, you can import or link the drawing in the CAD format only in the active Revit Architecture view. However, if you clear the check box, you can import the drawing in the CAD format in all views of Revit Architecture. In this case, the lines and geometries of the drawing will be imported without the text.

The **Layers/Levels** drop-down list in the **Import CAD Formats** or **Link CAD Formats** dialog box allows you to specify the layers to be imported from the linked file. On selecting **All** from the **Layers/Levels** drop-down list, all layers will be imported or linked. The **Visible** options in this list allow you to import or link the visible layers in the view. The **Specify** option allows you to import the specified layers and levels in the project.



Note

If you need to display layers of the linked files that were not selected or visible initially, you can get them by deleting the present link and relinking the file.

Assigning Colors to Imported or Linked Files

In Revit Architecture, you can import or link files in various colors. The **Color** drop-down list in the **Import CAD Formats** or **Link CAD Formats** dialog box allows you to link various colors to the displayed files. The options in this drop-down list are discussed next.

Black and white

If this option is selected, the file will be imported in black and white.

Preserve colors

If this option is selected, you can retain the original colors of the file.

Invert colors

If this option is selected, the color of the objects will be inverted. As a result, the dark colored objects will be converted to light colored objects and vice-versa. This option is useful for improving the clarity of lines and texts of the imported files to make them reader-friendly.

Positioning Imported Files

While importing or linking files to Revit Architecture, it is important that the imported geometries and texts are placed at correct position. Revit allows you to align the imported or linked files to the current geometry by providing various options in the **Positioning** drop-down list of the **Import CAD Formats** or **Link CAD Formats** dialog box. Depending on the project requirement, you can position the imported or linked files automatically or manually in the host project. Various positioning options that can be used to position the imported file automatically are given next.

Auto - Center to Center Revit will place the center of the footprint of the imported model geometry at the center of the model.

Auto - Origin to Origin The world origin of the imported model geometry will be aligned to the internal origin of the host model.

To place the linked model manually, select any of the following options from the **Positioning** drop-down list:

Manual - Origin The origin of the linked or imported project will be attached to the cursor.

Manual - Center The center of the linked project will be attached to the cursor.

You can place the origin or the base point of the imported or linked files at the selected level by selecting the options from the **Place at** drop-down list. You can also select the **Orient to View** check box to place the linked or imported file at the same orientation as that of the current view.



Note

Revit uses the coordinate system for its project, but this system is not visible to users. The center of the linked project is the geometric center of its footprint and may change with the change in the model geometry.

Setting Units for Imported or Linked Files

You can set the measurement unit of the imported geometry using the **Import units** drop-down list available in the **Import CAD Formats** or **Link CAD Formats** dialog box. If you select the **Auto-Detect** option, the imported or linked files will be inserted in the unit in which they were created. For example, if you import a file that has been created in AutoCAD using **English-Imperial (English)** as its default unit, Revit will automatically adopt feet and inches as the units for the imported geometry in the current project. Similarly, you can select other units from the **Import-units** drop-down list as per your project requirement.

Linking Revit Models

To link or import the Revit files, choose the **Link Revit** tool from the **Link** panel of the **Insert** tab; the **Import/Link RVT** dialog box will be displayed, as shown in Figure 16-25. In this dialog box, navigate to the desired folder and select the file to be linked to the host project; the preview image of the selected project file will be displayed in the **Preview** pane. Choose the **Open** button to open the file. Select the appropriate positioning option from the **Positioning** area to position the model automatically or manually in the host project.

Linked Revit Models in the Project Browser

The linked Revit models are listed in the **Project Browser** under the **Revit Links** head. You can access the linked model files from the **Project Browser**. You can also link a new file from the **Project Browser**. To do so, select **Revit Links** sub-node in the **Project Browser** and right-click; a shortcut menu will be displayed. Choose **New Link** from the shortcut menu; the **Import/Link RVT** dialog box will be displayed. Select the file to be linked from this dialog box. Similarly, you can access the link manager by choosing **Manage Links** from the shortcut menu and manage the links. You can also open the linked model in the project by dragging it from the **Project Browser** and dropping it in the project view.

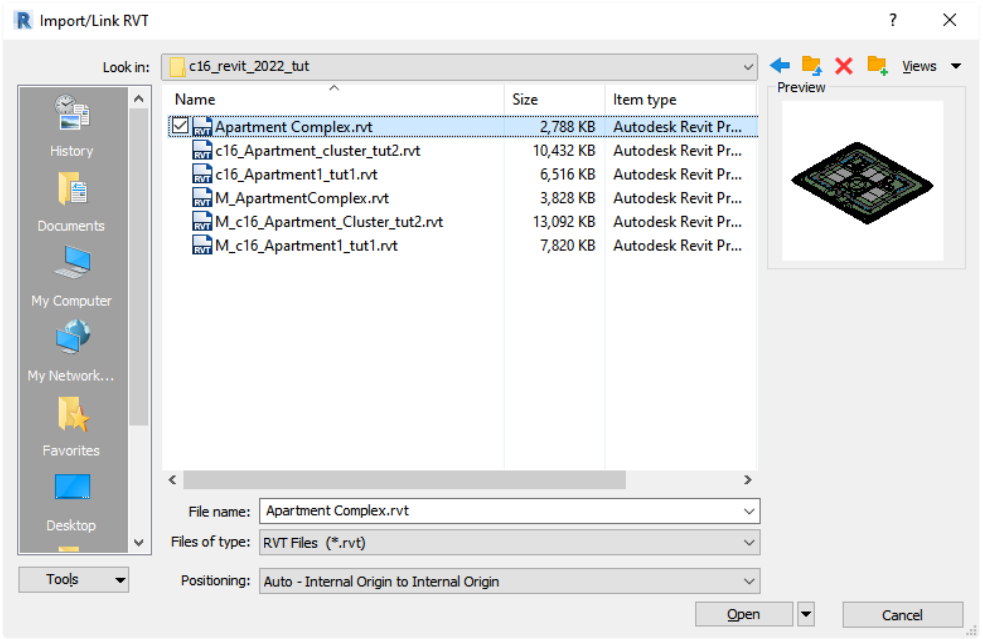


Figure 16-25 *The* ***Import/Link RVT*** *dialog box*

Nested Linked Models

If you import a Revit model that already contains a linked file, the linked file becomes a nested link file. You can control the visibility of the nested linked models in the host project file. When you link a file, by default, the nested link model will not be displayed in the host project file and the **Nested Links Invisible** message box will be displayed, as shown in Figure 16-26, indicating that the elements in the linked model will not be visible in the project view. This message is displayed because by default the **Overlay** value is set for the **Reference Type** option in the **Manage Links** dialog box. To display the nested link model in the host model, open the parent link view in which the file is linked and choose the **Manage Links** tool in the **Import** panel of **Insert** tab; the **Manage Links** dialog box will be displayed. Choose the **Revit** tab from the dialog box; the name of the linked file will be displayed in the **Linked Name** column. Click in the **Reference Type** column and change the value in this column to **Attachment**. Now, link the parent model file to the host project; the nested linked model will be displayed in the project. If you do not want to display the nested model elements in the host project, accept the default **Overlay** option. When you select the **Overlay** option, Revit does not load the linked model when its host is linked to another model. The following example explains the use of the **Overlay** and **Attachment** options in linking models. Example: Project A consists of a single horizontal wall, as shown in Figure 16-27. The project A is imported and linked to the project B that consists of a single vertical wall. Figure 16-28 shows the Project B and Figure 16-29 shows the project A linked to the project B. The project B becomes a host for project A and project A becomes a link for project B. Now, the project B along with the linked project A (consisting of both horizontal and vertical walls) is imported to another project, Project C, which consists of a single inclined wall. In this case, the project A (consisting of a horizontal wall) becomes a nested link. Figure 16-30 shows the project C after linking with the project B. You will notice that the horizontal wall of

project A will not be displayed in the project C. This is because the **Overlay** option is selected in the **Reference Type** column of the **Manage Links** dialog box. To display the horizontal wall of the project A (nested model) in the project C, open the project B parent view, consisting of vertical and horizontal walls. Next, choose the **Manage Links** tool from the **Link** panel in the **Insert** tab; the **Manage Links** dialog box will be displayed. Choose the **Revit** tab in the dialog box; the project A will be displayed in the **Linked File** column. Select the **Attachment** option for the linked project A in the **Reference Type** column and choose the **OK** button. Close the parent view and import the project B into the project C. Now, the horizontal wall of the project A (nested link) will be displayed in the project C, as shown in Figure 16-31. The project A will also be added in the **Project Browser** as the nested link under the parent project B, as shown in Figure 16-32.

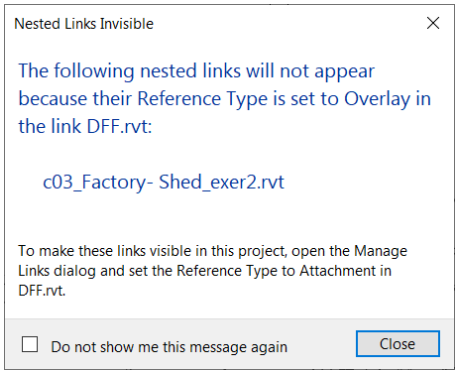


Figure 16-26 *The* ***Nested Links Invisible*** *message box*

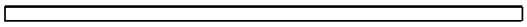


Figure 16-27 *Project A consisting of a horizontal wall*



Figure 16-28 *Project B consisting of a vertical wall*

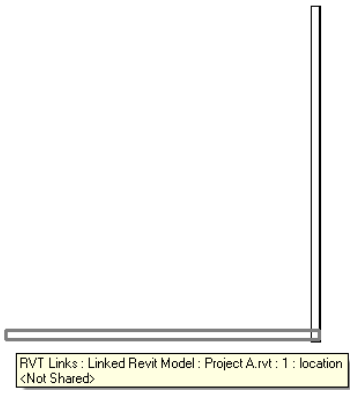


Figure 16-29 *Project A linked to project B*

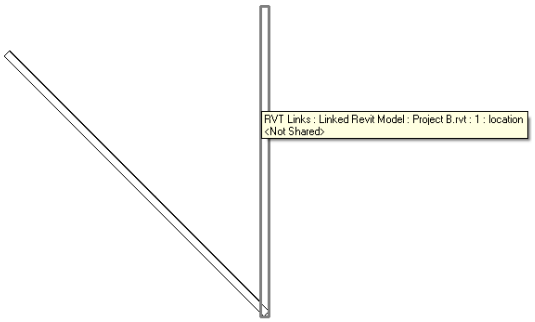


Figure 16-30 *The host project B linked to project C with the* ***Overlay*** *option selected*

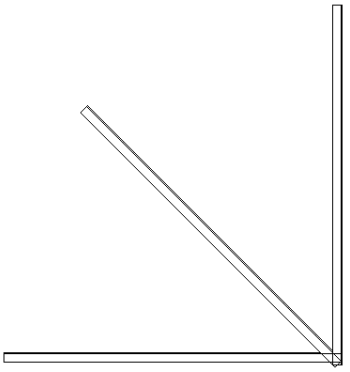


Figure 16-31 *Project B linked to Project C after selecting the* ***Attachment*** *option for project A*



Figure 16-32 *Project A added as a nested link with parent project B in the* ***Project Browser***

Converting Linked Models to Groups - Binding Links

You can convert the linked Revit models into groups in the host project. You can do so by binding the linked model with the host project, thereby making it a part of the host project. After binding the linked model, the model geometry will be transformed into a group, and therefore making changes in the host project will be easier for you. To bind and group a linked model, select the linked model in the drawing; the **Modify | RVT Links** tab will be displayed. Choose the **Bind Link** tool from the **Link** panel; the **Bind Link Options** dialog box will be displayed, as shown in Figure 16-33. In the dialog box, select the **Attached Details**, **Levels**, and **Grids** check boxes to include them in the group and then choose the **OK** button; the linked model will be converted into a group. If there is any group in the project with the same name as that of the linked Revit model, a dialog box with a message will be displayed prompting you to replace the group. Choose **Yes** to replace the existing group or choose **No** to rename the group. On choosing **Yes**, another dialog box with a message to remove the link will be displayed, as shown in Figure 16-34. Choose the **Remove Link** button in the dialog box to remove the link or choose the **OK** button to remove it later; the linked model will be transformed into a group and listed in the **Project Browser** under the **Groups** head.

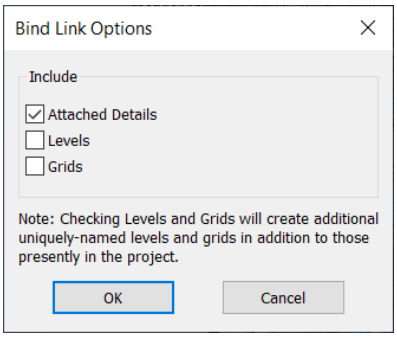


Figure 16-33 *The* ***Bind Link Options*** *dialog box*

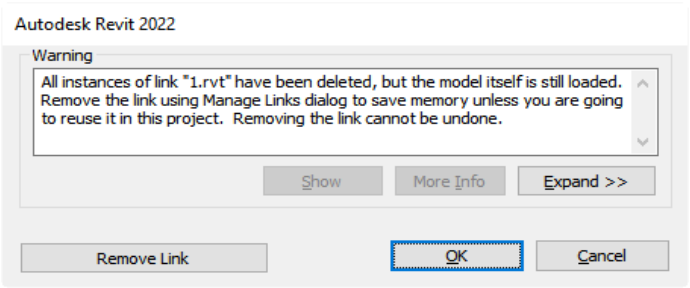


Figure 16-34 *The message box displayed on binding the link*

Controlling the Visibility of Linked and Nested Linked Models

You can control the visibility of the linked and nested Revit linked models in the host project file. Also, you can control the visibility settings, detail level, and display settings of the building elements in the linked project. To modify the visibility settings in the host project, open the view in which the visibility settings are to be modified. Choose the **Visibility/ Graphics** tool from the **Graphics** panel in the **View** tab; the **Visibility/Graphic Overrides** dialog box will be displayed. The **Revit Links** tab in this dialog box displays the linked projects, as shown in Figure 16-35. This tab will be displayed only when the files are linked in your project. Click on the project name to display the categories of components in the building model. Use the **Halftone** and **Display Settings** columns to modify the visibility settings and filters of the components of each linked project. The **By Host View** button in the **Display Settings** column can be used to control the visibility of the nested links, phases, and phase filters.

Click in the **Display Settings** column; the **RVT Link Display Settings** dialog box will be displayed. Choose the **Basics** tab from the dialog box. If you select the **By host view** radio button in this tab, the nested linked model will be able to use the same visibility and graphics settings as in the host view. On selecting the **By linked view** radio button, the nested linked model adopt the visibility settings of the parent model to which it was linked originally. On selecting this radio button, the **Linked view** drop-down list will be enabled. You can select the view in which you want to display the linked model from this list.

On selecting the **Custom** radio button, all the options in the **Basics** tab will be enabled. From the **Nested links** drop-down list, select the **By parent link** option to apply the visibility settings of the parent model to the nested link model. If you select **By linked view** from the drop-down list, the visibility and graphics override settings of the top level nested model will be applied to the linked model. The top level model is the first nested linked model. In the example explained earlier, project A will be the top-level nested model. Choose the **Apply** button to view the changes in the project and then choose the **OK** button.

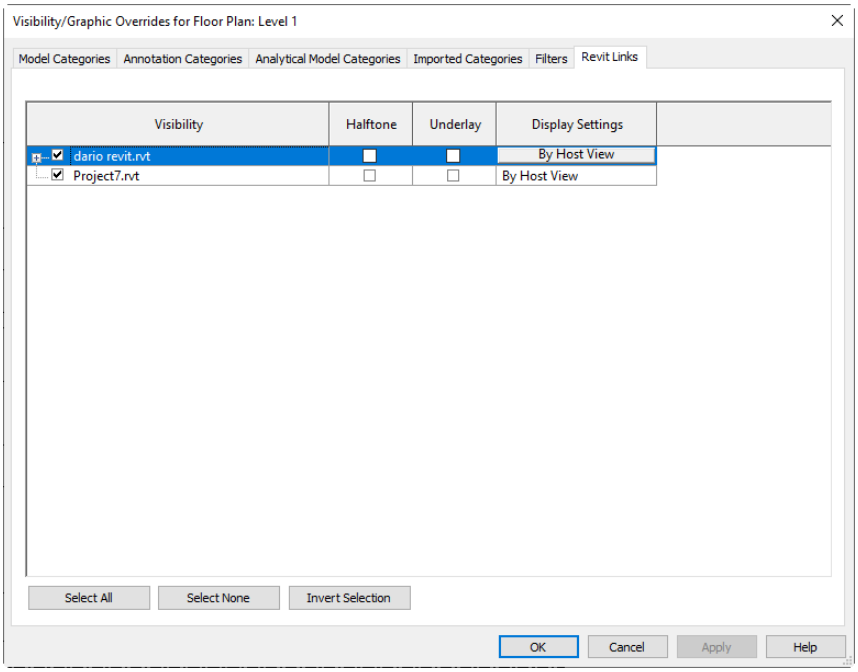


Figure 16-35 *The* ***Revit Links*** *tab of the* ***Visibility/Graphic Overrides*** *dialog box*

Managing Links

Revit enables you to manage links between the host and the linked projects. To do so, choose the **Manage Links** tool from the **Link** panel of the **Insert** tab; the **Manage Links** dialog box will be displayed with a list of linked projects, as shown in Figure 16-36.

The **Status** column in the **Manage Links** dialog box informs whether the linked project file is loaded in the host project. The **Reference Type** column in the dialog box provides you with the options to display or hide the nested linked Revit models. The default **Overlay** value in the **Reference Type** column restricts the loading and display of the nested linked models in the host project. The **Positions Not Saved** column of the dialog box indicates whether the linked models location is saved in its shared coordinate system or not. The shared coordinates take care of the mutual positions of multiple interlinked files. The **Saved Path** column shows the path of the linked file on your computer. The **Path Type** column is used to specify whether the saved path of the linked file is relative or absolute. It is recommended to keep the linked path relative because it enables Revit to trace and re-establish the link, in case the host and linked projects are moved to a different folder.

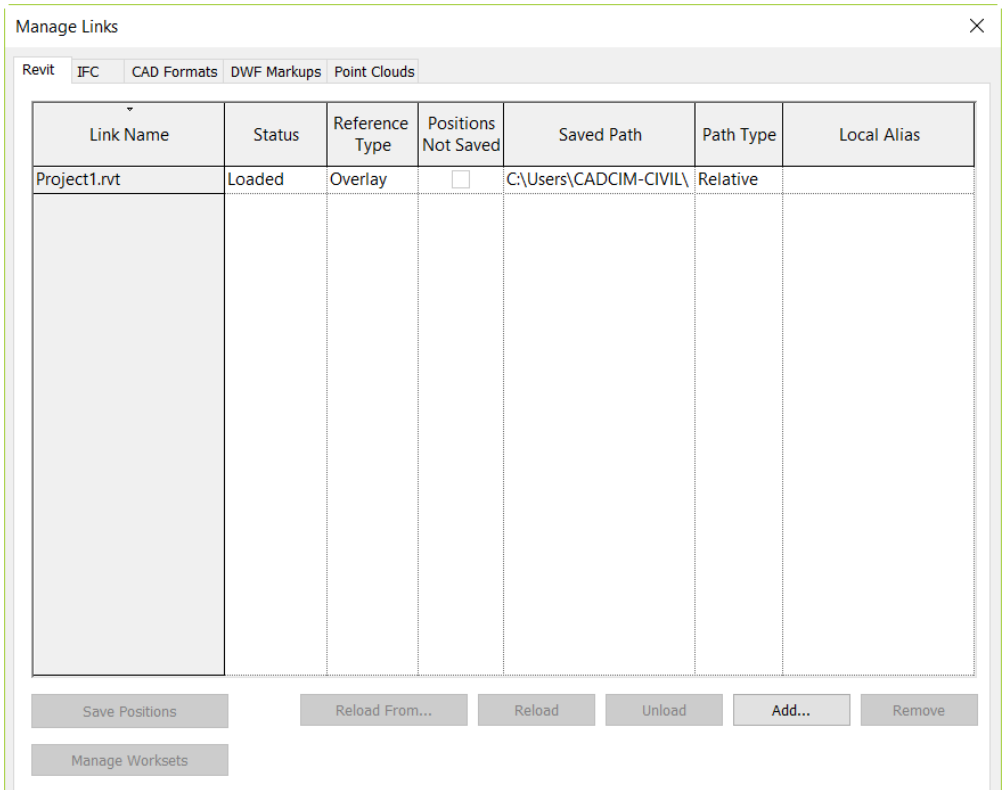


Figure 16-36 *The* ***Manage Links*** *dialog box*

Including Elements of Linked Models in Schedules

In Autodesk Revit, you can include different model elements from a linked file such as walls, doors, windows, and so on into a schedule. To do so, select the existing schedule of the current project from the **Schedules/Quantities(all)** head in the **Project Browser**; the instance properties of the selected schedule will be displayed in the **Properties** palette. In the value column of the palette, choose **Edit** in the **Fields** parameter; the **Schedule Properties** dialog box will be displayed. Select the **Include elements in Linked** files check box to include the elements from a linked file, if required. To include project information from a linked file, select **Project Information** from the **Select available fields from** drop-down list. Select the example explained earlier, project A will be the top-level nested model. Choose the **Apply** button to view the changes in the project and then choose the **OK** button.

Applying the Color Schemes of the Host Model to Rooms and Areas of the Linked Models

In Autodesk Revit, you can apply the color scheme assigned to the rooms and areas in the host file to the rooms and areas in the linked file. To do so, choose the **Color Schemes** tool from the **Room & Area** panel of the **Architecture** tab; the **Edit Color Scheme** dialog box will be displayed. In this dialog box, make sure that the **Include Elements from linked** files check box is selected in the **Options** area. Choose the **OK** button to close the dialog box. Next, choose the **Visibility/Graphics** tool from the **Graphics** panel of the **View** tab; the **Visibility/Graphic Override** dialog

box will be displayed for the current view. Next, choose the **Revit Links** tab from the dialog box. Select the linked model to which you want to apply the color scheme of the host file. Choose the default **By Host View** button in the **Display Settings** column; the **RVT Links Display Settings** dialog box will be displayed. You can select the **By host view** or **Custom** radio button in this dialog box if the linked model consists of rooms. However, if the linked model consists of only areas, select the **Custom** radio button. On selecting the **Custom** radio button, all options in the **Basics** tab will be enabled. From the **Linked view** drop-down list, select the view of the linked model to which you want to apply the color scheme. Next, from the **Color Fill** drop-down list, select the **By host view** option. Choose the **Apply** button to apply the changes. Next, choose the **OK** button to close the dialog box.

You can also display the room areas and the area boundary of the linked file in the host project. To do so, open the parent view that contains the linked model and select the **By linked view** radio button in the **RVT Links Display Settings** dialog box. Select the required plan view from the **Linked View** drop-down list and choose the **OK** button; the room areas and the area boundaries in the linked model will be displayed in the host file.

Copying Linked Model Elements

You can copy the elements of the linked model to the host model. To do so, move the cursor over the linked model and press TAB to highlight the required elements, in case the file has a nested link. Click on the element when it is highlighted and choose the **Copy to Clipboard** tool from the **Clipboard** panel of the **Modify | RVT Links** tab. Next, open the host file in which you want to paste the element and choose the **Paste from Clipboard** tool from the **Clipboard** panel; the linked model file from which you have selected the element will be displayed in the **Project Browser** under the **Revit Links** head. You can place the element either by clicking at the required location in the drawing area or by dragging the linked model from the **Project Browser** and dropping it in the drawing area.

WORKSHARING CONCEPTS

Worksharing is a method of distributing work among people involved in a project, and accomplishing it within the stipulated period of time. In Worksharing, each person involved in the project is assigned a task that has to be accomplished through proper planning and by coordinating with the other members of the team.

In a large scale building project, worksharing is the most important method to finish the project in time and meet the quality requirements that are set during the process. Generally, in a large-scale building project, worksharing is based on the specialization of work. For example, professionals like Structural Engineers, Architects, Interior Architects, Electrical Engineers, and Plumbing Engineers can be involved in their respective fields to accomplish the project. So, the distribution of work at the primary stage is made on the basis of the area of specialization. Each professional has his own set of work to perform for the accomplishment of the project. Therefore, worksharing is an important process that is needed to be implemented efficiently to complete the project in time.

Worksharing Using Workset Tools

In Autodesk Revit, you work in an integrated single file model. This implies that all the construction related information and documents are available in a single model file and this forms the basis of the worksharing process.

The process of worksharing can be implemented using the **Worksets** tool. Worksets are a collection of building elements such as walls, doors, windows, and others that define the domain and ownership of the user in a project. For example, a project may contain building elements like beams, columns, furniture, walls, doors, and so on. In a worksharing environment, you can assign each element to a workset, which defines its ownership to the user, thereby restricting other users to change or modify it in the project without prior permission. Therefore, only one user can edit a workset at a time.

When you start a new Revit Architecture project, the worksharing is not activated by default because the software assumes that you are working in a single user environment. When you transform your project from a single user to a multi-tasking environment, you need to understand the concept of central file system and the utility of using the worksets. A central file is a master file of the project and stores the entire building information of the building and its model. This file is connected and shared by all other files representing individual users and it monitors the progress of the entire project. The files that are shared and connected to the central file are called local files. These files are the copy of the central file and are saved on the individual users workstation locally. These files can also be saved in a specified network location, thereby differentiating them from the central file. These local files act as an interfacing mechanism for working on the central file.

Process of Worksharing

With the start of the new project, you start creating the basic building geometry like the shell of the model with basic detailing. But as the project progresses, you underscore the need of sharing the project with multiple users for which you need to speed up the process of work toward completion. To invite multiple users to work in your project, you save the file that you have worked as a central file in a network location and make copies of it in the local hard drives of individual team members. By doing so, you divide the work into different parts. Everybody will start working with the copied central file from his or her individual workstation. Before starting with the file, each member working in the project is instructed to rename the copied central file in their individual hard drive location and then open it in Revit Architecture to proceed further. The flow diagram in Figure 16-37 explains in brief the process of worksharing in brief.

Elements in each separate file are tied to the ownership rule linked to the central file. This restricts individual team members to edit an element in his or her local file, which is owned by someone in local files. In the worksharing process, the central file behaves as the controller of all elements that are shared by members.

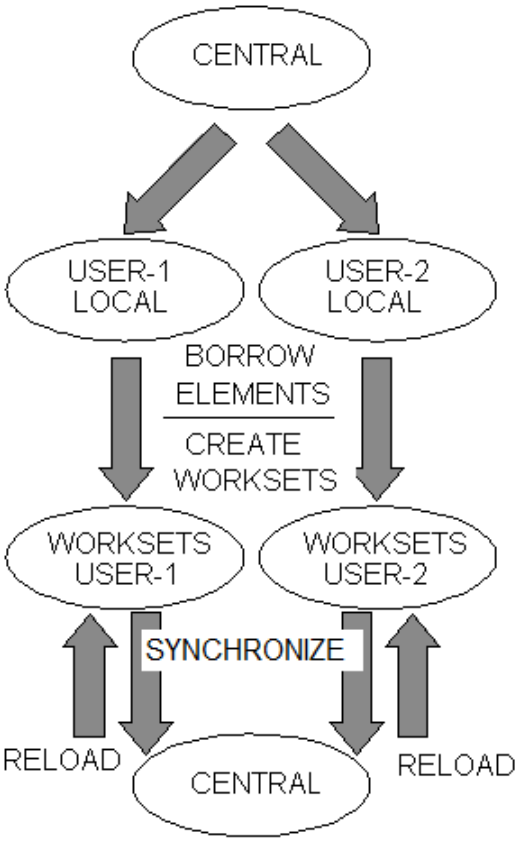


Figure 16-37 *Flow diagram explaining the Worksharing process*

Using Worksets Tool

To enable the process of worksharing choose the **Worksets** tool from the **Manage Collaboration** panel of the **Collaborate** tab. Autodesk Revit displays the **Worksets** dialog box, as shown in Figure 16-38.

In the **Worksets** dialog box, there are five different columns, **Name**, **Editable**, **Owner**, **Borrowers**, and **Opened**, as shown in Figure 16-39. The **Name** column displays the worksets that are defined or predefined in the project. The **Editable** column shows the status of the modification of elements and components of the workset in the project. The **Owner** column specifies the ownership of the particular workset in the project. The ownership of the workset refers to the name of the user who had created it. This name refers to the user of the master file or the user of the local file. By default, Revit Architecture denotes the name of the user, which is determined by the log-on name of the operating system. In Revit, before enabling the workset, you can change the username. To do so, choose the **Options** button from the **File** menu; the **Options** dialog box will be displayed. In this dialog box, choose the **General** tab and specify a new name in the **Username** edit box, as shown in Figure 16-39.

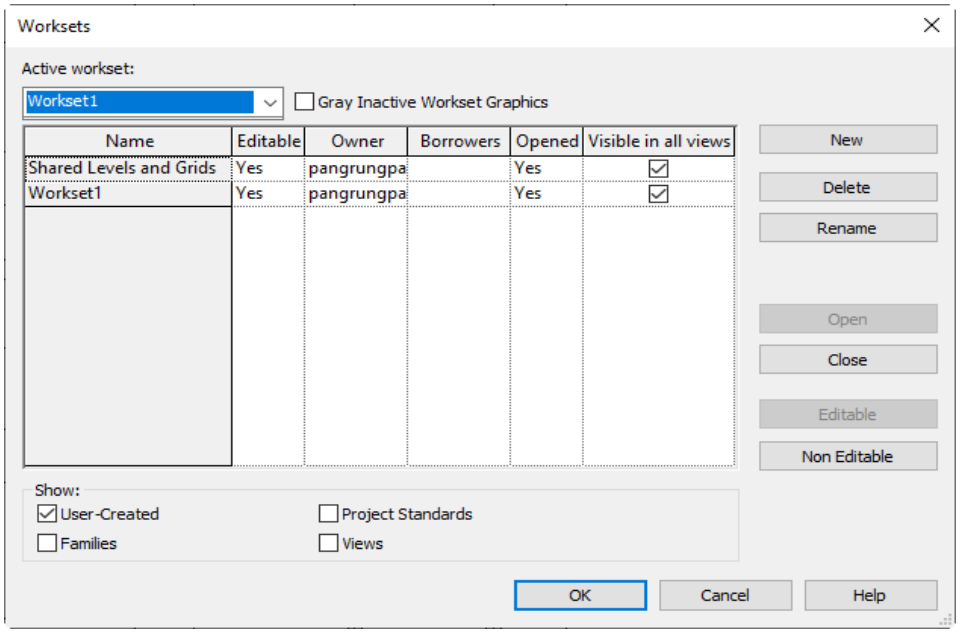


Figure 16-38 *The* ***Worksets*** *dialog box displaying different columns*

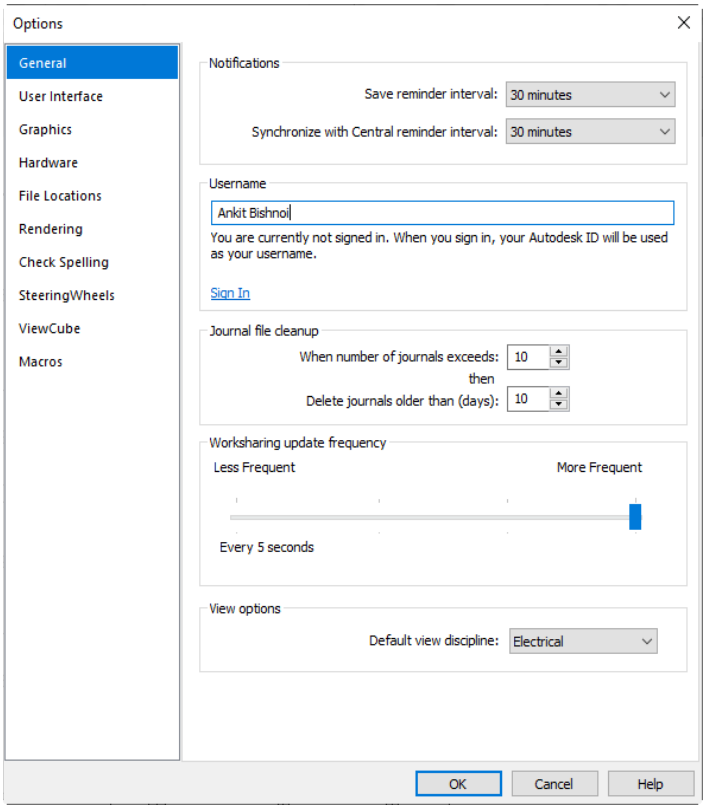


Figure 16-39 *The* ***Options*** *dialog box*

The **Borrowers** column in the **Worksets** dialog box displays the name of the user currently using the elements of the worksets that do not belong to him or her. In this process, the owner or any other user can only use the borrowed worksets, if the borrower allows to do so.

The **Opened** column is used to select a workset definition. There are two options in this column: **Yes** and **No**. These options can be used to control the visibility of elements in a group. By default, all worksets in the **Worksets** dialog box are assigned the **Yes** option. It means all elements and components of these worksets are visible in the file. But, if you choose the **No** option, the visibility of elements and components of worksets will be disabled.

The **Visible in View** column allows you to show workset in all views. This column carries checkboxes corresponding to the **Shared Level and Grids** and **Workset 1** Name parameters. These check boxes are selected by default. On clearing these check boxes, the workset will not be displayed in any view.

You can select various options from the **Active workset** drop-down list located at the top in the **Worksets** dialog box. This drop-down list is used to select those worksets that are user defined and have the status **Yes** in the **Opened** column of the **Worksets** dialog box. Select the appropriate workset available in the drop-down list to make it current. If you select the **Gray Inactive Workset Graphics** check box, the elements that do not belong to the active workset will turn gray in the drawing area and the active elements will be displayed in black. If you clear this check box, all elements in the drawing area, irrespective of whether they are active or inactive, will turn black.

To create a new workset definition, choose the **New** button in the **Worksets** dialog box; the **New Workset** dialog box will be displayed, as shown in Figure 16-40. Enter the name of the workset in the **Enter new workset name** edit box and choose the **OK** button to return to the **Worksets** dialog box.

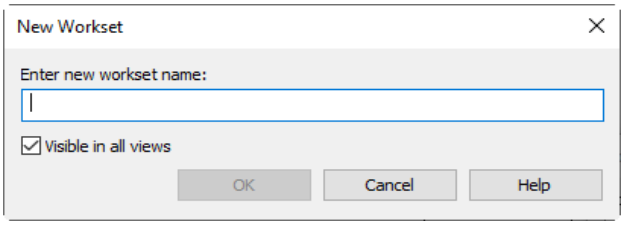


Figure 16-40 *The* ***New Workset*** *dialog box*

The **Delete** button in the **Worksets** dialog box is used to completely remove the selected workset. You can delete only that workset definition which is editable. When you choose the **Delete** button, the **Delete Workset** dialog box will be displayed, as shown in Figure 16-41. This dialog box can be used to delete the elements belonging to the deleted workset or to move these elements to a different workset definition. If you select the **Deleted** radio button in this dialog box, elements that belong to the workset being deleted, will be deleted. Similarly, if you want to move these elements to a different workset, select the **Moved to** radio button and then select the appropriate workset from the **Moved to** drop-down list. Choose the **OK** button to return to the **Worksets** dialog box. You can rename the editable worksets. To do so, select the workset in the **Name** column and choose the **Rename** button; the **Rename** dialog box will be displayed. Specify a name in the **New** edit box to change the name of the selected workset. The **Open** and

Close buttons in the **Worksets** dialog box are used to change the status of the selected workset in the **Opened** column to **Yes** and **No**, respectively. Similarly, the **Editable** and **Non Editable** buttons can also be used to change the status of the selected workset in the **Editable** column to **Yes** and **No**, respectively. While using the Workset for the first time, if you choose the **Non Editable** button before saving the file to the central file, the **Revit** warning message box will be displayed. This message box warns you to save your file to central file.

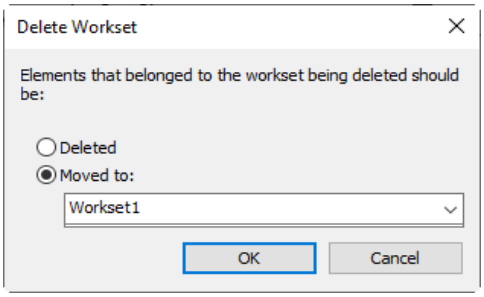


Figure 16-41 *The* ***Delete Workset*** *dialog box*

In Autodesk Revit, you can define four different types of worksets. These worksets are **User-Created**, **Family**, **Project Standards**, and **View** worksets. These Worksets are explained next in detail.

User-Created Workset

A user can define and modify this workset as per the requirements. As a user, you can create your own workset and assign different elements and components to it. When you invoke the **Worksets** dialog box, two worksets, **Shared Levels and Grids** and **Workset1** are created by default. The **Shared Levels and Grids** workset is automatically defined for the existing levels and grids in your drawing and the **Workset1** workset is defined for all elements and components created by you.

View Workset

In Revit Architecture, each view has a dedicated view workset that contains a dedicated view property and view-specific elements like dimensions, tags, text, and others. To display view worksets in the **Worksets** dialog box, you need to select the **Views** check box in the **Show** area of this dialog box.

The view-specific elements cannot be moved to other worksets. To own a view in a workset, select the view from the **Project Browser** and click the right mouse button over it; a cascading menu will be displayed. Choose the **Make Workset Editable** option from it to own the view in the workset.

Family Workset

When you load a family into your project, a workset is automatically created for it. You can view the family workset by selecting the **Families** check box in the **Show** area of the **Worksets** dialog box. To own a family, select it in the **Worksets** dialog box and change the default option **No** in the **Editable** column to **Yes** from the available drop-down list.

Project Standards Workset

The project standards worksets are used to set projects. You can view these worksets by selecting the **Project Standards** check box in the **Worksets** dialog box. In the **Worksets** dialog box, you can own a particular workset by changing the default option **No** in the **Editable** column to **Yes** from the available drop-down list for the selected workset. **Materials**, **Line Styles**, and **Callout Tags** are good examples of these worksets.

Once you have created and edited your workset, you can exit the **Worksets** dialog box by choosing the **OK** button from it. You can disable the worksharing in the project by choosing the **Disable Worksharing** tool from the expanded **Workset** panel of the **Collaborate** tab.

Synchronizing with Central

If you choose **Save** from the **File** menu after enabling the worksets for the first time, the **Save File as Central** message box will be displayed. On choosing the **Yes** button from this message box, the current project file will become the central file. If you choose the **No** button, a message box will be displayed informing that the file is not saved. Choose the **Close** button from this message box to close it. To save the file as a central file, choose **Save As > Project** from the **File** menu; the **Save As** dialog box will be displayed. Browse to a different location, specify a name in the **File name** edit box, and then choose **Save**; the file will be saved as a central file. Now, you can synchronize a project with the central file. To do so, choose the **Synchronize Now** tool from **Collaborate > Synchronize > Synchronize with Central** drop-down, as shown in Figure 16-42; the current project will be synchronized with the central file. As a result, all changes made to the current file will reflect in the central file as well.

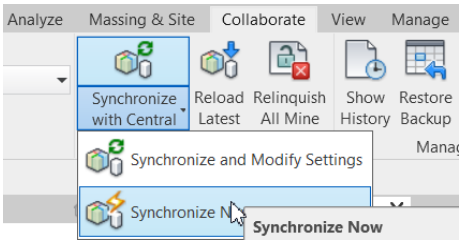


Figure 16-42 *Choosing the* ***Synchronize Now*** *tool from the* ***Collaborate*** *tab*

Note

A central file is a master project file that stores the information about the ownership of all worksets in a project. The central file should not be used for working when there is only one user.

Creating a Local File

While using a workset, you do not need to be connected to the system network to save the changes. For this, Autodesk Revit allows you to work on a local file of the portion of the building model file. A local file can be created by opening the central file and using the **Save As** tool to create a project file. This local file is only accessible to the user. The team member can work on the file and save it to the central file at regular intervals. The changes made to the workset are then propagated to all team members through the central file.

Saving Methodology in Worksharing

While working in a worksharing environment, it is important to learn the methods of saving your files. There are two methods of saving a file and sharing your files with others by saving a local file and synchronizing with the central file. You can save your file as a local file by choosing **Save** from the **File** menu. The **Save** option is generally used to save the local file. Using this method, you can just secure the work that you have done without affecting the worksharing process. The other method is to synchronize the file with central. The **Synchronize with Central** option is used to publish the work in the central file. The moment you synchronize your file to central, you acquire the changes made by other team members to their local models, provided they had also saved their files to the central file at that particular interval.

In Revit Architecture, you can synchronize a local file with the central file by choosing the **Synchronize Now** tool or the **Synchronize and Modify Settings** tool from the **Synchronize** panel. If you choose the **Synchronize Now** tool, the current project file will be saved to central. On choosing the **Synchronize and Modify Settings** tool, the **Synchronize with Central** dialog box will be displayed. This dialog box allows you to customize the way you save your file to central. In the **Synchronize with Central** dialog box, the **Central Model Location** text box shows the path for the central file in the network. You can use the **Browse** button to change the path, if required. After synchronizing the required file with central, you can use various check boxes to relinquish borrowed elements and various worksets, if required. The **Comment** text box in the **Synchronize with Central** dialog box allows you to publish the message throughout the team members regarding the changes you made in the particular session.

Reloading Files

In a worksharing environment, it is necessary to update your model corresponding to the changes made and saved to the central file by other team members. To do so, choose the **Reload Latest** tool from the **Synchronize** panel of the **Collaborate** tab. Alternatively, press RL in the keyboard to reload the file with the latest changes made in it.

Element Ownership Concepts

In a worksharing environment, you need to know about the status of ownership of a particular element or workset in the project. To check the status of ownership of an element, select it and check whether you can modify or reposition it. If you own the element, it will be highlighted in blue and can be modified and repositioned. In case, you do not own the element that you have selected, it will be highlighted in red, but with a blue icon attached to it indicating it cannot be modified.

In Autodesk Revit, you can use color to visualize the status of workshared elements. To do so, choose the **Worksharing Display Off** option from the **View Control Bar** and then select various options from the flyout displayed. You can use these options to customize the display modes to visually distinguish the following in a view: borrowed elements, current element owners, model updates, and element checkout status.

In Revit Architecture, it is easy to retain the ownership status of a particular element or a component. There are several methods to get the ownership of a particular element or a workset and that discussed next. One of the common methods of owning an element or a component is by trying to move or edit it. If you do so, Autodesk Revit facilitates you to own it, provided it

is not owned by anyone else in the worksharing environment. You can also get the ownership of an element by clicking the left mouse button over the blue icon that is displayed along with it. Next, to modify or edit an element, select it and click on the right mouse button and then choose the **Make Elements Editable** option from the shortcut menu displayed. In context to ownership, you need to know other concepts like Borrowing Elements, Placing Requests, and Granting Requests. These concepts are discussed next. Sometimes, you or your team member may need to take the ownership of some of the elements within a particular workset rather than the entire workset. In such a situation, you can borrow elements from other users. To do so, select the element to be borrowed and click on the blue icon displayed with the element; the **Revit 2022** dialog box will be displayed with a warning message regarding the ownership of the element. This message box also informs you to place request to the owner to use it in your file. Choose the **Place Request** button in the dialog box to request the owner to grant permission for using the element. On doing so, the **Check Editability Grants** dialog box will be invoked. Choose the **Check Now** button from the dialog box to check the status of the request made and choose the **Continue** button to resume the work.

Autodesk Revit also provides you with the flexibility to borrow components from worksets that are not editable by a team member. This is possible by getting permission from the user of the component, and then, the borrowed elements or components can be edited, saved to central, and relinquished. In this release, the process of granting or denying permission to borrow an element or a component for editing it has been made more fast and interactive.

PURGING UNUSED ELEMENT FAMILIES

The **Purge Unused** tool enables you to unload families and family types from the project file. This reduces the file size to a considerable extent. However, in case the worksets have been enabled, they must be opened to use this tool.

Invoke the **Purge Unused** tool from the **Settings** panel of the **Manage** tab; the **Purged unused** dialog box will be displayed, as shown in Figure 16-43. It displays the list of element categories that can be unloaded. You can select the families, groups, or annotation types and choose the **OK** button to purge them. You can also use the **Check All** and **Check None** buttons for the selection. In Autodesk Revit, you can also purge unused materials.

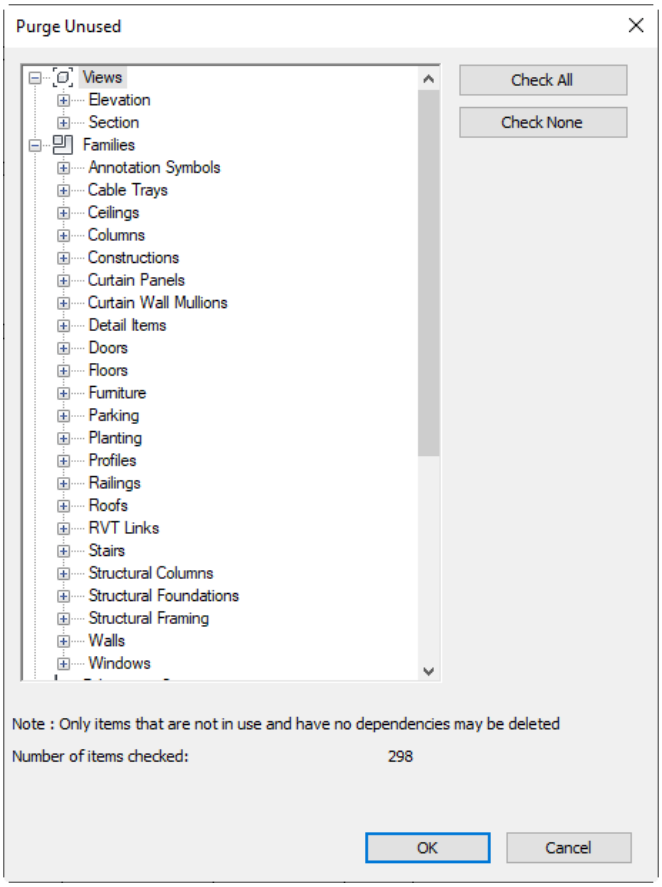


Figure 16-43 *The* ***Purge unused*** *dialog box*

TRANSFERRING PROJECT STANDARDS

The **Transfer Project Standards** tool allows you to copy and paste project standards from one project to another. The project standards that can be transferred include family types, materials, view templates, and object types.

To transfer project standards, you first need to open the source and target projects. In the target project, choose the **Transfer Project Standards** tool from the **Settings** panel of the **Manage** tab. On doing so, the **Select Items To Copy** dialog box will be displayed, as shown in Figure 16-44. Select the source project from the **Copy from** drop-down list. From the list box in the dialog box, select the required project standards to be copied. Now, choose the **OK** button; the selected project standards of the source project will be copied to the target project.

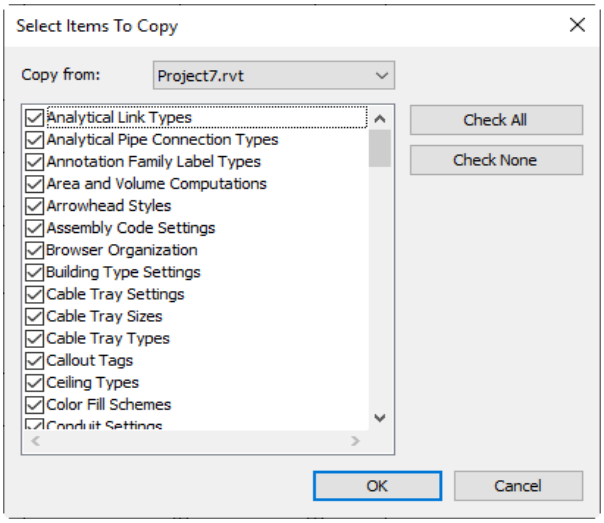


Figure 16-44 *The* ***Select Items To Copy*** *dialog box*

ORGANIZING THE PROJECT BROWSER

Autodesk Revit also enables you to organize the **Project Browser** based on the documents to be prepared for the project. Invoke the **Browser Organization** tool from **View > Windows > User Interface** drop-down; the **Browser Organizatio**n dialog box is displayed. The **Views** tab of this dialog box displays the parameters that can be selected for organizing the browser.

The **Sheets** tab can be used to view the sheets created for a project in the **Project Browser**. You can select an option to display the sheets. For example, you can rename the sheets created for a construction document package based on their sheet numbers. You can also select the **Sheet Prefix** check box in the **Sheets** tab to arrange the sheet display in the **Project Browser**. Figure 16-45 shows the **Project Browser** with such an arrangement.

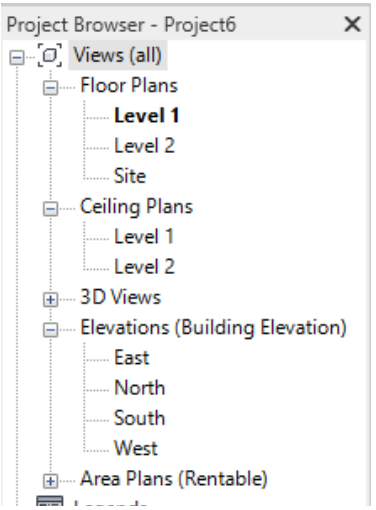


Figure 16-45 *An example of organised* ***Project Browser***

GENERATING SHADOWS

Another powerful feature provided in Autodesk Revit is the automatic generation of shadows based on the location of the sun with respect to the building. Shadows can be generated in the plan, elevation, section, or 3D view. To use this feature, open the view and click on the inclined arrow symbol (Graphic Display Options) in the **Graphics** panel of the **View** tab. On doing so, the **Graphic Display Options** dialog box will be displayed. In this dialog box, select the **Cast Shadows** check box. The intensity and direction of the shadow can also be controlled by using various options from **Graphic Display Options** dialog box. You can also choose the **Shadow On** button from the **View Control Bar** to generate shadows in the view.

AUTODESK REVIT SOLAR STUDIES

Revit Architecture's solar study helps you visualize and analyze the position of Sun and solar effects on buildings and sites in the real world at a specified time, date, duration, and location. You can analyze the effect of the Sun on the same building at different locations, such as Boston or Melbourne, by changing the location of the building from Boston to Melbourne. The **Solar Study** tools in Revit Architecture provide you with a wide range of locations to view the Sun and shadow effects on the same building or site but at different locations by generating the solar studies. Revit Architecture allows you to generate a still solar study in a single frame depicting the shadows at a specified date and time. It can also generate an animated three-dimensional solar study consisting of multiple frames depicting the shadow movements for a specified duration of time.

These solar studies help you analyze the amount and impact of the natural sunlight and shadows on the building and the site at a particular time in a day and at a particular location. It also helps you study the amount of lighting inside the building during different times of a day and year, at a particular location.

Generating Still Solar Study

You can generate a still solar study to see the shadow patterns based on the location of the building, or the azimuth and altitude of the Sun from the horizontal surface. To generate a still solar study, open the floor plan view or the site plan view. In the **Properties** palette of the opened view, set the value of the **Orientation** parameter to **True North** and choose the **Apply** button. Next, choose the **Rotate True North** tool from **Manage > Project Location > Position** drop-down; a rotation symbol will be displayed in the drawing area. In the **Options Bar**, specify the rotation angle in the **Angle from Project to True North** edit box. This angle specified in the edit box will be the angle difference of the building from the Project North direction to the **True North** direction. You can rotate the building to the **East** or **West** of the **True North** direction. Open the 3D view of the building and adjust the view of the building as required. Choose the **View** tab and then choose the inclined arrow symbol in the **Graphics** panel; the **Graphic Display Options** dialog box will be displayed, as shown in Figure 16-46.

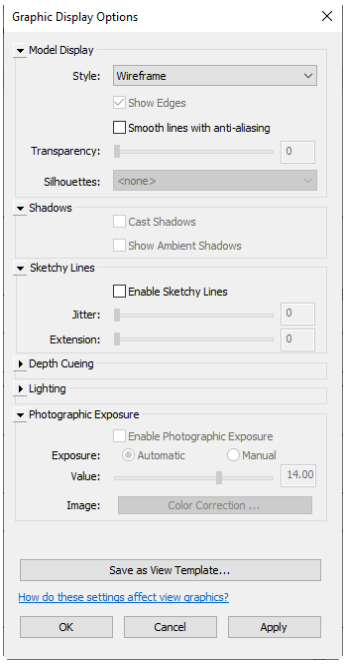


Figure 16-46 *The* ***Graphic Display Options*** *dialog box*

In the **Model Display** area of this dialog box, you can select an option from the **Style** drop-down list to specify the visual style of the model in the drawing area. In this drop-down list the **Hidden Line** option will be selected by default. The other options in this drop-down list are: **Wireframe**, **Hidden Line**, **Shaded**, **Consistent Colors**, and **Realistic**. The **Show Edges** check box will be disabled if you select **Wireframe**, **Hidden Line**, or **Consistent Colors** in the **Style** drop-down list. If this check box is active and selected then the edges of the model will be displayed in the **Shaded** or **Realistic** view style. The transparency of the surfaces of the model in the **Shaded** or **Realistic** view style, can be changed by the **Transparency** slider. The **Silhouettes** drop-down list is used to specify a line style that will help create a silhouette in the model. In the **Shadows** area, you can select the **Cast Shadows** check box to display shadows of a building model in a 3D view. You can select the **Show Ambient Shadows** check box to display shadow in the building model due to ambient light. In the **Lighting** area of the **Graphic Display Options** dialog box, choose the button on the right of the **Sun Setting** text; the **Sun Settings** dialog box will be displayed. By default, the **Lighting** radio button is selected in this dialog box. Select the **Still** radio button and in the **Settings** area and then set the time and date for the solar study in the **Date** and **Time** edit boxes. To specify the location for the solar study, choose the button on the right of the **Location** edit box; the **Location Weather and Site** dialog box will be displayed. In the **Location** tab of the dialog box, select the **Default City List** option from the **Define Location by** drop-down list. On doing so, the options to set the locations will be displayed below this drop-down list. Specify the latitude and longitude in the **Latitude** and **Longitude** edit boxes for a precise solar study or select a city from the **City** drop-down list. Next, choose the **OK** button to close the **Location Weather and Site** dialog box. In the **Sun Settings** dialog box, clear the **Ground Plane at Level** check box to view the shadow pattern on the terrain. If you want the shadows to fall at a particular level or at the entry level, select the **Ground Plane at Level** check box and then select a level from the drop-down list displayed below it. Next, choose the **OK** button to return to the **Graphic Display Options** dialog box.

If you want to create a solar study based on the azimuth and altitude of the Sun from the horizontal surface, select the **Lighting** radio button in the **Sun Settings** dialog box and specify the azimuth and altitude for the solar study. After you have specified the settings for the solar study, choose the **OK** button.



Tip

*You can invoke the **Graphic Display Options** dialog box and control the display of shadows from the **View Control Bar** at the lower left corner of the screen.*

Next, in the **Lighting** area of the **Graphic Display Options** dialog box, set the intensity of the sun, ambient light, and shadows by using the **Sun**, **Ambient Light**, and **Shadows** sliders, respectively. You can save the settings in the **Graphic Display Options** dialog box as a template. To do so, choose the **Save as View Template** button; the **New View Template** dialog box will be displayed. In this dialog box, enter a name for the settings in the **Name** edit box and choose the **OK** button; the **View Templates** dialog box will be displayed. In the **View Properties** area of this dialog box, you can use various options to edit the view properties of the current setting. Now, choose the **OK** button in the **View Templates** dialog box to close it. In the **Graphic Display Options** dialog box, choose the **OK** button to notice the shadows based on the specified date, time, and location. The shadow pattern generated in a Still solar study at the same location at different time during a day is shown in Figures 16-47 through 16-51. The options in the **Photographic Exposure** area helps you to create realistic appearances of objects in **Realistic** and **Raytrace** view style. On selecting the **Realistic** view style from the **Style** drop-down list, the **Enabled** check box is activated. Select the **Enable** check box; the options in the **Exposure** section are enabled. In the **Exposure** section, you can either select the **Automatic** radio button to enable automatic exposure of the model. Alternatively, you can select the **Manual** radio button. On doing so, the **Value** slider will be enabled where you can adjust exposure needed in the model. To improve the appearance of the model and make it more realistic, you can choose the **Color Correction** button corresponding to the **Image** parameter. On doing so, the **Color Correction** dialog box will be displayed. In this dialog box, you can adjust the values of **Highlights**, **Shadow Intensity**, **Color Saturation**, and **White Point** parameters by using their respective sliders. After setting the parameters, choose **OK** to close the **Color Correction** dialog box and return to **Graphic Display Options** dialog box.

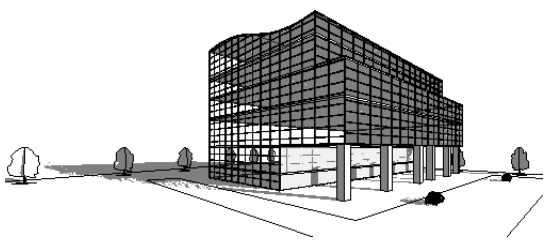


Figure 16-47 *After sunrise at around 6 AM*

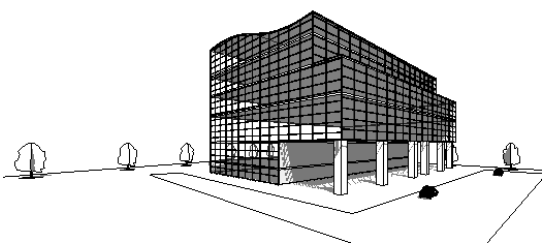


Figure 16-48 *In the morning at 10.25 AM*

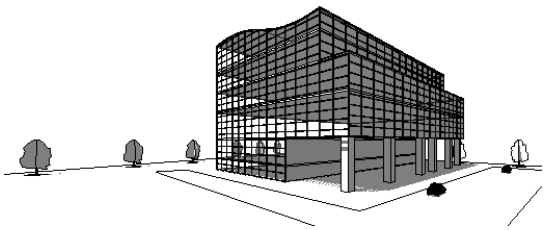


Figure 16-49 *In the afternoon at 1.25 PM*

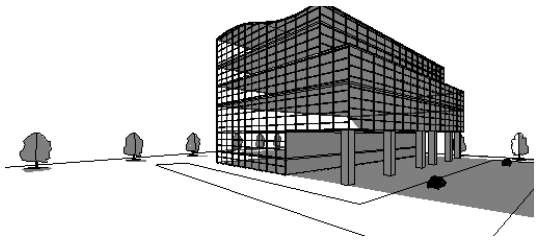


Figure 16-50 *In the evening at 4.30 PM*

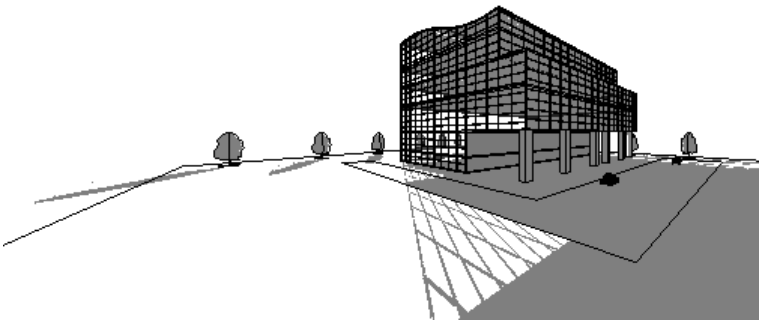


Figure 16-51 *During sunset at 6.55 PM*

In the **Graphic Display Options** dialog box, you can use the options in the **Background** area to set the background of the displayed view. In the **Background** area, you can select any of the four options from the **Background** drop-down list: **Sky, Gradient, Image**, and **None**. On selecting the **Sky** option from the **Background** drop-down list, the **Ground Colo**r parameter will be displayed under it. Choose the swatch corresponding to the **Ground Color** parameter; the **Color** dialog box will be displayed. Select a desired color from this dialog box and choose **OK**. The color of the sky will be set as per your selection and will be applied in the project view. On selecting the **Gradient** option from the **Background** drop-down list, three parameters: **Sky Color**, **Horizon Color,** and **Ground Color** are displayed under it. For each of these, you can choose different colors by using the **Color** dialog box. On selecting the **Image** option from the **Background** drop-down list, the **Customize Image** button will be displayed under it. Choose this button; the **Background Image** dialog box will be displayed. You can use this dialog box to apply an image to the background. After selecting an image and specifying the settings, choose **OK**; the **Background Image** dialog box will be closed and the **Graphic Display Options** dialog box will be displayed. In this dialog box, choose **Apply** and **OK** buttons to apply the display settings to the view.

Creating an Animated Solar Study

In Revit Architecture, you can also create an animated single-day or multi-day solar study. The single-day solar study generates the animation of shadow movements for a specified period of time in a single day and at a particular location. For example, you can create a solar study from

6 AM to 7 PM on August 15 in Boston. The multi-day solar study helps you create an animation of shadow movements at a fixed time of a day, but for specified number of days at a particular location. For example, you can create a solar study at 2 PM from August 15 to August 20, 2012 in Boston.

To generate a single-day solar study, open the 3D view of the building model and click on the inclined arrow symbol in the **Graphics** panel of the **View** tab; the **Graphic Display Options** dialog box will be displayed. Make sure the **Cast Shadows** check box is selected in the dialog box. Choose the button on the right of the **Sun Setting** text; the **Sun Settings** dialog box will be displayed, as shown in Figure 16-52. Select the **Single Day** radio button; the options of sun settings for single day will be displayed in the **Sun Settings** dialog box. Select any of the predefined sun and shadow settings from the **Presets** list box. You can also define your own sun and shadow settings and name them by choosing the **Duplicate** button. The name of the setting will be listed in the list box. Specify the settings for the solar study in the **Settings** area as explained earlier and choose the **OK** button in the **Sun Settings** dialog box. Now, choose the **OK** button from the **Graphic Display Options** dialog box to apply the settings to the project view.

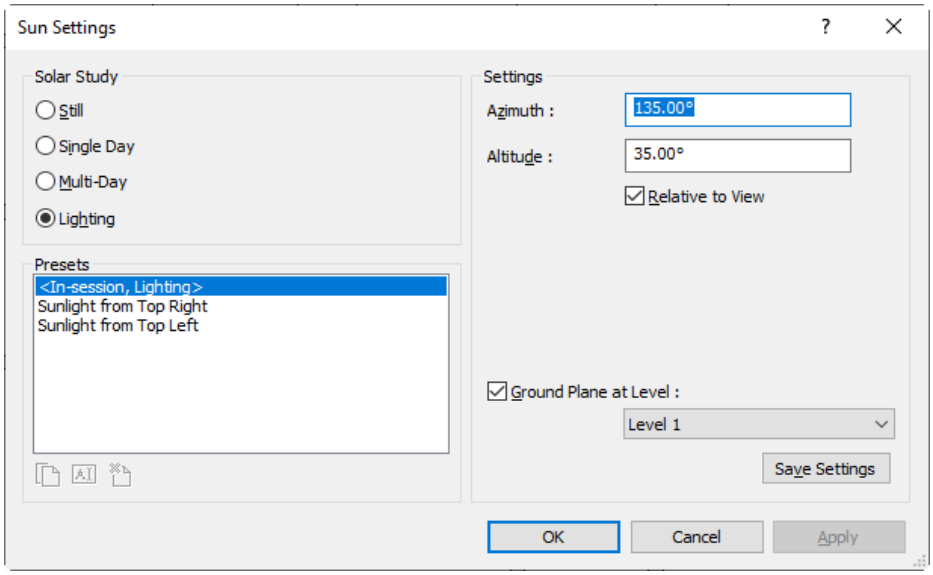


Figure 16-52 *The* ***Sun Settings*** *dialog box*

Animation Preview

To preview the solar study animation, choose the **Shadows On** button from the **View Control Bar**. Now, choose the **Preview Solar Study** option from the **Sun Path** button. Choose the **Play** button from **Options Bar** to play the animation. You will notice the shadow movements in multiple frames at a specified time. You can use the **Previous Key Frame** and **Next Key Frame** buttons from the **Options Bar** to move the animation back or forward by 10 frames. To view a particular frame of the animation, enter the frame number in the **Frame** edit box. Choose the **Next Frame** or **Previous Frame** button to view the previous or the next frame. Similarly, you can create the multi-day animation by selecting the **Multi-Day** radio button from the **Sun Settings** dialog box. In this dialog box, specify the time, location, and dates for the days for which you need to generate the solar study.

Exporting the Solar Study Animation

You can save and export the solar study animation and share it with clients and owners. To export the solar study animation, choose **Export > Images and Animations > Solar Study** from the **File** menu; the **Length/Format** dialog box will be displayed, as shown in Figure 16-53. Select the **Frame range** radio button and set the number of frames to be exported by setting the suitable values in the **Start** and **End** spinners in the **Output Length** area. The animation in that particular range of frames will be exported. You can also set the speed of the animation by setting suitable value in the **Frames/sec** spinner. The **All frames** radio button is selected to export the complete animation. In the **Format** area, select the graphics style from the **Visual Style** drop-down list. Specify the dimensions in pixels or zoom percentage to specify the frame size in the exported file. Choose the **OK** button to display the **Export Animated Solar Study** dialog box, as shown in Figure 16-54.

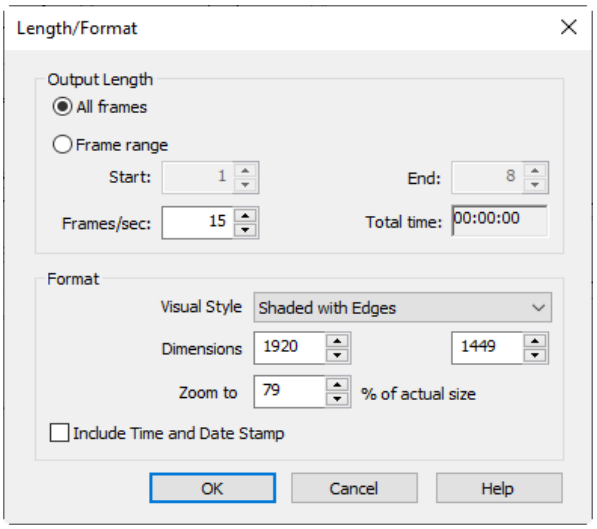


Figure 16-53 *The* ***Length/Format*** *dialog box*

In the **Save in** drop-down list, navigate to the required location to save the file. Enter the file name of the file in the **File name** edit box. Select the file format from the **Files of type** drop-down list to save the file.

Next, choose the **Save** button. If you have saved the file using the AVI file format, the **Video Compression** dialog box will be displayed on choosing the **Save** button. Choose the **OK** button to accept the default option in the dialog box; the animation file will be processed frame by frame and finally it will be saved as an AVI format at the specified location.

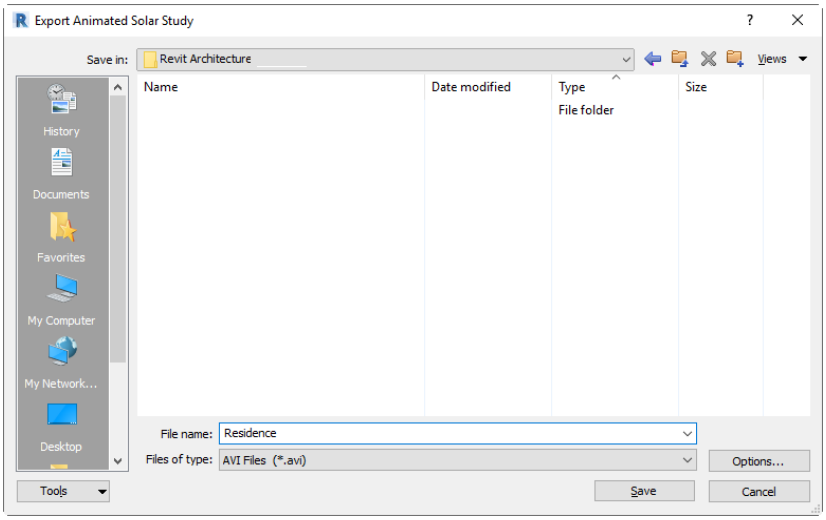


***Figure 16-54** The **Export Animated Solar Study** dialog box*

POINT CLOUD

Point Cloud is a collection of point data in X, Y, and Z ordinates. This data is collected by 3D scanners. These 3D scanned point clouds are then used to create 3D revit models. These point cloud files are inserted in the Revit project to modify the existing condition of a building.

Inserting a Point Cloud File

Point cloud files are .rcp and .rcs type format files. If the file is in raw format such as .pcg or .las format, then you will be prompted to index the data. The .rcp and .rcs format files are indexed point cloud files which are inserted in a Revit project.

To directly use the .rcp or .rcs format file in a project, invoke the **Point Cloud** tool from the **Link** panel of the **Insert** tab; the **Link Point Cloud** dialog box will be displayed. In the **Link Point Cloud** dialog box, navigate to the location of files from the **Look in** drop-down list. Select the desired type of file format from the **Files of Type** drop-down list. After selecting the type of file from the list, select the desired position of file from the **Positioning** drop-down list located at the lower right corner of the **Link Point Cloud** dialog box. Now, choose the **Open** button; Revit retrives the current version of the point cloud file and links the .rcp and .rcs format files in the project.

If the files are in raw format, you will be prompted to index the data. To do so, choose the **Point Cloud** tool from the **Link** panel of the **Insert** tab; the **Link Point Cloud** dialog box will be displayed. In this dialog box, insert the raw format file type and then choose the **Open** button; the **File Not Indexed** window will be displayed prompting you to create the new .rcp or .rcs format file. Choose the **Yes** button in this dialog box; the **Point Cloud File Indexing** dialog box will be displayed. Now, to convert the raw data into the .rcs or .rcp format, choose the **Start Indexing** button; the file will be converted. As the indexing process finishes, choose the **Close** button; the dialog box will be closed. Now, the file is converted into an .rcp format. Choose the **Point Cloud** tool again to insert the new indexed file in the project.

Point Cloud Visibility

To view a point cloud in a project, invoke the **Visibility/ Graphic** tool from the **Graphics** panel of the **View** tab; the **Visibility/Graphics Overrides for <current view>** dialog box will be displayed. In this dialog box, choose the **Point Cloud** tab. Next, in the **Visibility** column of this tab, you can select or clear the checkbox corresponding to the selected point cloud file to show or hide the point cloud in the view, respectively. You can also assign the color for each point cloud in the model. To do so, choose the **RGB** button; the **Point Cloud Color Mode** dialog box will be displayed. In the **Point display** area of this dialog box, by default, the **RGB** option is selected in the **Color Mode** drop-down list. On selecting any other color option in the drop-down list, the **Settings** area, and the **Clear Overrides** button at the bottom of the dialog box will be activated. Specify the required settings in the **Settings** area. You can also choose the **Clear Overrides** button to restore the previous settings. Next, choose the **OK** button; the dialog box will be closed.

Using Point Cloud File in a Project

In Autodesk Revit, after inserting the point cloud file, you will use that file in the project. This file helps the user to provide a higher level of visual appearance of existing condition of a building. To capture the existing building, laser scanners are used to sample point from the surface of the existing building and saves that data as point cloud. The data collected by the laser scanner is huge. Thus, Revit links a point cloud as a reference rather than embedding the complete file. Now, you can modify the existing building condition easily and the work performance will be also be improved due to better visibility.

REVIT INTEROPERABILITY

Autodesk Revit is quite compatible with CAD-based programs. You can create your own designs in Revit Architecture and then export them into other programs for visualization and creating photorealistic renderings of your designs. Revit is user-friendly, parametric, flexible, and compatible features help you create and implement your designs better and faster. Revit Architecture supports a wide range of file formats, thereby enabling the files to be imported and exported to other programs such as Autodesk 3ds Max, Autodesk Inventor, Revit Structures, Revit MEP, SketchUp, Microstation, and so on.

Interoperability with Autodesk 3ds Max

You can export a 3D view from Revit to Autodesk 3ds Max through DWG format to create photorealistic renderings and visualizations. The interoperability of Revit with 3ds Max has improved in the following ways:

1. Before exporting the views, you can use the section box to restrict the unwanted content in the file to be exported to Autodesk 3ds Max. The section box has been enhanced to enable you to switch to 2D view while modifying the section box size for the 3D view. Reducing the amount of data from the file reduces the size, thus making the importing and exporting of data faster and easier.

2. The objects that have different materials assigned to different surfaces in Revit Architecture and the objects that have a complex geometry are exported in 3D view as ACIS solids. When such objects are imported in 3ds Max, they display different materials assigned to different surfaces unlike the previous releases that showed only one material for the entire ACIS solid.

3. The files exported from Revit and imported into 3ds Max show the Revit Material Names, unlike the Material names that used to be displayed for the materials in the previous releases.

4. To export drawings from Revit to 3ds Max, you do not need to use the plug-in anymore, as this functionality has been incorporated in 3ds Max.

Revit - 3ds Max Workflow

The main steps followed to export a Revit project to 3ds Max are discussed next.

Create a 3D view for the project to be exported to 3ds Max. Choose **Export > CAD Formats > DWG** files /**DXF** files /**DGN** files / **ACIS (SAT)** files from the **File** menu; the **DWG Export** dialog box will be displayed. Export the file using the DWG format in the **DWG Export** dialog box.

In Autodesk 3ds Max, import or link the DWG file using the **File Link Manager** option by choosing **References > Manage Links** from the **File** menu. Linking the file will allow you to make changes in the project design in Revit and then update it in 3ds Max automatically, without making the same changes again in 3ds Max. If you do not want to update the design, then just import the file. Make the final adjustments in the materials for rendering and then render the view. Before you export the project from Revit to 3ds Max, limit the model geometry using the section box and turn off the visibility of the elements or the element categories that will not be used for rendering. For example, while rendering the exterior view, you should turn off the visibility of the elements in the interior of the building. Also, set the detail level for the view. By reducing the detail in a Revit view, the number of objects and the size of the DWG file will be reduced. After you have reduced the unwanted content of the file, you can export the file to 3ds Max as DWG file, ACIS solids or by creating a layer mapping template.

Interoperability with Trimble SketchUp

Revit Architecture supports SKP files. You can create your design in Revit and then export it to Trimble SketchUp. Similarly, you can import the design from Trimble SketchUp and link it to Revit. Trimble SketchUp is best suited for modeling and visualization. You can work on your designs using both Revit and SketchUp. If you want to quickly create a model of your design, assign materials and visualize it, then you can use SketchUp and then Revit Architecture to modify the designs. If you want to create a design, and at the same time, want to analyze and document the results, you should start your design in Revit and then use SketchUp at a later stage when you need to add materials and visualization. Trimble SketchUp along with Google Earth helps you place your models on the web using the real world coordinates and share it with world using the **3D Ware house** feature of SketchUp that helps you to search, share and store 3D models.

Exporting a Drawing from Revit to SketchUp

Before you export the drawing from Revit to SketchUp, reduce the unwanted drawing file by using the section box, turn off the visibility of the elements, and set the detail levels for the elements. Next, create an export template or a layer mapping file to save the layer settings for the drawing to be exported. These settings are customized to be used with SketchUp. After creating the template, choose **Export > CAD Formats > DWG files** from the **File** menu; the **DWG Export** dialog box will be displayed, as shown in Figure 16-55. On selecting the **Modify Export Setup** option from the **Select Export Setup** drop-down list in this dialog box; the **Modify DWG/DXF Export Setup** dialog box will be displayed. After setting the required views and other options, choose the **OK** button in this dialog box, and then choose the **Next** button in the **DWG Export** dialog box, the **Export CAD Formats - Save to Target Folder** dialog box will be displayed. In this dialog box, navigate to the required location to save the file, and select the DWG format. Next, enter the name of the file in the **File name/prefix** edit box and choose the **OK** button; the file will be exported to the specified location in the DWG format. Now, you can transfer and import the DWG file in SketchUp.

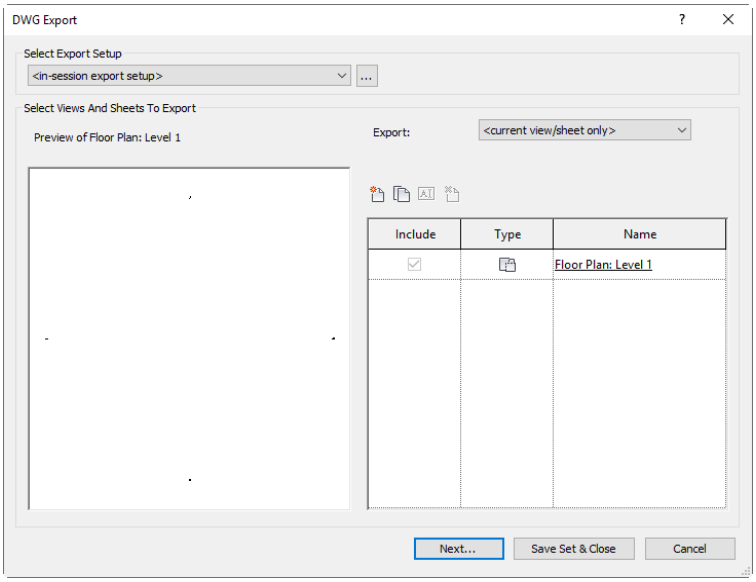


Figure 16-55 *The* ***DWG Export*** *dialog box*

Creating a Layer Mapping File for Layer Settings

Creating a layer mapping file or template file helps you to save the layer settings. These settings are customized for the drawing to be exported to SketchUp. To create a layer mapping file, choose **Export > CAD Formats > DWG file**s from the **File** menu; the **DWG Export** dialog box will be displayed, refer to Figure 16-55. In this dialog box, choose the **Modify Export Setup** button; the **Modify DWG/DXF Export Setup** dialog box will be displayed, as shown in Figure 16-56. In this dialog box, ensure that the **Layers** tab is chosen and then select an option from the **Export layer options** drop-down list to set the layer mapping for the file to be exported. After selecting an option from the **Export layer options** drop-down list, you can select an option from the **Load layers from standards** drop-down list to specify the standard to be followed for the layer mapping set. Now, choose the OK button; the dialog box will be closed and the layer mapping for the exported file will be set.

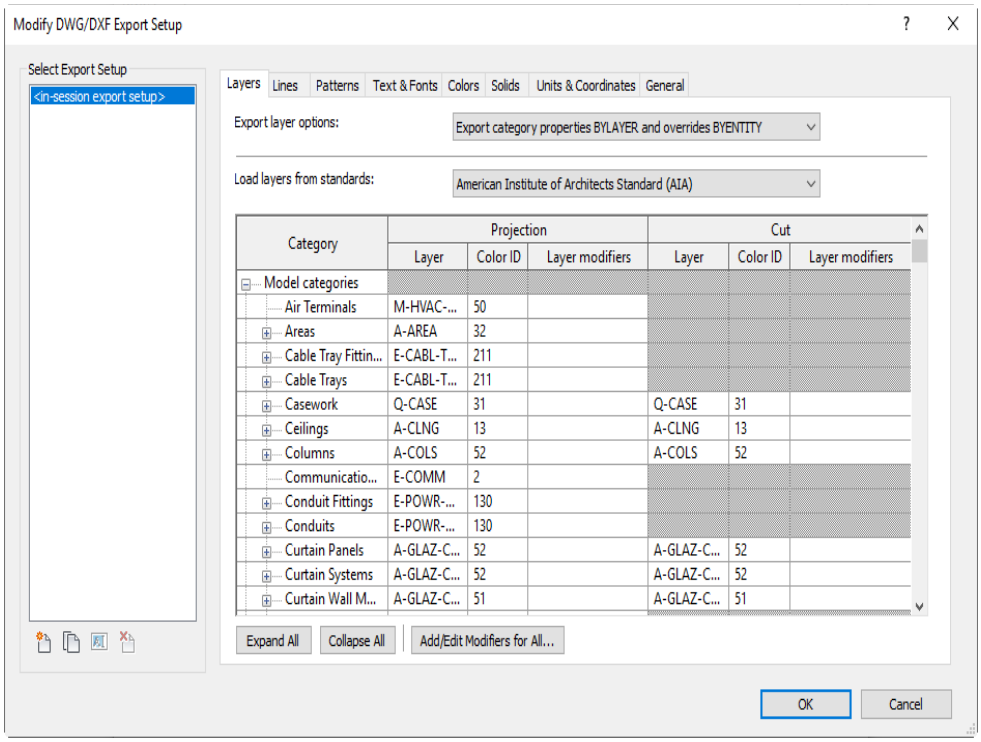


Figure 16-56 *The* ***Modify DWG/DXF Export Setup*** *dialog box for creating a layer mapping file*

Publishing Tips in Revit 2022

Revit Architecture allows you to export the 2D and 3D project views to Design Web Format (DWF). DWF provides you with an alternative of Portable Drawing Format (PDF) to publish your project views. The advantages of using the DWF are given below:

1. You can print the same DWF file using any printer since the DWF file is not device specific.

2. You can share the DWF files electronically through emails because of their smaller size.

3. The DWF files are generally one-twentieth the size of the original DWG files.

4. You can publish all your data in one DWF file instead of multiple DWG files.

5. You can place your designs on web using the Google search engine.

6. You can share your files irrespective of the versions of AutoCAD.

7. You can decide what to publish in DWF file and avoid the sharing of the original files.

8. You can see models clearly in a DWF file by zooming in the DWF files.

9. You can use a 3D viewer to view designs in DWF files.

10. Using the DWF files, you can share your designs in a much secure and easy way. You can share your designs even with people who do not use Revit Architecture.

Revit Architecture has the functionality of setting the default zoom option to **Fit To Page** in the **Print SetUp** dialog box. Therefore, you can avoid inclusion of a cropped portion of a 2D view into the DWF file. Also, you can publish rooms, areas, and room boundaries along with walls and other elements.

ROUTE ANALYSIS



The route analysis allows you to find out the shortest path and the quickest time of traversing between two defined points in a model. Using this analysis, you can design your space to prevent any obstacle in the path of traverse between spaces in the model.

To perform the route analysis, you can use the **Path of Travel** tool in the **Route Analysis** panel of the **Analyze** tab. You can use this tool to create a path in a plan view. The path of the model will then be generated based on the model elements acting as obstacles along the path of travel. The path of travel will be generated on the basis of the shortest distance between the start and the end points of the created path. Also, when the path generates, the model elements acting as obstacles in the travel path will be avoided.



Note:
The path of a travel can be used for a single level and considers horizontal distance on the plane of the path of travel.

Creating a Travel Path

Open a plan view and then choose the **Path of Travel** tool in the **Route Analysis** panel of the **Analyze** tab; the **Modify | Place Path of Travel** contextual tab will be displayed. In this tab, you can select an option from the **Line Style** drop down in the **Line Style** panel to specify a line type to the path of travel. Also, you can choose the **Tag on Placement** button from the **Tag** panel to enable the display of tag along with the path of travel. After choosing an appropriate option click to specify the start point of the path and then click to specify the end of the path. On doing so, a path of travel will be generated as the shortest travel distance between the two specified points avoiding model element obstacles in the path of travel, as shown in Figure 16-57. After the path is generated, you can make changes to the route by modifying the model categories that are considered obstacles to the path of travel. The settings for the route analysis can be modified by using the **Route Analysis Settings** dialog box. After the setting is modified, the travel path can be updated by using the **Update** tool that can be applied by selecting the travel path.

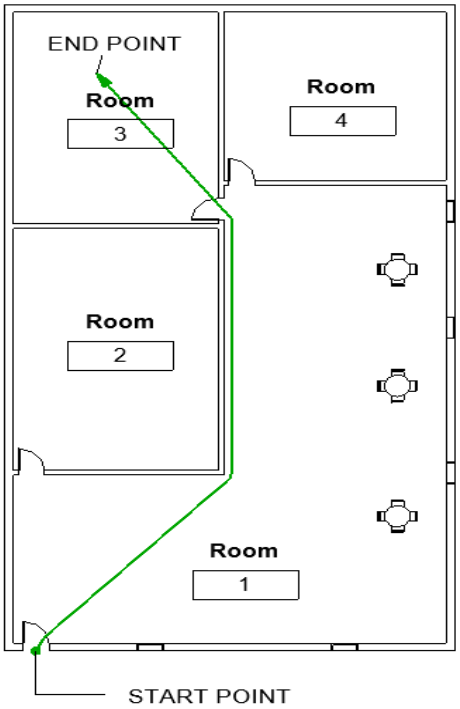


Figure 16-57 *Path of travel displayed in a model*

Modifying Properties of the Path

After creating the path you can view and modify the instance proprieties of the path. To do so, select the path created; the instance properties of the path will be displayed in the **Properties** palette, as shown in Figure 16-58. In this palette, you can select an option from the drop-down list corresponding to the **Line Style** parameter to change the line pattern of the selected path. The **Speed**, **View Name**, **Level, Time**, and **Length** are read-only parameters and cannot be modified. You can assign a value to the **Mark** parameter that can be used for reference in the schedules and tags created for the path of travel.

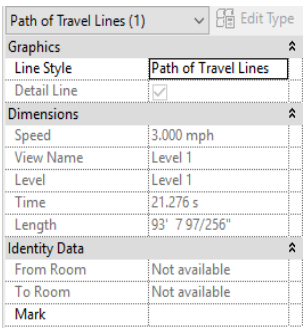


Figure 16-58 *Partial view of the* ***Properties*** *pallete displaying the instance properties of the travel path*

Setting the Travel Path

After creating the path you can modify the route of the path based on the obstacles that you choose to come in its traverse. To modify the settings of the obstacles in the path, choose the **Route Analysis Settings** button in the **Route Analysis** panel of the **Analyze** tab. On doing so, the **Route Analysis Settings** dialog box is displayed as shown in Figure 16-59.

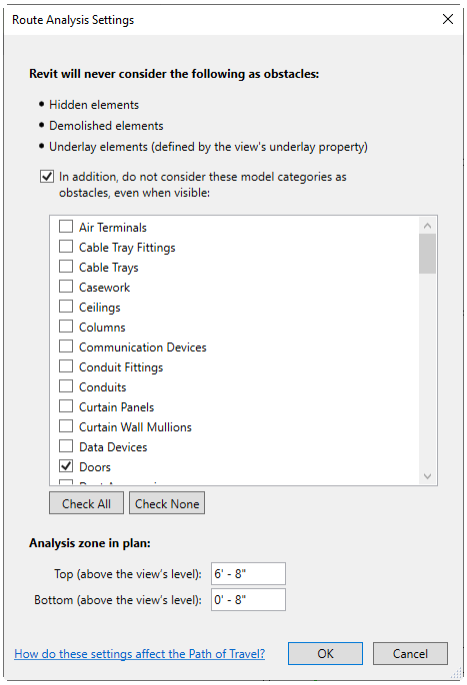


Figure 16-59 *The* ***Route Analysis Settings*** *dialog box*

In the **Revit will never consider the following as obstacles:** area select the **In addition, do not consider these model categories as obstacles, even when visible:** check box to enable the check boxes in the display area to be selected or cleared. By selecting the check boxes in the display area you select the categories of the objects in the model to behave as an obstacle to the path while generating it. As such, Revit will not consider the element of the particular category as an obstacle and will guide the path to reverse to it.

In Autodesk Revit 2022, a new set of tools known as People Flow Toolkit are added to the **Path of Travel** toolset to help you understand how people will move through your design. The tools in the People Flow Toolkit includes **Multiple Paths**, **One Way Indicator**, **People Content**, and **Spatial Grids**. Theses tools are available with Revit versions starting at 2020.2. You can invoke these tools from the **Route Analysis** panel of the **Analyze** tab. These tools help the building designers to automate, visualize, and analyze the routes within a model to understand the impacts of physical distancing within the context of a design project. With the use of these tools, you can address the challenges of designing for physical distancing due to COVID-19.

TUTORIALS

In the following two tutorials, you will combine the projects created in this book. In the first tutorial, you will create two facade options for the *Apartment 1* project. In the second tutorial, you will combine the *Elevator and Stair Lobby* and the *Apartment 2* project to create a cluster of apartments. You will then link the cluster to the *Site Layout* project created earlier in Chapter 9.

Tutorial 1 Apartment 1

In this tutorial, you will create two design options for the exterior facade. The first option uses 18" x 18" (for Metric 450 x 450 mm) square structural columns and beams, as shown in Figure 16-60. The distance between these members is shown in Figure 16-61 and Figure 16-62. The second design option is created using 12" X 12" (for Metric 300 x 300mm) square concrete columns and 12" X 24" rectangular concrete beams, as shown in Figure 16-63. The distances between the structural members and some other dimensions are shown in Figures 16-64. You can assume the missing dimensions for this tutorial.

(Expected time: 45 min)



Note

In this tutorial, the usage of structural elements has been given only as an example for creating the design options for a facade. Their general usage in a project should, however, depend on their placement.

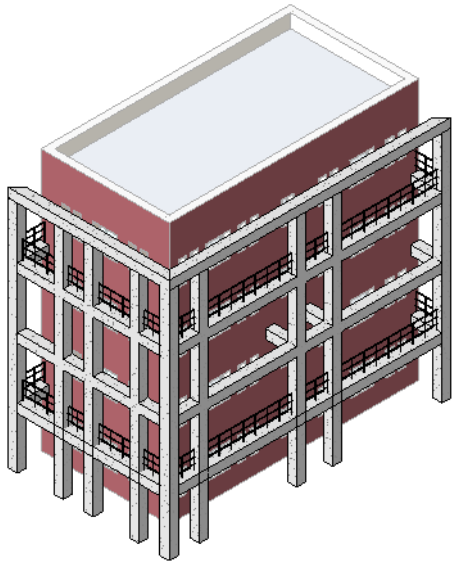


Figure 16-60 *The 3D view for creating structural elements for Design Option 1*

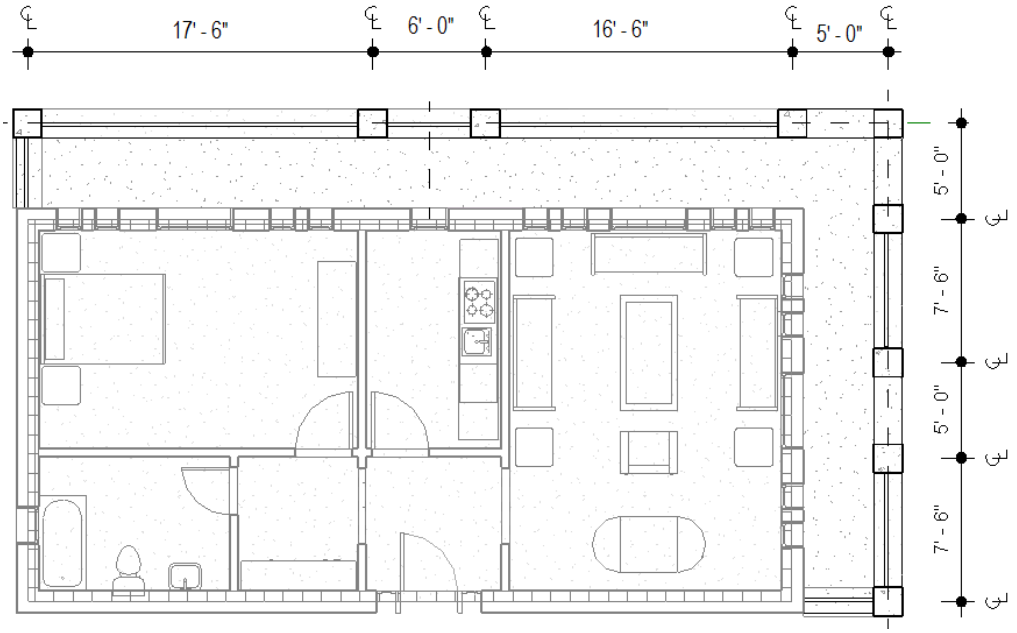


Figure 16-61 *The sketch plan for creating structural elements for Design Option 1*

The following steps are required to complete this tutorial:

a. Create the design options in the *Apartment 1* project.
b. Add structural elements to the Design Option 1, refer to Figures 16-60 through 16-62.
c. Add structural elements to the Design Option 2.
d. Save the project using the **Save As** tool.
   For Imperial *c16_Apartment1_tut1.rvt*
   For Metric *M_c16_Apartment1_tut1.rvt*
e. Close the project using the **Close** tool.

Creating Design Options

In this section of the tutorial, you will first create the two design options and then add elements to each of them.

1. Choose **Open > Project** from the **File** menu and open the *c15_Apartment1_tut1.rvt* file (for Metric *M_c15_Apartment1_tut1.rvt* file) created in Tutorial 1 of Chapter 15. You can also download this file from *https://www.cadcim.com*. The path of the file is as follows: *Textbooks > Civil/GIS > Revit Architecture > Exploring Autodesk Revit 2022 for Architecture*.

2. Double-click on **First Floor** in the **Floor Plans** head of the **Project Browser** to open the corresponding floor plan in the drawing window.

3. Choose the **Manage** tab and then choose the **Design Options** tool from the **Design Options** panel; the **Design Options** dialog box is displayed.

4. In the **Design Options** dialog box, choose the **New** button from the **Option Set** area; the **Option 1** node with **Option 1(primary)** subhead is displayed in the left side pane of **Design Option** dialog box.



Note

*The headings for the **Option Set**, **Edit**, and **Option** areas in the **Design Options** dialog box will disappear on creating a new option set. To locate these areas in the dialog box, refer to Figure 16-9 in this chapter.*

5. In the **Option** area, choose the **New** button to create **Option 2** under the **Option Set 1**.

6. Select **Option Set 1** and choose the **Rename** button in the **Option Set** area; the **Rename** dialog box is displayed. Enter **Facade Options** in the **New** edit box and choose **OK**; the **Option Set 1** node is renamed to **Facade Options**.

7. Similarly, rename **Option 1(primary)** as **18"X18" columns** (**450 x 450 mm** for metric) and **Option 2** as **12"X12"** (**300 x 300 mm** for metric) **columns**.

8. Select the option **18"X18" columns (primary)** and choose the **Edit Selected** button from the **Edit** area; the drawing area turns into edit mode for the selected design option.

9. Now, choose the **Close** button to close the **Design Options** dialog box.



Figure 16-62 *The north elevation view for creating structural elements for Design Option 1*

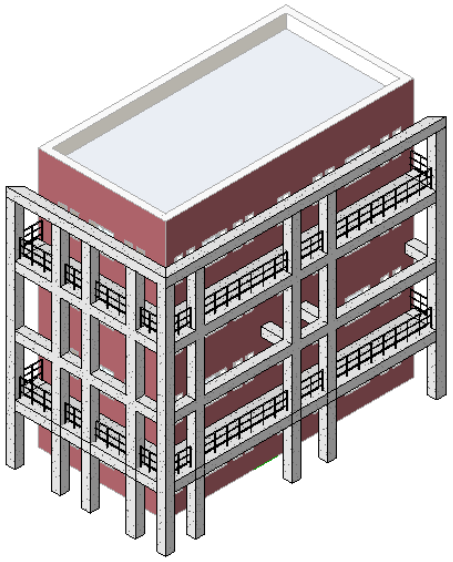


Figure 16-63 *The 3D view for creating structural elements for Design Option 2*

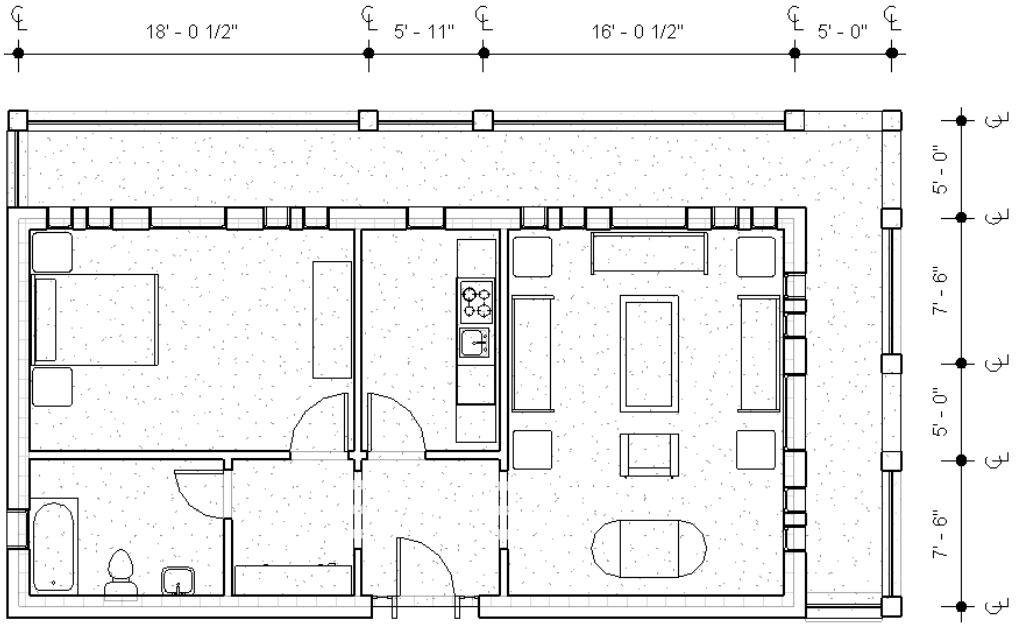


Figure 16-64 *The sketch plan for creating structural elements for Design Option 2*

Adding Structural Components to Design Option 1

In this section of the tutorial, you will load and add structural columns in Design Option 1.

1. You need to add the structural columns to the drawing. To do so, choose the **Structural Column** tool from **Architecture > Build > Column** drop-down; the **Modify | Place Structural Column** tab is displayed.

2. From the **Mode** panel, choose the **Load Family** tool; the **Load Family** dialog box is displayed.

3. In the **Load Family** dialog box, choose **English-Imperial > Structural Columns > Concrete** folder (for Metric **English > Structural Columns > Concrete** folder) and select the *Concrete-Square-Column.rfa* file (for Metric *M_Concrete-Square-Column.rfa* file). Next, choose **Open**; the **Concrete-Square-Column** family (for Metric **M_Concrete-Square-Column** family) is loaded into the project file.

4. From the **Type Selector** drop-down list in the **Properties** palette, select **Concrete-Square-Column: 18 x 18** (for Metric **M_Concrete-Square-Column: 450 x 450mm**).

5. Move the cursor near the top right corner of the floor plan and click when the vertical dimension in the upward direction displays **5'-0"** (1500 mm) and the wall centerline is displayed, as shown in Figure 16-65. Now, exit from the **Modify | Place Structural Column** tab by choosing the **Modify** button from the **Select** panel.

6. In the **3D Views** head in the **Project Browser**, double-click on **{3D}**.

7. Select the added structural column to display its instance properties in the **Properties** palette. In the **Properties** palette, click in the value field of the **Base Level** instance parameter and select the **First Floor** option from the drop-down list displayed, if it is not selected by default.

8. Click on the value field of the **Top Level** instance parameter and select **Roof** from the drop-down list displayed. In the value fields of the **Base Offset** and **Top Offset** instance parameters, enter **0'0"** (**0 mm**) and **-6"** (**-150 mm**), respectively.

9. Choose the **Apply** button from the **Properties** palette; the specified instance parameters are assigned to the selected column.

10. Open the **First Floor** plan view. Select the structural column and make its copies, refer to Figure 16-58. To make copies, choose the **Copy** tool from the **Modify** panel of the **Modify | Structural Columns** tab and select the **Multiple** checkbox from the **Options Bar** and create copies in the horizontal direction at the specified dimension, refer to Figure 16-58.

11. Now, choose the **Modify** button from the **Select** panel to clear the selection.

12. Repeat the procedure followed in step 10 to draw the column in vertical direction, refer to Figure 16-58. After adding all columns as per the sketch plan, choose the **Modify** button from the **Select** panel.

13. To add beams to the columns, choose the **Beam** tool from the **Structure** panel of the **Structure** tab.

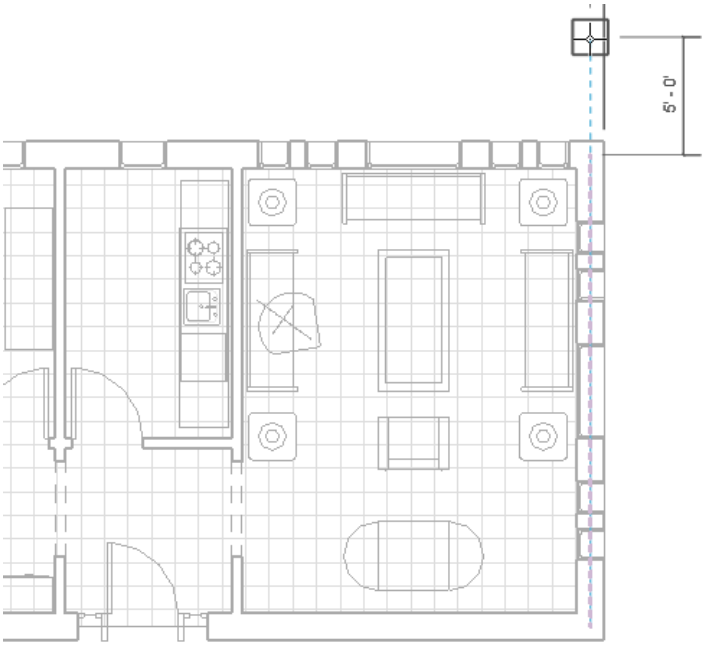


Figure 16-65 *Adding structural elements to the Design Option 1*

14. On invoking the **Beam** tool, the **Modify | Place Beam** tab is displayed. In this tab, choose the **Load Family** tool from the **Mode** panel; the **Load Family** dialog box is displayed.

15. In this dialog box, choose **English-Imperial > Structural Framing > Concrete** folder (for Metric **English > Structural Framing > Concrete** folder) and then select the *Concrete-Rectangular Beam.rfa* file (for Metric *M_Concrete-Rectangular Beam.rfa* file), and then choose **Open**; the **Concrete - Rectangular Beam** family (for Metric **M_Concrete - Rectangular Beam**) is loaded in the project.

16. In the **Properties** palette, notice that the **Concrete-Rectangular Beam 16 x 32** type (for Metric **M_Concrete-Rectangular Beam 400 x 800mm**) is selected by default in the **Type Selector** drop-down list. Next, choose the **Edit Type** button; the **Type Properties** dialog box for the selected beam type is displayed.

17. Choose the **Duplicate** button; the **Name** dialog box is displayed. Enter **18 x 18** (for Metric **450 x 450mm**) in the **Name** edit box and choose **OK**; the **Name** dialog box closes.

18. In the **Type Properties** dialog box, modify the values for **b** and **h** type parameters to **1' 6"** (**450 mm**) respectively and choose the **OK** button to assign the specified value to the new type and close the **Type Properties** box.

19. In the **Options Bar**, select the **Level: Second Floor** option from the **Placement Plane** drop-down list.

20. Sketch the horizontal beam between the two columns, as shown in Figure 16-66. Ignore the warning displayed.

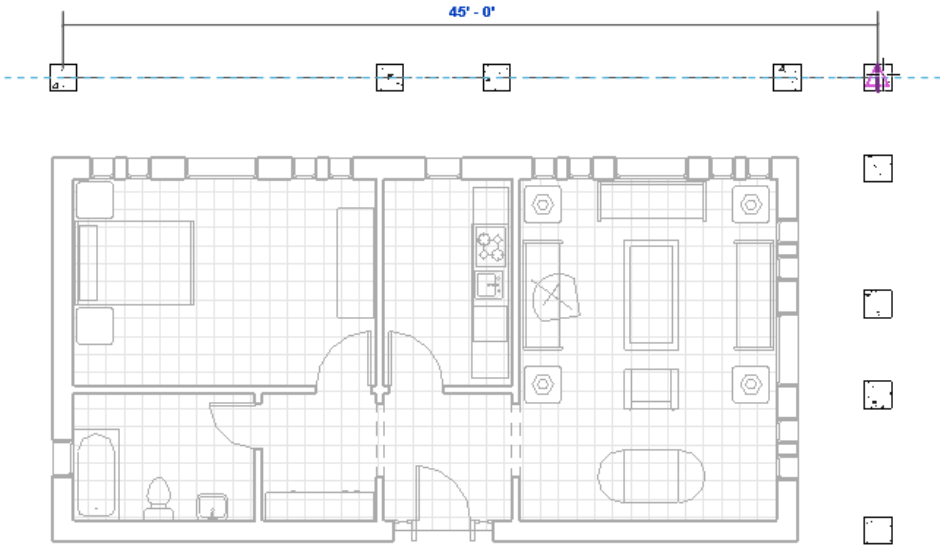


Figure 16-66 *Adding the horizontal structural beam to the Design Option 1*

21. Similarly, sketch the vertical beam between the two columns. Again, ignore the warning. After sketching the vertical beam, choose the **Modify** button; the current selection is cleared.

22. In the **Project Browser**, double-click on **{3D}** under the **3D Views** head; the default 3D view of the project is displayed in the drawing area.

23. Right-click on the **ViewCube** tool; a shortcut menu is displayed. Choose **Orient to a Direction > Northeast Isometric** from the shortcut menu; the current view reorients toward the northeast isometric view, as shown in Figure 16-67.

24. Select the two beams using the CTRL key; the **Modify | Structural Framing** tab is displayed. Now, choose the **Copy to Clipboard** tool from the **Clipboard** panel; the selected beams are copied to the clipboard.

25. To paste the copied beams, choose the **Aligned to Selected Levels** tool from the **Paste** drop-down in the **Clipboard** panel; the **Select Levels** dialog box is displayed.

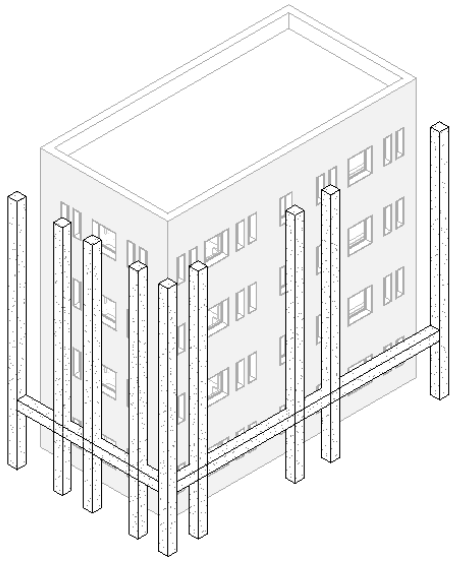


Figure 16-67 *The 3D view of the added structural elements*

26. In this dialog box, select the **Third Floor**, **Fourth Floor**, and **Roof** options using the CTRL key and then choose the **OK** button to paste the beams at the selected levels. Now, choose the **Modify** button to exit the current selection.

27. Select the beams at the roof level and use the drag controls to complete the beam. You will use the **East** and **North Elevation** views to drag and extend the beams. After this step, the 3D view should appear similar to the illustration shown in Figure 16-68.

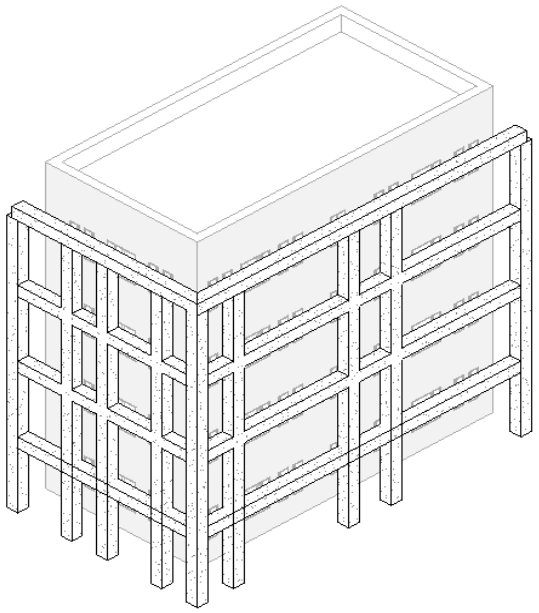


Figure 16-68 *The 3D view of the copied structural beams*

Similarly, you can add other smaller beams between the levels and the beams perpendicular to the walls, based on the given sketch plan and 3D View for Option 1. You may need to convert the exterior wall to bearing.

28. In the **Project Browser**, double-click on the **Second Floor**; to display the corresponding view.

29. Invoke the **Floor: Architectural** tool from **Architecture >Build > Floor** drop-down and add the floor slab between the exterior wall and the columns on the two sides at the second floor level, as shown in Figure 16-69. After you create the floor, Autodesk Revit displays a prompt box. Choose the **No** button to keep the walls detached from the slabs created in this design option.

30. Choose the **Sketch Path** tool from the **Architecture** > **Circulation** > **Railing** drop-down and then create the default railing on the second floor between the structural columns, as shown in the 3D view for Design Option 1, refer to Figure 16-60.

31. After creating the railing and the floor, select them; the **Modify | Multi-Select** tab is displayed. Choose the **Copy to Clipboard** tool from the **Clipboard** panel of the **Modify | Multi-Select** tab; the selected elements are copied to the clipboard.

32. Choose the **Aligned to Selected Levels** tool from the **Modify | Multi-Select > Clipboard > Paste** drop-down; the **Select Levels** dialog box is displayed. From this dialog box, select the **Fourth Floor** option and then choose **OK**; the **Select Levels** dialog box closes and the selected element gets pasted. Choose the **Modify** button to exit the current selection.

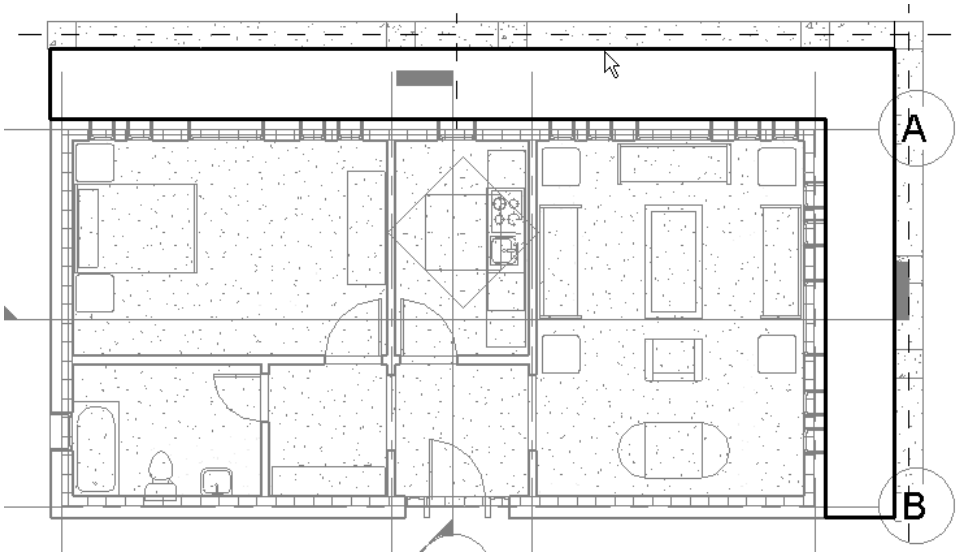


Figure 16-69 *A foor slab added using the* ***Floor*** *tool*

33. Choose the **Manage** tab and then choose the **Design Options** tool from the **Design Options** panel; the **Design Options** dialog box is displayed.

34. In this dialog box, choose the **Finish Editing** button from the **Edit** area and then choose the **Close** button; the **Design Options** dialog box closes and the 3D view appears similar to the view given for Option 1, refer to Figure 16-68. Notice that the **Main Model** option is selected in the **Active Design Option** drop-down list that is displayed below the **Pick to Edit** button in the **Design Options** panel of the **Manage** tab.

Adding Structural Components to Design Option 2

In this section of the tutorial, you will create elements to Design Option 2. In general, you can use two methods to create elements to a design option. The first method is to create the elements as they were created in the previous option. The second method is to copy elements from Option 1 to Option 2 and then modify them based on the given project parameters. You will use the second method in this tutorial.

1. To start adding element to the design option, choose the **Design Options** tool from the **Design Options** panel of the **Manage** tab; the **Design Options** dialog box is displayed; as shown in Figure 16-70. In this dialog box, select the **18" X 18" columns (primary)** (for Metric **450 x 450 mm columns(primary)**) choose the **Edit Selected** button. Next, choose the **Close** button; the **Design Option** dialog box is closed.

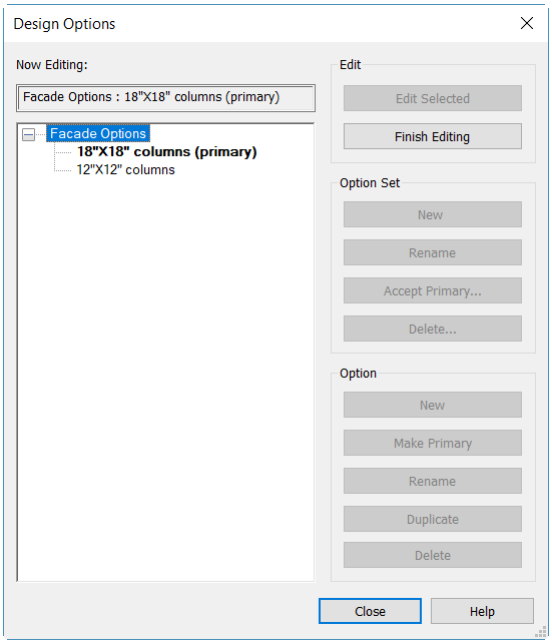


***Figure 16-70** The **Design Option** dialog box*

2. Select all elements created in Design Option 1, including columns, beams, floors, and railings and choose the **Copy to Clipboard** tool from the **Clipboard** panel of the **Modify | Multi-Select** tab and then choose the **Manage** tab.

3. In this tab, select the **12"X 12" columns** (for Metric **300 x 300mm columns**) option from the **Active Design Option** drop-down list in the **Design Options** panel. Notice that from the current view, the elements of the previous design option disappear.

4. Choose the **Modify** tab and then choose the **Aligned to Same Place** tool from the **Paste** drop-down in the **Clipboard** panel. Notice that the copied elements of Design Option 1 are pasted in Design Option 2.

5. Select all the column and by using the **Type Selector** drop-down list in the **Properties** palette, replace all **Concrete-Square-Column 18" X 18"** (for Metric **M_Concrete-Square-Column 450 x 450mm**) types with **Concrete-Square-Column 12" X 12"**types (for Metric **Concrete-Square-Column 300 x 300mm** type). Similarly, select all the beams and replace all **Concrete-Rectangular Beam : 18" X 18"** beams with **Concrete-Rectangular Beam: 12" X 24"** beams.

6. Use the drag control to extend the beams, wherever necessary, such that they completely lie over the column. You may need to work in various views to select and extend the beams based on the given 3D view for Design Option 2.

7. Similarly, select the railings and edit them such that they span between the columns. Also, modify their properties to match the given railing profile. Assume the dimensions for the railing and baluster placement.

8. Select and extend the floor slabs at the second and fourth floors up to the beams. Now, the 3D view of the project should resemble the views given for creating Design Option 2, refer to Figures 16-63 through 16-65.

9. Choose the **Design Options** tool from the **Design Options** panel in the **Manage** tab to invoke the **Design Options** dialog box. Choose the **Finish Editing** button from this dialog box. Choose the **Close** button to close the dialog box.

Saving the Project

In this section, you will save the project file using the **Save As** tool.

1. Now, choose **Save As > Project** from the **File** menu; the **Save As** dialog box is displayed. Enter **c16_Apartment1_tut1.rvt** (for Metric **M_c16_Apartment1_tut1.rvt**) in the **File name** edit box of the **Save As** dialog box.

2. Choose **Save**; the **Save As** dialog closes and the file is saved.



Note

You will not close the project file for Apartment 1 project at this stage as this file will be required for the next tutorial for building the Apartment Complex.

Tutorial 2 Apartment Complex

In this tutorial, you will generate the Apartment Complex project by copying and pasting the elements of the *Elevator and Stair Lobby* and *Apartment 2* projects into the *Apartment* project. Edit them to attach to the *Apartment* project. Group them into an apartment cluster, as shown in Figure 16-71. Save the project file as *Apartment Cluster.rvt*. Use all latest project files for this tutorial.

In the *Site Plan* file created in Exercise 1 of Chapter 9, link the *Apartment Cluster* and the *Club* project based on Figure 16-72. Save the project file as *Apartment Complex.rvt*.

(Expected time: 45 min)

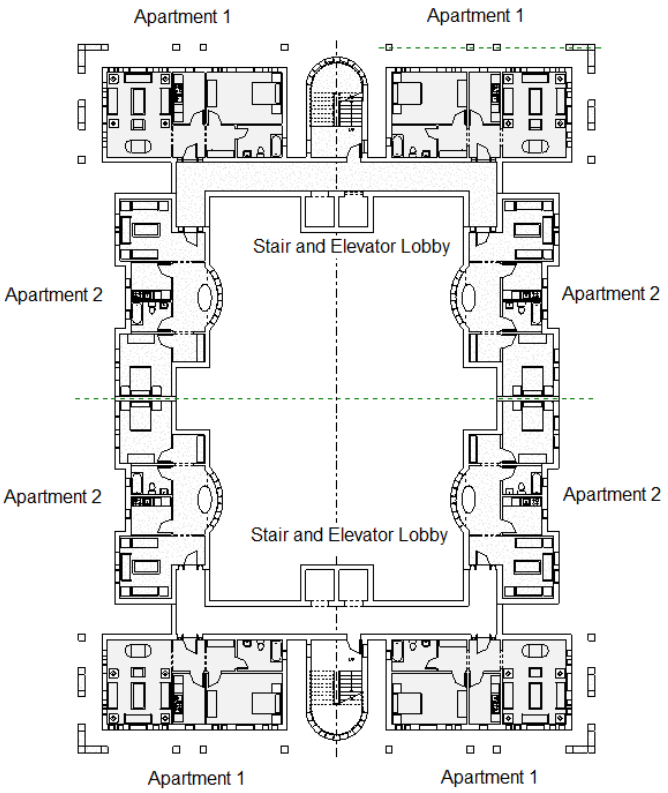


Figure 16-71 *The sketch plan showing the cluster of apartments*

Note

The tools used to copy/paste and link projects have been given to describe their general usage in a project. These tools should, however, be used based on the project parameters and intent.

The following steps are required to complete this tutorial

a. Copy and paste elements of the *Elevator and Stair Lobby* project and the *Apartment 2* project to the base file, refer to Figures 16-73 through 16-76.
b. Group the projects and use the modifying tools to create the *Apartment Cluster* project, refer to Figure 16-77.
c. Open the *Site Plan* project and link the *Apartment Cluster* and the *Club* project using the **Import/Link** tool, refer to Figures 16-78 and 16-79.
d. Save the project using the **Save As** tool.
   For Imperial *c16_ApartmentComplex_tut2.rvt*
   For Metric *M_c16_ApartmentComplex_tut2.rvt*
e. Close the project using the **Close** tool.

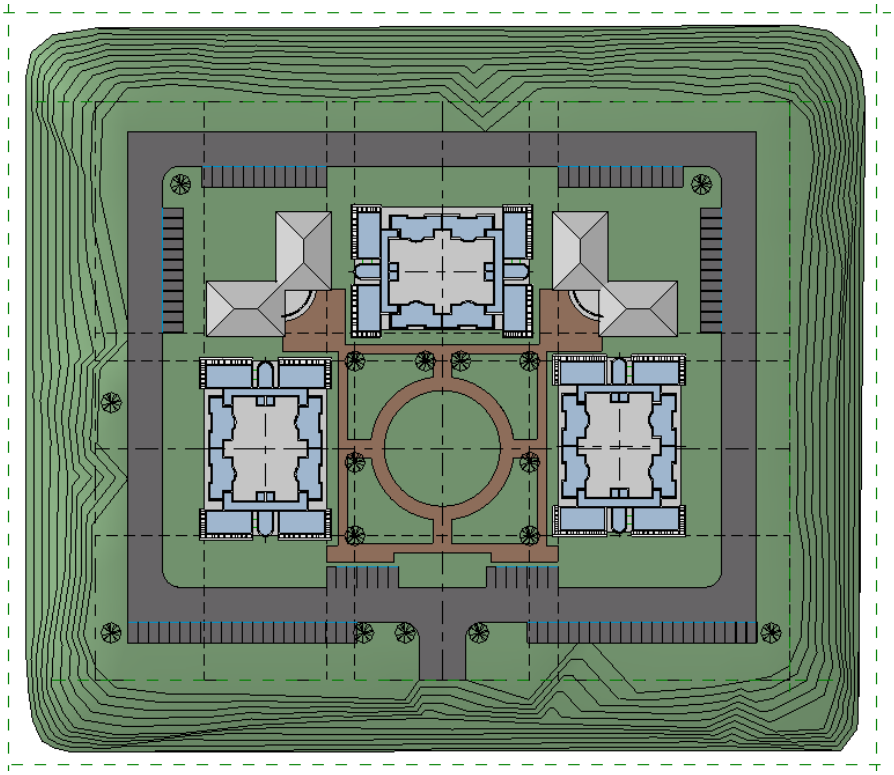


Figure 16-72 *The sketch plan for linking Apartment Cluster and Club project to the Site Plan project*

Copying the Elements of the Elevator and Stair Lobby and Apartment 2 and Pasting in a New Project

In this section of the tutorial, you will first copy and paste the elements of the *Elevator and Stair Lobby* and the *Apartment 2* projects into the *Apartment 1* project. For this, you need to group all the elements in each project before inserting them into the base file. You will also edit the walls of the former project in order to attach them to the latter, based on the layout plan given for the apartment cluster.

1. Choose **Open > Project** from the **File** menu and open the *c11_ElevatorandStairLobby_ex2.rvt* file (for Metric *M_c11_ElevatorandStairLobby_ex2.rvt)* created in Exercise 2 of Chapter 11. You can also download this file from *https://www.cadcim.com*. The path of the file is as follows: *Textbooks > Civil/GIS > Revit Architecture > Exploring Autodesk Revit 2022 for Architecture*

2. Open the **{3D}** view from the **Project Browser** and select all elements created in the project. Now, choose the **Create Group** tool from the **Create** panel of the **Modify | Multi-Select** tab; the **Autodesk Revit 2022** message box is displayed.

3. In this message box, choose **OK**; the **Create Model Group** dialog box is displayed. In this dialog box, ensure that **Group 1** is entered in the **Name** edit box and then choose the **OK** button; the **Create Model Group** dialog box closes and the selected elements are highlighted in a group.

4. Next, you need to copy the created group to the clipboard. To do so, ensure that the new group is selected and then choose the **Copy to Clipboard** tool from the **Clipboard** panel of the **Modify | Model Groups** tab; the selected group is copied to the clipboard.

5. Open the *c16_Apartment1_tut1.rvt* file (for Metric *M_c16_Apartment1_tut1.rvt* file) and double-click on the **First Floor** plan view; the corresponding view is displayed. Next, choose the **Modify** tab. In this tab, choose the **Paste from Clipboard** tool from the **Clipboard** panel; the **Duplicate Types** dialog box is displayed. Choose the **OK** button from the dialog box; the copied elements of the *Elevator and Stair Lobby* project are displayed in the drawing area.

6. Zoom out the current view and place the elements of the *Elevator and Stair Lobby* project anywhere outside the *Apartment 1* project profile.

7. Choose the **Move** tool from the **Modify** panel of the **Modify | Model Groups** tab and move the selected elements using the object snaps, as shown in Figure 16-73. Ignore any warning message at this stage.

8. Open the *c08_Apartment2_ex1.rvt* project file (For Metric *M_c08_Apartment2_ex1.rvt* project file) and choose **Site** from the **Project Browser**. Now, select all elements (except the annotations) displayed in the view and choose the **Create Group** tool from the **Create** panel of the **Modify | Multi Select** tab. Then group the selected elements with the default name. Now, ensure that the group is selected and then choose the **Copy to Clipboard** tool from the **Clipboard** panel of the **Modify | Model Groups** tab.

9. Choose the **c16_ Apartment1_tut1-Floor Plan: First Floor** option (for Metric **M_c16_ Apartment1_tut1-Floor Plan: First Floor**) from **View > Windows > Switch Windows** drop-down; the *Apartment 1* project is displayed.

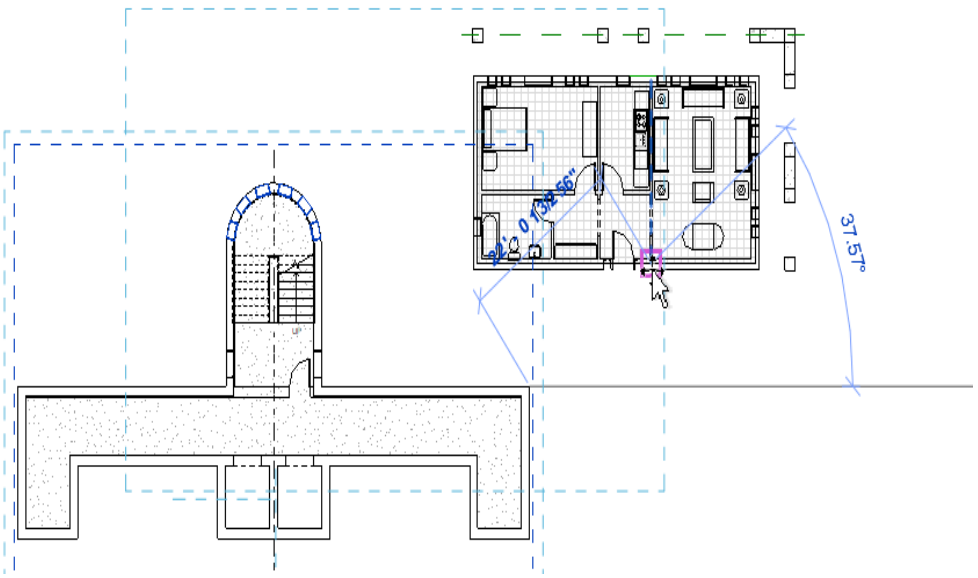


Figure 16-73 *Moving the elements of the Elevator and Stair Lobby project*

10. In the *Apartment 1* project, choose the **Modify** tab. In this tab, choose the **Paste from Clipboard** tool from the **Clipboard** panel; the **Duplicate Types** dialog box is displayed. Choose the **OK** button from the dialog box. Now, place the *Apartment 2* elements anywhere outside the profile of the existing project.

11. Next, you need to change the orientation of the pasted elements of the *Apartment 2* project. To do so, ensure that the elements of the *Apartment 2* project are selected and then choose the **Rotate** tool from the **Modify** panel of the **Modify | Model Groups** tab.

12. Use the **Rotate** tool to rotate the elements of the *Apartment 2* project clockwise by 90 degrees, refer to Figure 16-74.

13. Ensure that the elements of the *Apartment 2* project are selected, and then choose the **Mirror - Draw Axis** tool from the **Modify** panel of the **Modify| Model Groups** tab. In the **Options Bar**, ensure that the **Copy** check box is cleared. Now, draw the axis of reflection along the horizontal axis that passes through the centre of the *Apartment 2* project. On doing so, the *Apartment 2* project gets mirrored in its own central horizontal axis.

14. Ensure that the elements of the *Apartment 2* project are selected. Then, choose the **Move** tool from the **Modify** panel of the **Modify | Model Groups** tab and move the elements, as shown in Figure 16-74. Ignore any warning message at this stage. Next, choose the **Modify** button from the **Select** panel.

15. Now, you need to ungroup the elements of the *Elevator and Stair Lobby* project. To do so, select the elements of the *Elevator and Stair Lobby* project from the drawing and then choose the **Ungroup** tool from the **Group** panel of the **Modify| Model Groups** tab; the selected group is ungrouped and you will notice that the **Modify | Model Groups** tab is replaced by the **Modify | Multi-Select** tab.

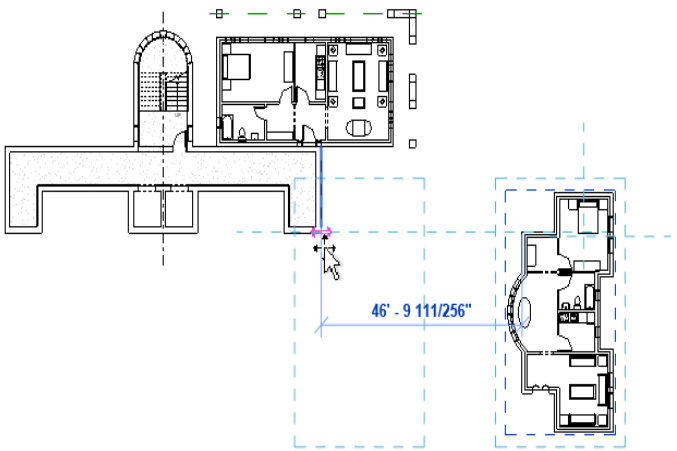


Figure 16-74 *Moving the elements of the Apartment 2 project*

16. Choose the **Modify** button from the **Select** panel and zoom into the area that shows the overlapping walls, refer to Figure 16-75. Next, select the wall of the *Elevator and Stair Lobby* project that overlaps with the wall of the *Apartment 1* project and use the drag control to stretch the walls to their intersection. Similarly, select the other wall of the *Elevator and Stair Lobby* project that intersects with the wall of *Apartment 2* project and use the drag control to stretch it to the intersection point. Use the **Split Element** tool to create a split in the wall that is common to the *Elevator and Stair Lobby* project and the *Apartment 1* project, as shown in Figure 16-76.

17. Next, select the overlapping wall of the *Elevator and Stair Lobby* project near the entrance of the *Apartment 2* project, refer to Figure 16-75 and choose the **Delete** tool from the **Modify** panel of the **Modify | Walls** tab; the selected walls are deleted.

18. Now, you need to save the project file. To do so, choose **Save As > Project**; the **Save As** dialog box is displayed. Enter **c16_Apartment_Cluster_tut2** (for Metric **M_c16_Apartment_Cluster_tut2)** in the **File name** edit box and then choose **Save**; the **Save As** dialog box closes and the project file is saved with the specified name.

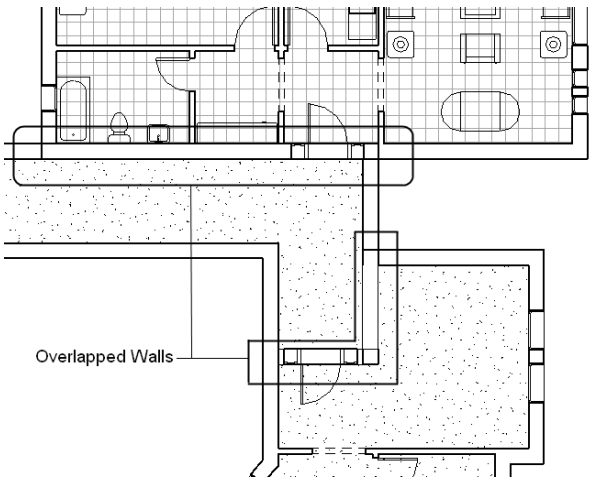


Figure 16-75 *The overlapping walls*

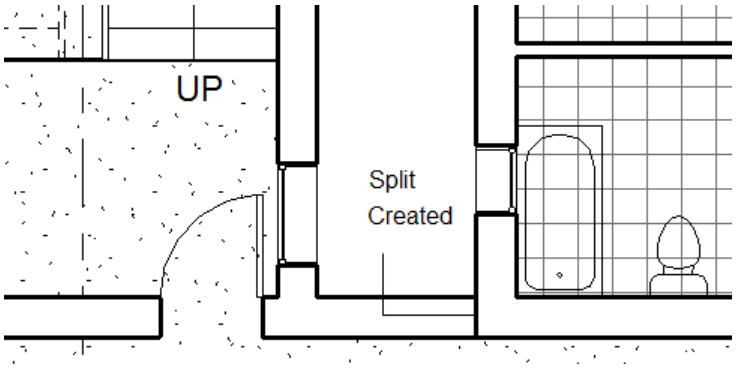


Figure 16-76 *The split created to separate the walls*

Creating the Apartment Cluster

1. Choose **Site** from the **Floor Plans** head in the **Project Browser** and then select all elements (except annotations) of the *Apartment 1* project. Next, choose the **Create Group** tool from the **Create** panel of the **Modify | Multi-Select** tab; the **Create Model Group** dialog box is displayed.

2. In the **Create Model Group** dialog box, enter **Apartment 1** in the **Name** edit box and choose **OK**; the selected elements of *Apartment 1* project are highlighted as a group. Choose the **Modify** button from the **Select** panel to clear the current selection.

3. Similarly, select the grouped elements of the *Apartment 2* project and rename the group as **Apartment 2**.

4. Choose **First Floor** from the **Floor Plans** head of the **Project Browser** and then select the *Apartment 1* group along with the *Apartment 2* group; the **Modify | Model Groups** tab is displayed.

5. Choose the **Mirror - Pick Axis** tool from the **Modify** panel and mirror the selected groups along the vertical reference line of the center of the *Elevator and Stair Lobby* project. Alternatively, you can choose the **Mirror - Draw Axis** tool and mirror the selected group by drawing a vertical axis along the center of the circular wall. Ignore any warning message at this stage. Choose the **Modify** button from the **Select** panel to clear the current selection.



Note

After mirroring the Apartment 1 and Apartment 2 projects, you will use the drag controls to remove the overlapping of walls, if created.

6. Next, you need to mirror the Design Option 1 of the *Apartment 1* project. To do so, choose **Site** from the **Floor Plans** head in the **Project Browser** and choose the **Manage** tab. Next, select the **18"x18" columns** option from the **Active Design Options** drop-down list in the **Design Options** panel; the elements of the selected Design Option are highlighted.

7. Select the elements created in the **18" X 18" columns** option (for Metric **450 X 450mm columns**). Invoke the **Mirror - Pick Axis** tool from the **Modify | Multi-Select** tab and then mirror the selected elements along the same vertical axis as selected in Step 5. Choose the **Modify** button from the **Select** panel to clear the current selection.

8. Now, choose **First Floor** from the **Floor Plans** head in the **Project Browser** and then select the **Main Model** option from the **Active Design Option** drop-down list in the **Design Options** panel of the **Manage** tab. Next, select all elements of the project and mirror them along the horizontal axis. The horizontal axis should be defined by the wall centerlines of the south walls of the *Apartment 2* project, as shown in the cluster plan of this tutorial, refer to Figure 16-71. Ignore any warning message during the mirroring process. After mirroring the selected elements, choose the **Modify** button from the **Select** panel to clear the current selection.

9. You will also mirror the elements created for Design Option 1, separately in the Site view. Use the drag control to complete the overlapping walls. After completing this step, the northeast 3D view should appear similar to the illustration shown in Figure 16-77.

10. Next, select the **Main Model** option from the **Active Design Option** drop-down list in the **Manage** tab and then choose the **Purge Unused** tool from the **Settings** panel of the **Manage** tab. Then, choose the **OK** button from the **Purge unused** dialog box to purge all the unused elements and annotations.

11. Choose **Save As** from the **File** menu and save the *Apartment_Cluster* project (for Metric *M_Apartment_Cluster* project).

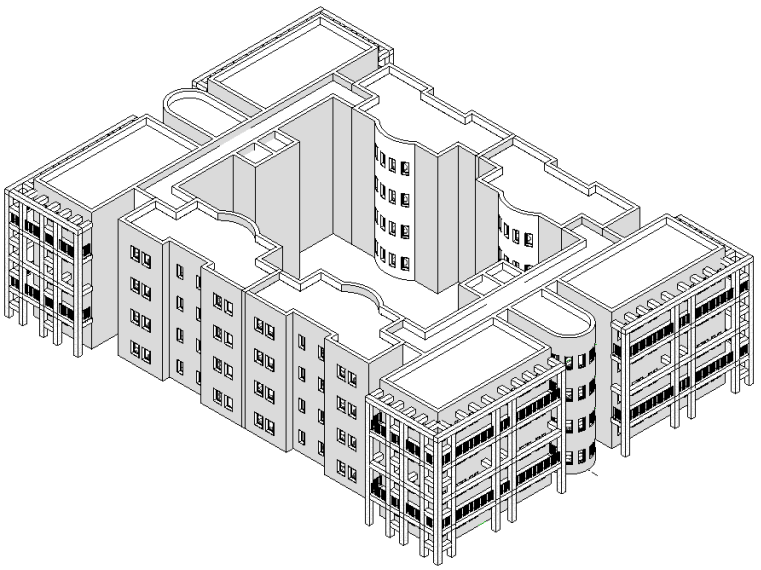


Figure 16-77 *The northeast 3D view for the apartment cluster*

Linking the Apartment Cluster and the Club Projects to the Site

1. Open the *Site Plan* project created in Tutorial 1 of Chapter 9.

2. Choose the **Manage** tab and then choose the **Transfer Project Standards** tool from the **Settings** panel; the **Select Items To Copy** dialog box is displayed. Ensure that the **c16_Apartment _Cluster_tut2** option is selected in the **Copy from** drop-down list. Choose the **OK** button; the **Duplicate Types** message box is displayed. This message box displays the list of element types that are duplicated in the projects.

3. Choose the **New Only** button to return to the *Site Plan* project.

4. Navigate to the *Apartment _Cluster* project and choose **Close** from the **File** menu; the *Apartment Cluster* project is closed.

5. In the *Site Plan* project, choose the **Insert** tab and then choose the **Link Revit** tool from the **Link** panel; the **Import/Link RVT** dialog box is displayed.

6. Select the *Apartment_ Cluster. rvt* project file (for Metric *M_Apartment_ Cluster_. rvt* project file)and then select the **Manual - Base point** option from the **Positioning** drop-down list. Choose the **Open** button; the **Import/Link RVT** dialog box closes and the selected file is displayed in the drawing area.

7. Place the *Apartment Cluster* project over the building pad at the location shown in Figure 16-78. You may need to use the **Move** tool to align the linked model. The exact location is not important for this tutorial.

8. Select the linked model and choose the **Array** tool from the **Modify** panel of the **Modify | RVT Links** tab. Create two more copies of the model using the **Radial** tool with center of the model as the center of the site.

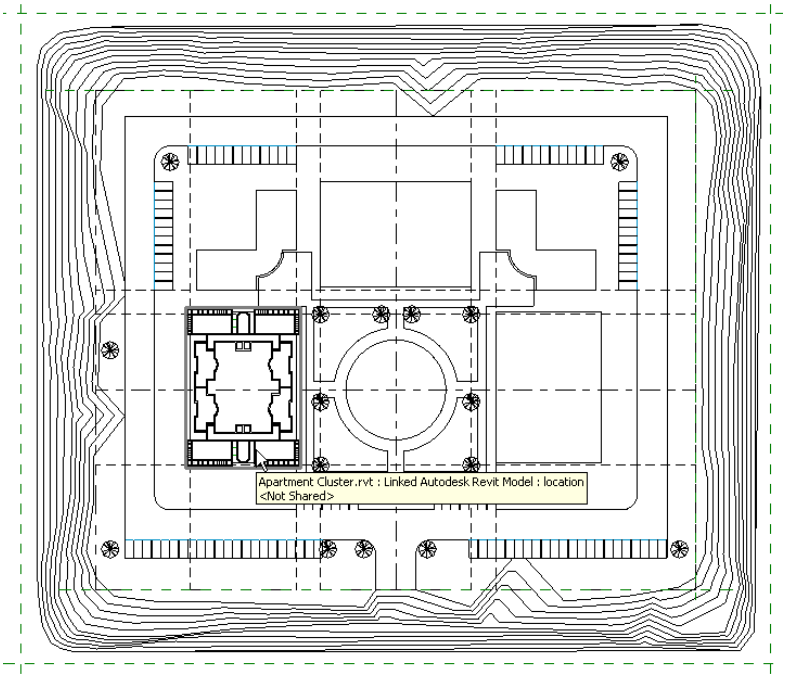


Figure 16-78 *Placing the linked Apartment 1 project over the building pad*

9. Similarly, link and place the *c14_Club_tut2.rvt* file (for Metric *M_c14_Club_tut2.rvt* file)and place it into the *Site Plan* project, as shown in Figure 16-79.

10. Create a mirror copy of the *Club* project along the vertical axis.

11. You will notice that all the linked projects have been placed at the base level, **Level 1**. Select all the linked models and move them vertically upward by 10'0"(3000mm) using the elevation views. The site plan of the completed project appears similar to the sketch view given for the site plan of this tutorial. The 3D view of the project looks similar to the illustration given in Figure 16-80.

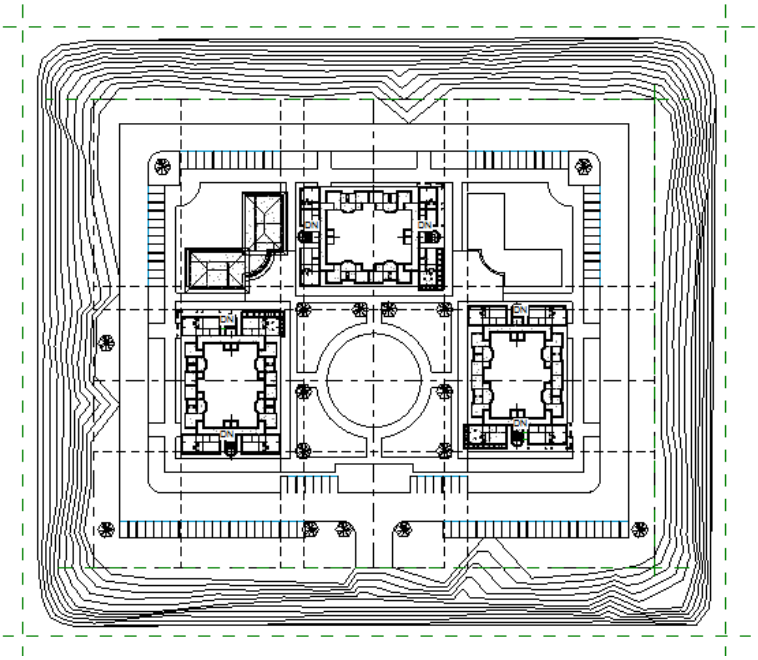


Figure 16-79 *Placing the linked Club project over the building pad*

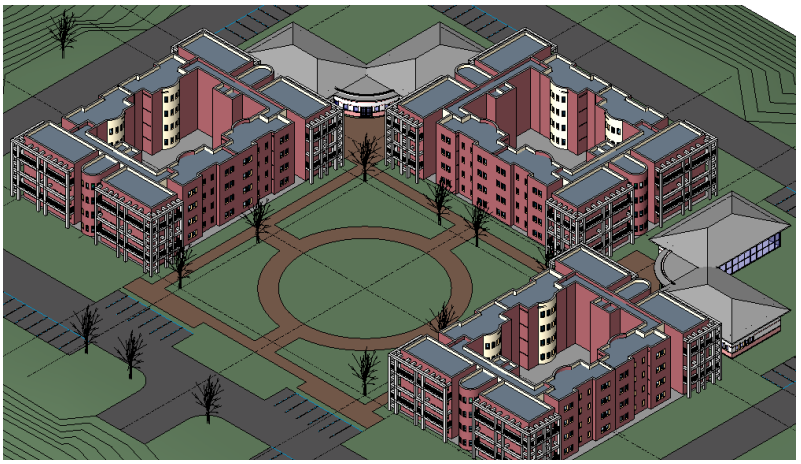


Figure 16-80 *The 3D view of the completed Apartment Complex project*

Saving the Project

In this section, you will save the project file using the **Save As** tool.

1. Choose **Save As > Project** from the **File** menu and save the file as *Apartment Complex* (for Metric *M_Apartment Complex*).

2. Choose **Close** from the **File** menu to close the project file.

Self-Evaluation Test

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

1. The _____ tool is used to create area schemes.

2. The _____ tool is used to link revit projects.

3. You can use the _____ tool to purge or remove unused elements from an Autodesk Revit project.

4. The _____ tool is used to enable worksets in a project file.

5. The _____ tool can be used to organize the **Project Browser**.

6. Structural columns can be aligned along the inclined grid lines using the SPACEBAR. (T/F)

7. You can add structural columns to the multiple grid intersection by using the **At Grids** tool. (T/F)

8. You cannot create multiple design options in the same Autodesk Revit project. (T/F)

9. When a project is linked, its elements can be edited in the base project. (T/F)

10. You cannot control the visibility of elements of a linked project. (T/F)

Review Questions

Answer the following questions:

1. Which of the following tools is used to share projects between project teams?

   a) **Link Revit** b) **Worksets**
   c) **Export** d) **Purge Unused**

2. Which of the following tools is used to create a structural column?

   a) **Wall** b) **Stairs**
   c) **Railing** d) **Structural Column**

3. Which of the following tools is used to remove unused elements and annotations from a project file?

   a) **Purged Unused** b) **Delete**
   c) **Demolish** d) **Cut**

4. The **Transfer Project Standards** tool can be used to link project files. (T/F)

5. The **Manage Links** tool can be used to reload a linked project. (T/F)

6. You can create a number of option sets under each design option. (T/F)

7. Structural columns are created downward from the specified level. (T/F)

8. The **Workset** tool can be used to subdivide and share a large project into smaller projects. (T/F)

9. You can use the **Color Fill** tool to create color plans describing their spatial usage in a building plan. (T/F)

10. The **Phasing** tool enables you to divide a project into various development phases. (T/F)

EXERCISES

Exercise 1 Apartment 2

Modify the *Apartment Cluster* project (for Metric *M_Apartment_Cluster* project) created in the Tutorial 1 of this chapter. Add structural elements for the *Apartment 2* exterior wall, based on the sketch plan shown in Figure 16-81 and the sketch elevation, as shown in Figure 16-82. Use 18”x18” columns to generate the facade. The 3D view should appear similar to the illustration given in Figure 16-83. Modify the *Apartment 2* project file and reinsert the elements into the *Apartment Cluster* file. **(Expected time: 45 min)**

Save the file as-

For Imperial *c16_apartment_cluster_ex1.rvt*
For Metric *M_c16_apartment_cluster_ex1.rvt*)

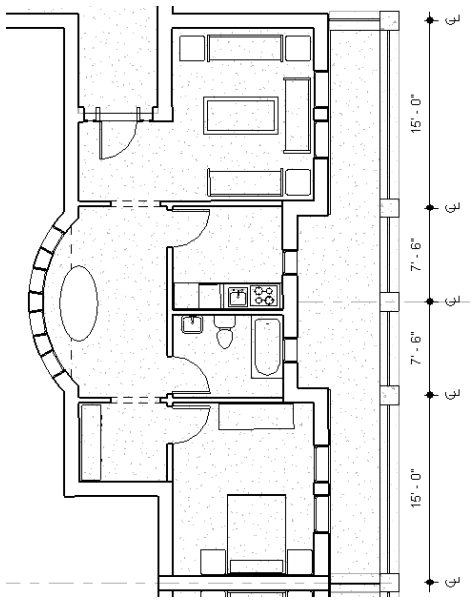


Figure 16-81 *The sketch plan view for adding structural elements to the Apartment 2 project*

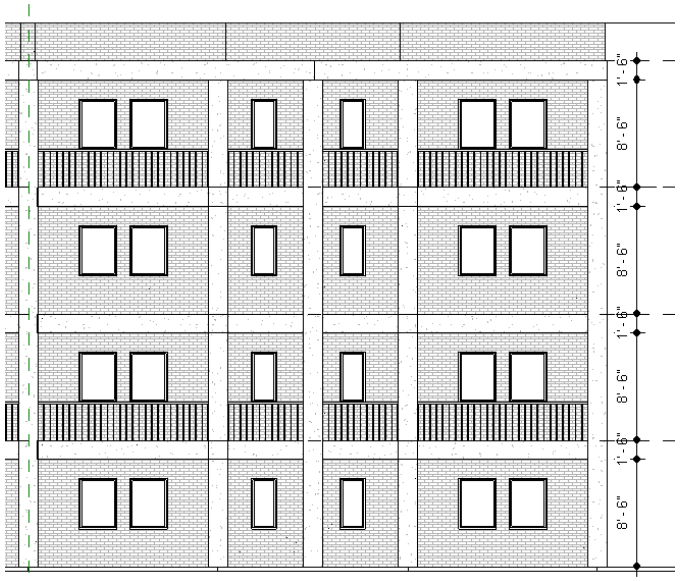


Figure 16-82 *Sketch elevation for adding structural elements to the Apartment 2 project*

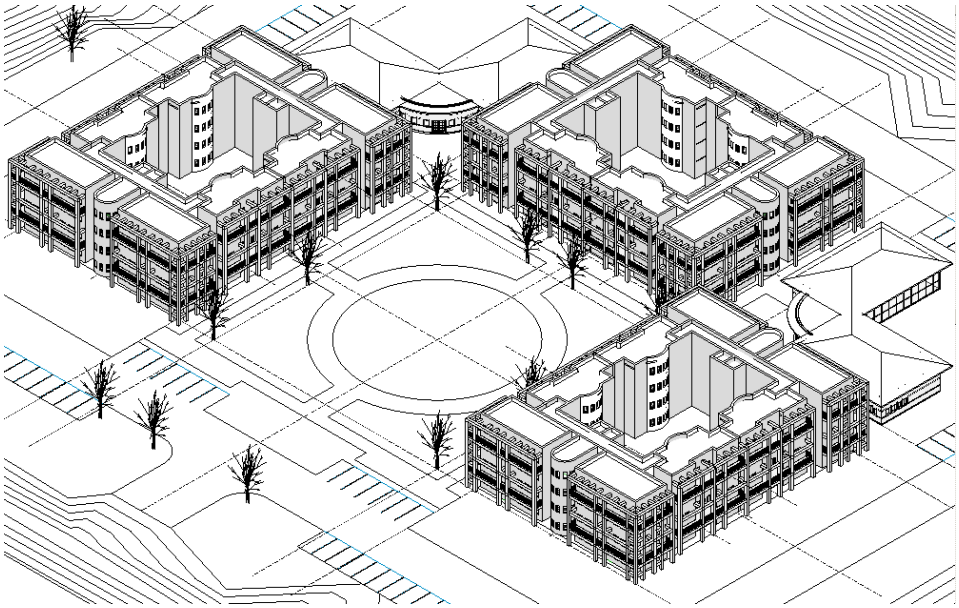


Figure 16-83 *The 3D view of the completed Apartment Complex project*

Exercise 2 Apartment Complex

Create the 3D perspective views of the *Apartment Complex* project, based on the view shown in Figures 16-84 and 16-85. Also, render the perspective views.

(Expected time: 30 min)

Save the file as *exercise1_apartment_cluster.rvt* (for Metric *M_exercise1_apartment_cluster.rvt*)



Figure 16-84 *First 3D perspective view of the Apartment Complex project*

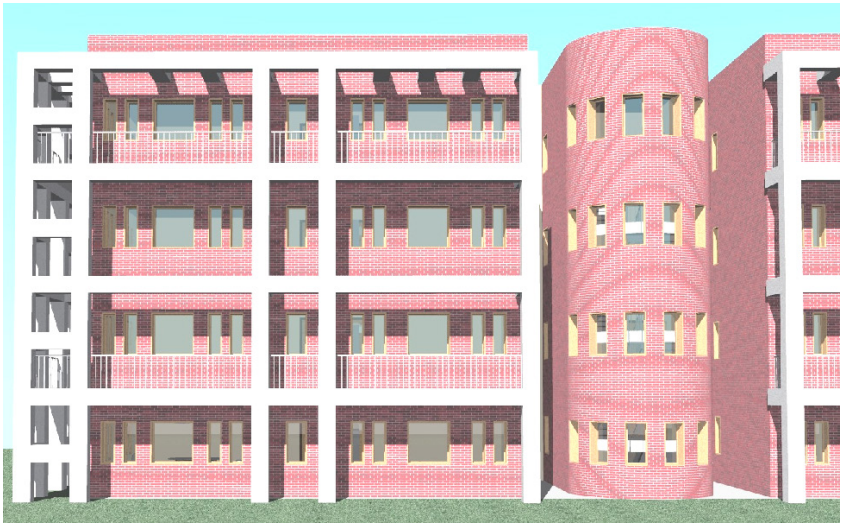


Figure 16-85 *Partial 3D perspective view of the Apartment Complex project*

Answers to Self-Evaluation Test

1. Area and Volume Computations, **2. Link Revit**, **3. Purge Unused**, **4. Worksets**, **5. Browser Organization**, **6. T**, **7. T** , **8. F**, **9. F**, **10. F**