

Autodesk®

# Revit® 2024 MEP Fundamentals



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## Starting an MEP Project

Starting an MEP project in Revit begins by using a template. You can then link in a CAD file or an existing Revit model, if these are available. From there, you can add the framework for your system designs, including levels to define vertical heights and grids to utilize the structural layout.

### Learning Objectives

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- Link and import CAD files to be used as a basis for developing a design.
- Link and import raster image and PDF files.
- Link existing Revit models to develop and coordinate with other disciplines.
- Add and modify levels to define floor-to-floor heights and other vertical references.
- Add and modify grids to provide locations for model elements.

## 2.1 Selecting a Project Template

New projects are based on a project template file. The template file includes preset levels, views, and some families, such as wall styles and text styles. When using templates, most of the views are set to display only the elements specific to the template, so it is best practice to select a template that reflects your company's discipline.

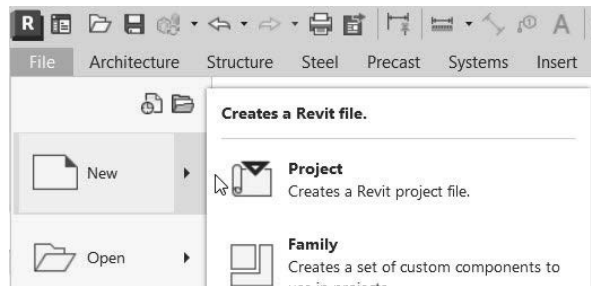
- Check with your BIM manager about which template you need to use for your projects. Your company might have more than one based on the type of project you are designing.
- Ideally, you should not start your work inside of another discipline or model. Instead, you should start from either the Revit structural template or your company's custom template and link the architectural model into your project.
  - If you link a Revit model into your project, you can use the monitoring and coordinating features to copy/monitor necessary items, such as walls, floors, and grids, from the architect. To learn more about Copy/Monitoring, see *6.1 Copying and Monitoring Elements*.

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### How To: Start a New Project

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1. In the *File* tab, expand  (New) and click  (Project), as shown in Figure 2–1, or press <Ctrl>+<N>.



**Figure 2–1**

2. In the New Project dialog box (shown in Figure 2–2), select the template that you want to use and click **OK**.

**Note:** The list of template files is set in the Options dialog box in the File Locations tab. It might vary depending on the installed product and company standards.

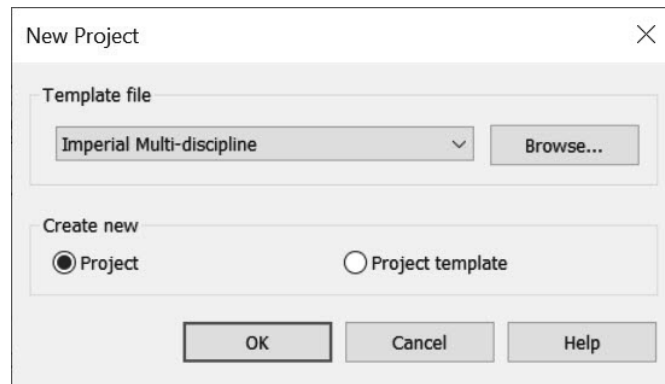


Figure 2-2

**Hint: Revit Worksharing**

If established by your company that worksharing is needed, you would typically want to start a worksharing project on your local network once a project has been created.

- For more information on worksharing, see *A.6 Introduction to Revit Worksharing*.
- For more information about establishing and using worksets, refer to the ASCENT guide *Autodesk Revit: Collaboration Tools*.

## 2.2 Linking and Importing Files

CAD files can be imported or linked into a Revit project. As an example, a designer might lay out a floor plan using the standard 2D AutoCAD software, and you then need to incorporate that information into your structural model. In addition, many renovation projects start with existing 2D drawings. Instead of redrawing from scratch, link or import the CAD file (as shown in Figure 2–3) and trace over it in Revit. You can also print a hybrid drawing that is part Revit project and part imported/linked drawing.

**Note:** When you hover over an imported or linked CAD file, you can see in the tooltip that it is called an *Import Symbol*.

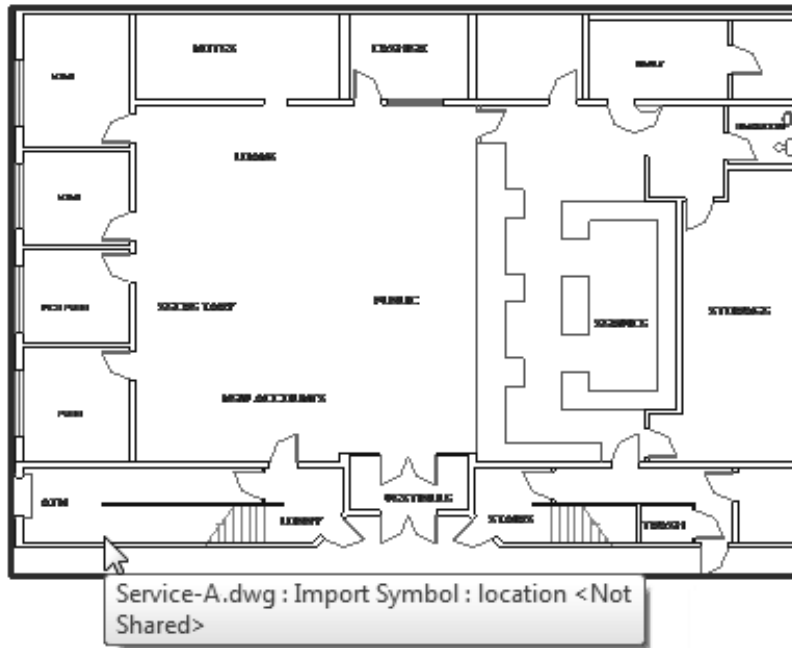




Figure 2–3

- CAD file formats that can be imported or linked include AutoCAD® (DWG and DXF), MicroStation (DGN), 3D ACIS modeling kernel (SAT), Trimble SketchUp (SKP), FormIt (AXM), 3D Shape (OBJ and STL), and Rhino (3dm).
- When linking or importing a CAD file, you can specify a level or a named horizontal reference plane in the project to position the CAD file at.
- You can specify the linking or import units (e.g., feet, meter, or US survey feet).

## Linking vs. Importing

- **Link:** A connection is maintained with the original file and the link updates if the original file is updated.
- **Import:** No connection is maintained with the original file. It becomes a separate element in the Revit model.

### How To: Link or Import a CAD File

1. Open the view into which you want to link or import the file.
  - For a 2D file, this should be a 2D view. For a 3D file, open a 3D view.
2. In the *Insert* tab>Link panel, click  (Link CAD), or in the *Insert* tab>Import panel, click  (Import CAD).
3. In the Link CAD Formats or Import CAD Formats dialog box, select the file that you want to import.
  - Select a file format in the **Files of type** drop-down list to limit the files that are displayed.

**Note:** The dialog boxes for Link CAD Formats and Import CAD Formats are the same.

4. If **Current view only** is selected, as shown in Figure 2–4, you can set all options except the *Place at* and the *Orient to View* options. The view will only display in the current view.

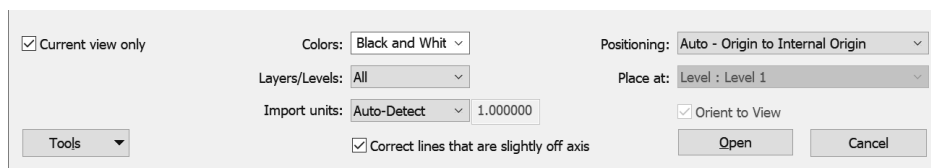


Figure 2–4

5. If you would like to place the CAD file at a level or reference plane, verify **Current view only** is unchecked and set the *Place at* option, as shown in Figure 2–5.

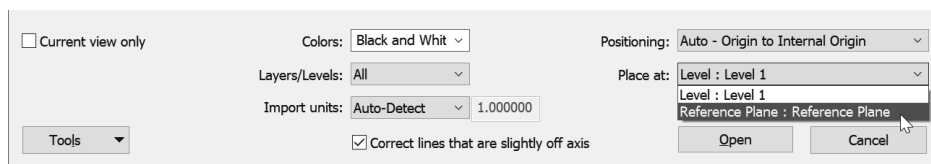


Figure 2–5

6. Click **Open**.

## Link and Import Options

<b>Current view only</b>	Determine whether the CAD file is placed in every view, or only in the current view. This is especially useful if you are working with a 2D floor plan that you only need to have in one view.
<b>Colors</b>	Specify the color settings. Typical Revit projects are mainly black and white. However, other software frequently uses color. You can <b>Invert</b> the original colors, <b>Preserve</b> them, or change everything to <b>Black and White</b> .
<b>Layers/Levels</b>	Indicates which CAD layers are going to be brought into the model. Select how you want layers to be imported: <b>All</b> , <b>Visible</b> , or <b>Specify...</b>
<b>Import units</b>	Select the units of the original file, as required. <b>Auto-Detect</b> works in most cases.
<b>Correct lines...</b>	If lines in a CAD file are off axis by less than 0.1 degree, selecting this option straightens them. It is selected by default.
<b>Positioning</b>	Specify how you want the imported file to be positioned in the current project: <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <div style="text-align: center;"> <p>Auto - Center to Center Auto - Origin to Internal Origin Manual - Origin Manual - Center</p> <p><b>Import option</b></p> </div> <div style="text-align: center;"> <p>Auto - Center to Center Auto - Origin to Internal Origin Auto - By Shared Coordinates Manual - Origin Manual - Center</p> <p><b>Linking option</b></p> </div> </div> <p>The default position is <b>Auto - Origin to Internal Origin</b>.</p>
<b>Place at</b>	Select a level or named reference plane at which to place the imported file. If you selected <b>Current view only</b> , this option is grayed out.
<b>Orient to View</b>	Used to orient the CAD file on import/link.

- When a file is positioned **Auto - Origin to Internal Origin**, it is pinned in place and cannot be moved. To move the file, click on the pin to unpin it, as shown in Figure 2–6.

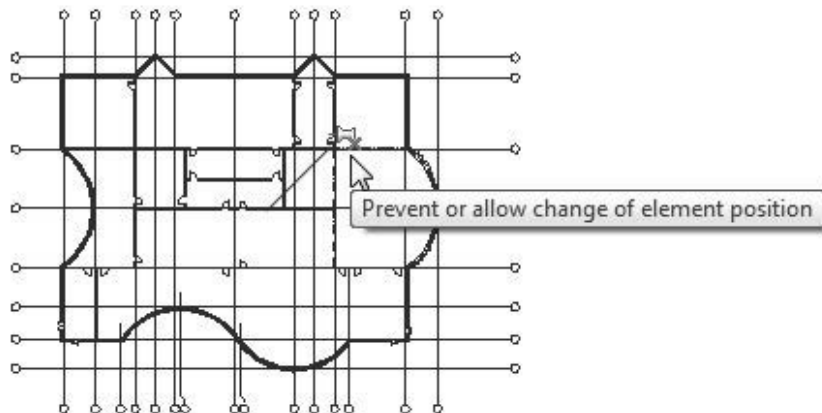
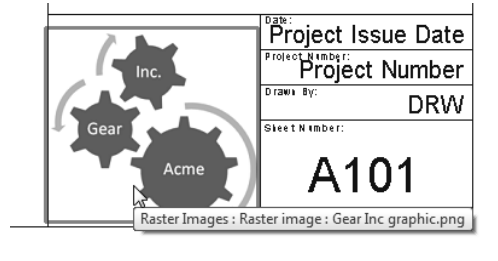


Figure 2–6



# Linking and Importing Raster Image Files

Raster images are made up of pixels or dots in a file that create a picture. For example, a raster file is created when you scan a blueprint and then import or link it into Revit to reference or trace. You can add raster images to any 2D view, including sheet views (as shown in Figure 2–7). They can be used as background views or as part of the final drawing. Imported or linked images can be placed behind model objects and annotations.



**Figure 2–7**

- Link a PDF or raster image into a 2D view if you need to reference a file that will be updated throughout the project cycle and to keep the project’s file size from increasing when importing files.
- Linked PDFs or raster images can be scaled, rotated, and moved just like an imported PDF or raster image. Any changes made to the PDF or raster image will update in the project it is linked into when you open the project.
- A PDF can be imported into Revit as a raster image. If the PDF contains vector data, you can snap to the elements in the PDF.

## How To: Import and Link an Image

To...	Then...
Import an image file	In the <i>Insert</i> tab>Import panel, click  (Import Image).
Link an image file	In the <i>Insert</i> tab>Link panel, click  (Link Image).

1. In the Import Image or Link Image dialog box, select the image you want to insert. You can insert .BMP, .JPG, .JPEG, .PNG, and .TIF files.

- Click **Open**. Four blue dots and an “X” illustrate the default size of the image file, as shown on the left in Figure 2–8. Click on the screen to place the image. It displays with the shape handles still visible, as shown on the right in Figure 2–8.

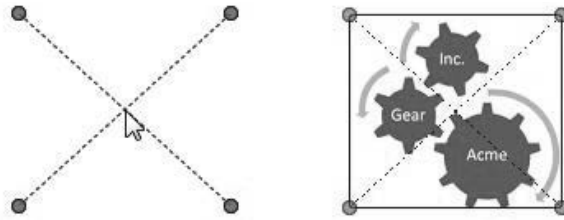


Figure 2–8

- In Properties, you can adjust the height and width and also set the *Draw Layer* to either **Background** or **Foreground**, as shown in Figure 2–9.

Dimensions	
Width	1' 5 185/256"
Height	1' 1 41/64"
Horizontal Scale	1.000000
Vertical Scale	1.000000
Lock Proportions	<input checked="" type="checkbox"/>
Other	
Draw Layer	Background

Figure 2–9

- You can select more than one image at a time and move them as a group to the background or foreground.
- In the *Modify | Raster Images* tab (shown in Figure 2–10), you can access the Arrange options and **Manage Links**.

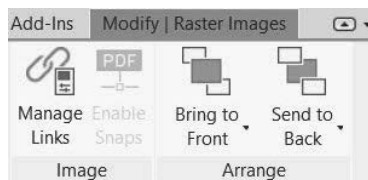




Figure 2–10

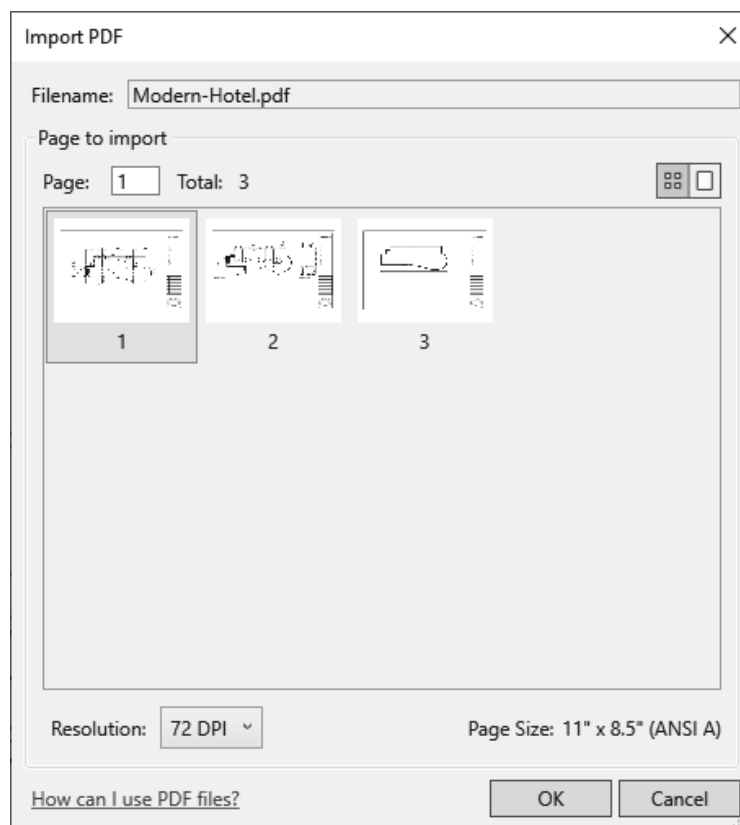
# Linking and Importing PDF Files

PDF files are often created for sharing information with people that do not have the original program and when you do not want anyone to change the original information. They can also be used as underlays when the original information includes vector data.

## How To: Import and Link a PDF File

To...	Then...
Import a PDF file	In the <i>Insert</i> tab>Import panel, click  (Import PDF).
Link a PDF file	In the <i>Insert</i> tab>Link panel, click  (Link PDF).

1. In the Import PDF or Link PDF dialog box, navigate to the location where the PDF file is stored, select it, and click **Open**.
2. In the Import PDF or Link PDF dialog box (Figure 2–11 shows the Import PDF dialog box), select the page you want to import/link and click **OK**.



**Figure 2–11**

- Only one page can be imported/linked at a time, but you can import/link additional pages by repeating the process.

3. In Properties, you can specify the size and scale of the image, as shown in Figure 2–12.
- If the PDF comes from a vector source, you can also choose to enable snaps and trace over the elements in the PDF.
  - The Foreground/Background status can be set in the Options Bar and in Properties.

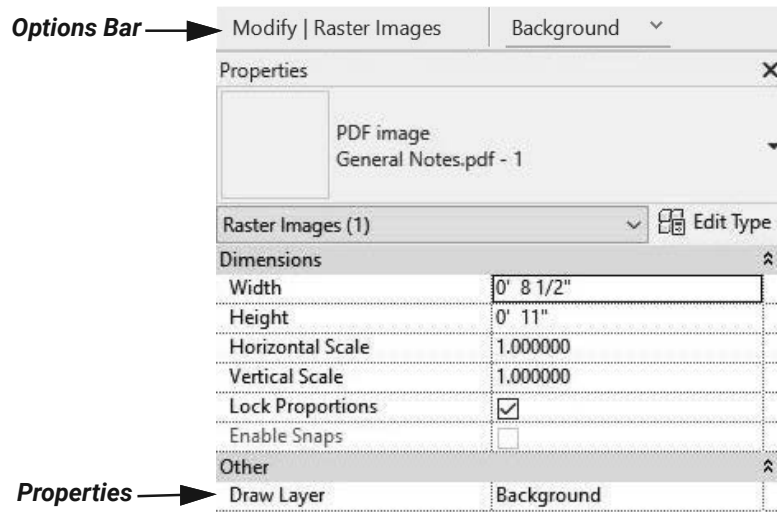


Figure 2–12

## 2.3 Linking in Revit Models

You can link Revit models directly into a project. These models can be an existing building that you are creating an addition to, as shown in Figure 2–13, or engineering models that you are checking to ensure that they line up with your model. They are also used for campus-like projects where the same building is repeated multiple times. They are full 3D models.

**Note:** A linked model automatically updates when the original file is changed.

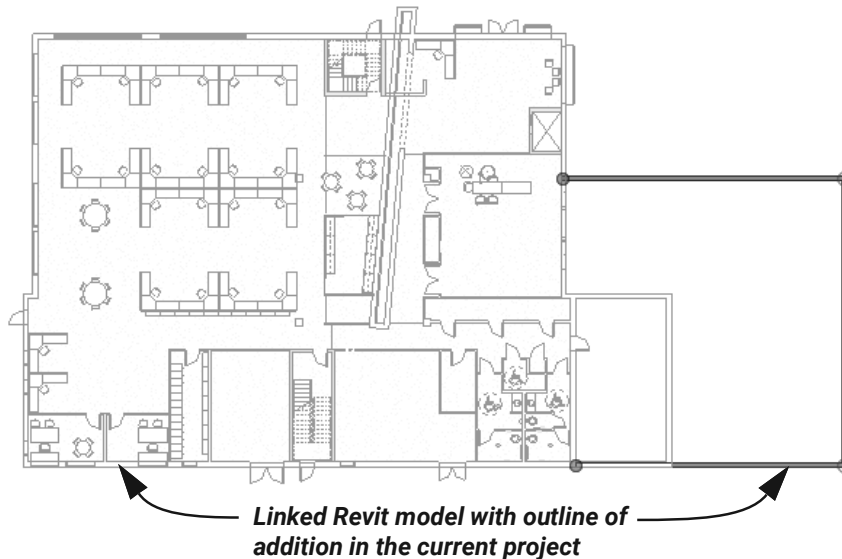



Figure 2–13

- Architectural, structural, and MEP models created in Revit can be linked to each other as long as they are from the same release cycle.
- When you use linked models, clashes between disciplines can be detected and information can be passed between disciplines.
- Revit models are always linked. They cannot be imported.

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### How To: Add a Linked Model to a Host Project

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1. In the *Insert* tab>Link panel, click  (Link Revit).

- In the Import/Link RVT dialog box, select the file that you want to link. Before opening the file, set the *Positioning*, as shown in Figure 2–14.

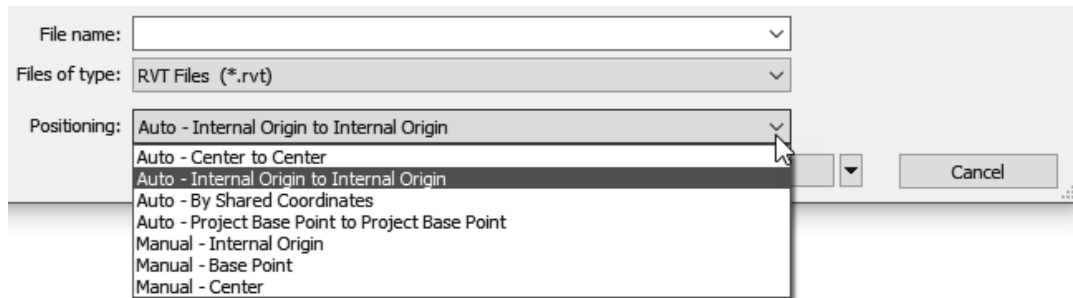


Figure 2–14

- Click **Open**.
  - Depending on how you decide to position the file, it is automatically placed in the project or you can manually place it with the cursor.
- As the links are loading, do not click on the screen or click any buttons. The more links present in a project, the longer it takes to load.

## 2.4 Modifying Imported/Linked Files

When you select an imported/linked file, you can modify it by arranging the Foreground/Background status, modifying its Type Properties, querying information about elements in the file, and deleting layers. You can also modify the Visibility/Graphic Overrides of each imported/linked instance.

- An imported/linked file is called an *import symbol* once it is inserted into a project, as shown in Figure 2–15.

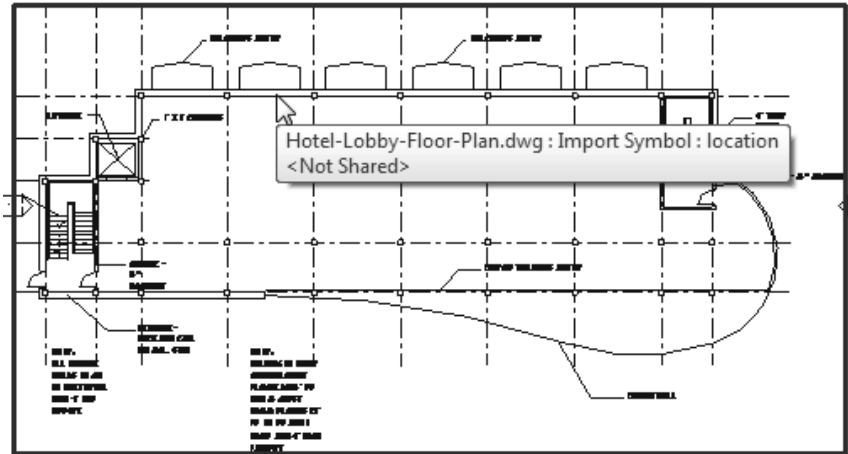


Figure 2–15

### Setting an Imported or Linked File to Halftone

To see the difference between the host model elements and the linked or imported file, you can set the linked/imported file to halftone, as shown in Figure 2–16.

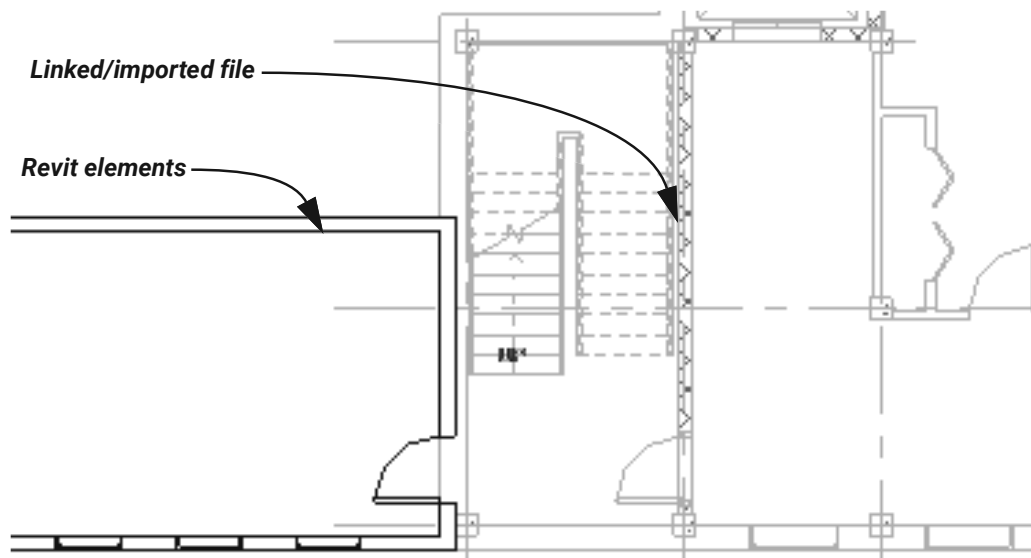


Figure 2–16

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## How To: Set an Element to Halftone

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1. Select the imported file.
2. Right-click and select **Override Graphics in View>By Element....**
3. In the View Specific Element Graphics dialog box, select **Halftone**, as shown in Figure 2–17.
  - The options shown in the View Specific Element Graphics dialog box will depend on the element selected.

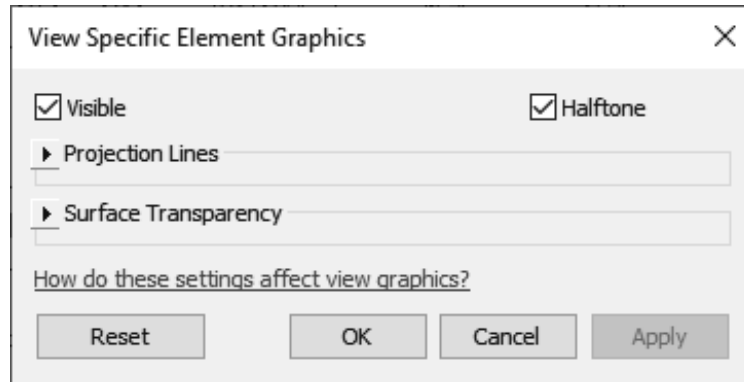


Figure 2–17

4. Click **OK**.
  - You can use this method to set any element or category to halftone.

## Draw Layer

Linked CAD files are typically in the background of a view. To change this, select the CAD file in the view and in the Options Bar or in Properties, in the *Other* section, change the *Draw Layer* to **Foreground**.

## Editing Raster Files

Select an imported/linked image to make changes. Once it is selected, you can resize the image as you did when you first inserted it or specify the *Width* and *Height* values in Properties.

- Select **Lock Proportions** in the Options Bar to ensure that the length and width resize proportionally to each other when you adjust the size of an image.
- Use the standard modification tools to **Move, Copy, Rotate, Mirror, Array, and Scale** images. Images can also be grouped together into detail groups.



- The Foreground/Background status can also be set in the Options Bar and in Properties, as shown in Figure 2–18.

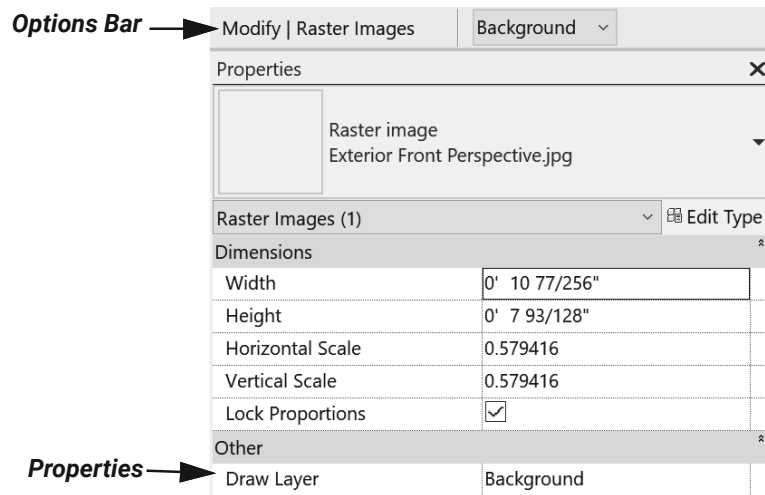


Figure 2–18

- In the *Modify | Raster Images* tab>Arrange panel (shown in Figure 2–19), use the Arrange tools to move images to the front or back of other images or objects.

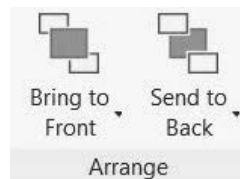


Figure 2–19

- You can snap to edges of images, as shown in Figure 2–20.

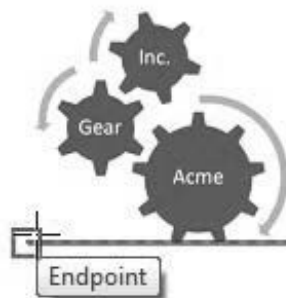





Figure 2–20

## Managing Links

The Manage Links dialog box (shown in Figure 2–21) enables you to reload, unload, add, and remove links, and it also provides access for you to set other options. To open the Manage Links dialog box, in the *Insert* tab>Link panel, click  (Manage Links). Alternatively, you can go to the *Manage* tab>Manage Projects panel and click  (Manage Links).

- You can also select the link and click  (Manage Links) in the *Modify | RVT Links* tab>Link panel.

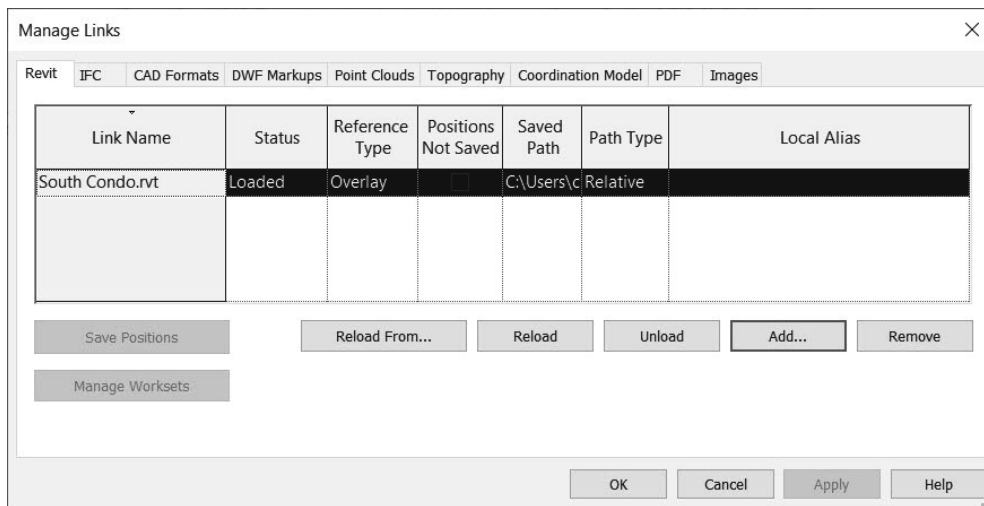


Figure 2–21

- The Manage Links dialog box does not show imported CAD files.
- You can manage both imported and linked images and PDFs.

The following options are available:

- Reload From:** Opens the Add Link dialog box, which enables you to select the file you want to reload. Use this if the linked file location or name has changed.
- Reload:** Reloads the file without additional prompts.
- Unload:** Unloads the file so that the link is kept, but the file is not displayed or calculated in the project. Use **Reload** to restore it.

**Note:** Some of these options are also available in the Project Browser. Expand the Revit Links node, then right-click on the Revit link and select **Reload**, **Unload**, or **Reload From...**

- Add:** Opens the Import/Link RVT dialog box, which enables you to link additional models into the host project.
- Remove:** Deletes the link from the file.

Links can be nested into one another. How a link responds when the host project is linked into another project depends on the option in the *Reference Type* column.

- **Overlay:** The nested linked model is not referenced in the new host project.
- **Attach:** The nested linked model displays in the new host project.

The option in the *Path Type* column controls how the location of the link is remembered.

- **Relative**
  - Searches the root folder of the current project.
  - If the file is moved, the software still searches for it.
- **Absolute**
  - Searches the entire file path where the file was originally saved.
  - If the original file is moved, the software is not able to find it.
- Other options control how the linked file interfaces with worksets and shared positioning.

## Modifying the Visibility of Imported/Linked Files

If you have used the imported/linked file as a guideline for tracing, you can toggle off the visibility of the entire image using the Visibility/Graphic Overrides dialog box, without removing it from the project in case you need it later. You can also toggle off individual layers or levels.

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### How To: Hide Individual Layers

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1. In the *View* tab>Graphics panel, click  (Visibility/Graphic Overrides), or type **VG** or **VV** to open the Visibility/Graphic Overrides dialog box.

2. Switch to the *Imported Categories* tab. It displays a list for each imported instance and their layers/levels, as shown in Figure 2–22.
3. To have the linked/imported file display in halftone, check the box in the *Halftone* column.

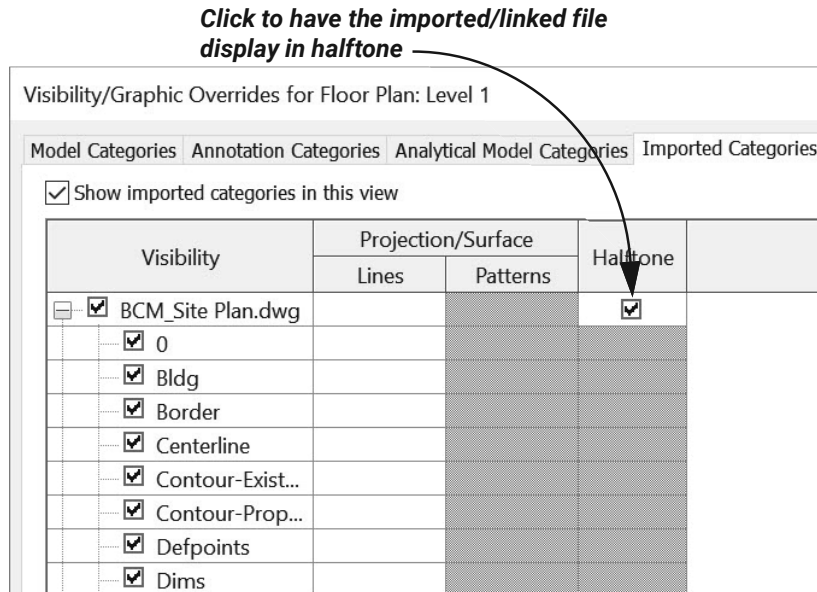



Figure 2–22

4. Click the plus sign beside the file name to expand a list of the layers or levels in that file.
5. Clear the checkmark from the individual layers that you do not want to display.
  - Typically, these layers contain similar information, such as all windows or all notes in a drawing. However, it is not as definite as using Revit elements. An item might have been misplaced on a different layer and, if so, it does not toggle off.
6. Close the dialog box.
  - To toggle off the entire file, clear the checkmark next to the file name.

## Temporarily Hide/Isolate

You might want to temporarily remove linked or imported files from a view, modify the project, and then restore the elements. Instead of completely toggling the elements off, you can temporarily hide them.

Select the elements you want to hide (make invisible) or isolate (keep displayed while all other elements are hidden) and click  (Temporary Hide/Isolate). Select the method you want to use, as shown in Figure 2–23.

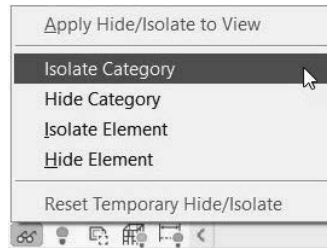


Figure 2–23

- The category or elements are hidden or isolated. A cyan border displays around the view with a note in the upper left corner, as shown in Figure 2–24. It indicates that the view contains temporarily hidden or isolated elements.

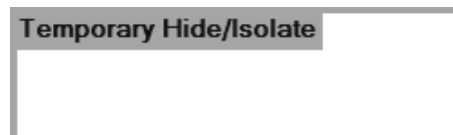



Figure 2–24

- Click  (Temporary Hide/Isolate) again and select **Reset Temporary Hide/Isolate** to restore the elements to the view.
- If you want to permanently hide the elements in the view, select **Apply Hide/Isolate to View**.
- Elements that are temporarily hidden in a view are not hidden when the view is printed.

## Hide Linked or Imported Files in a View

When working in views, you can quickly hide linked or imported files. To hide the imported or linked file, select it and right-click to display the shortcut menu, then select **Hide in View** and select either **Elements** or **Category**, as shown in Figure 2–25. Alternatively, select the link in the view and type **VH** to hide the selected file in the view.

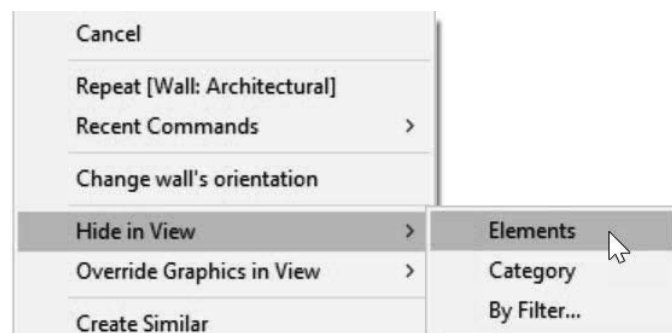


Figure 2–25

## Practice 2a

# Start a Project and Link Files - All Disciplines

### Practice Objectives

- Start a Revit project.
- Link a CAD file.
- Link a Revit file.
- Modify the linked files in a view.

In this practice, you will link both an AutoCAD (.DWG) file as well as a Revit model (.RVT). You will then modify the view properties. Figure 2–26 shows what you will see when the practice is completed.

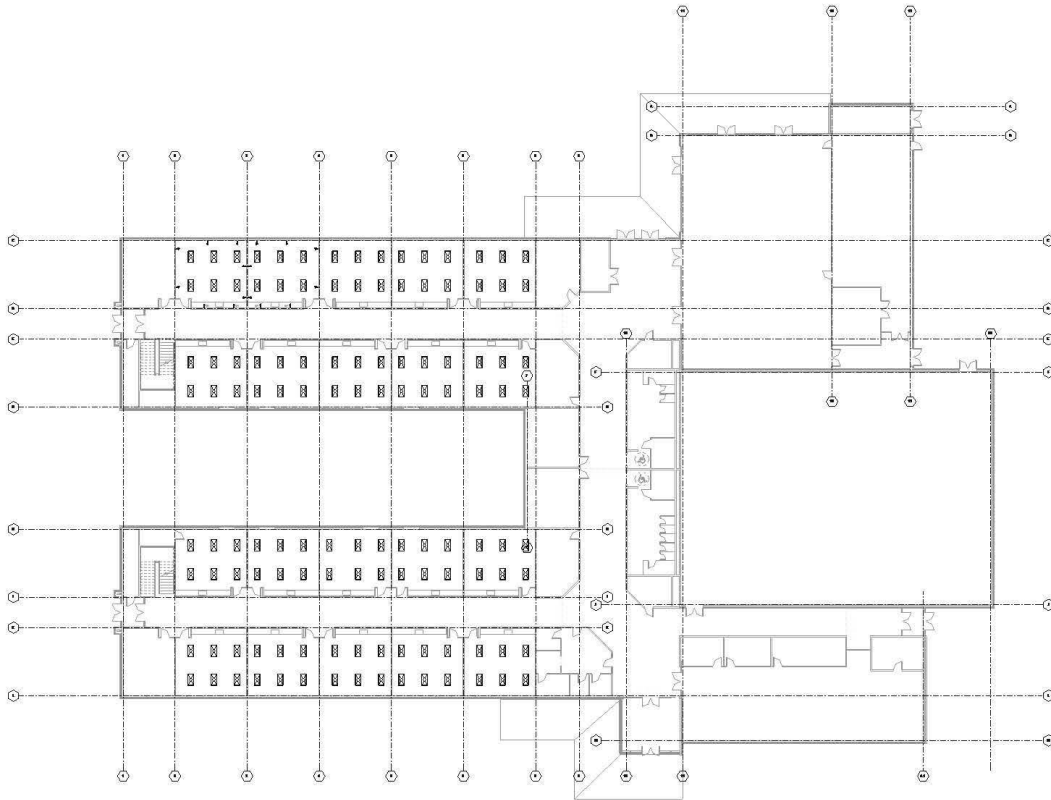





Figure 2–26

## Task 1: Start a project.

1. In the *File* tab, expand  (New) and click  (Project).
  - Alternatively, if you are on the Home screen, click the **New** button under the *MODEL* section.
2. In the New Project dialog box, click **Browse...**
3. In the Choose Template dialog box, navigate to the practice files *Templates* folder, select **Imperial-MEP-Template.rte**, and click **Open**.
4. In the New Project dialog box, click **OK**. (There are no elements in this file, only datums and basic views.)
5. The project opens up to the **1 - Mech** view.
6. Save the project as **School-MEP-Start.rvt** to the practice files *Working Models>General* folder.

## Task 2: Link a CAD file.

1. In the *Insert* tab>Link panel, click  (Link CAD).
2. In the Link CAD Formats dialog box, navigate to the practice files *Working Models>General>CAD* folder and select the file **Struct-School\_Grids.dwg**, then set the following options, as shown in Figure 2–27:
  - Keep **Current view only** unchecked
  - *Colors*: **Black and White**
  - *Layers/Levels*: **All**
  - *Import units*: **Auto-Detect**
  - *Positioning*: **Auto - Origin to Internal Origin**
  - *Place at*: **Level : Level 1**
  - Keep **Orient to View** checked

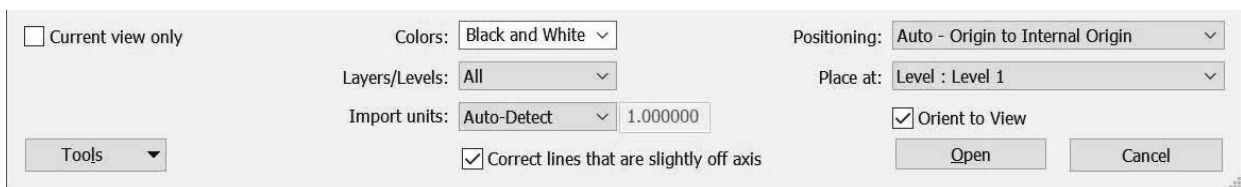


Figure 2–27

3. Click **Open**. The linked CAD file is placed in the project.

4. Select the linked CAD file. In Properties, you can see that it is an imported symbol. In the view, you can see a pin at the center of the CAD file because it was imported origin to internal origin.
5. Right-click on the linked file (also called an import symbol) and select **Override Graphics in View>By Element**.
6. In the View-Specific Element Graphics dialog box, select **Halftone**, as shown in Figure 2–28.

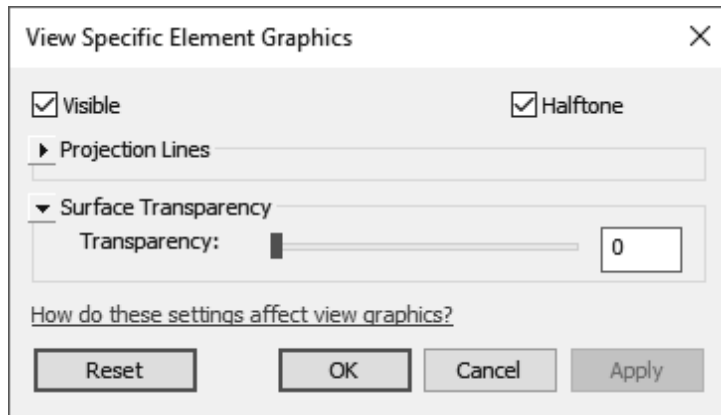






Figure 2–28

7. Click **OK**.
8. Click in an empty space in the view to release the selection. The linked file displays in halftone.
9. Zoom to the extents of the view. (Hint: Type **ZE** or double-click the mouse wheel.)
10. From the Project Browser, open the Mechanical>HVAC> Floor Plans>**2 - Mech** view. The CAD file linked in level 1 does not display because the **Place at** in the Link CAD Formats dialog box was set to **Level : Level 1**.
11. Open the Electrical>Lighting>Floor Plans>**1 - Lighting** view. The grids display because this view is associated to level 1.
  - Note that the grid is not set to halftone like in the **1 - Mech** view. This is because **Override Graphics in View** is view specific.
  - If you do not want the CAD file to display in other level 1 views, you would select the **Current view only** option in the Link CAD Formats dialog box.
12. Save the project.



### Task 3: Link in a Revit file.

1. In the Quick Access Toolbar, click  (Default 3D View).
2. In the *Insert* tab>Link panel, click  (Link Revit).
3. In the Import/Link RVT dialog box, navigate to your practice files *Working Models>General>Revit Link Files* folder and select the file **School-Arch.rvt**. Ensure that the *Positioning* is set to **Auto - Internal Origin to Internal Origin** and click **Open**.
4. Type **ZF** (Zoom to Fit) or **ZA** (Zoom All). The new building displays in the active view and is linked into the new Revit MEP project.
5. In the ribbon, click the Select drop-down list under the **Modify** tool and make sure that **Select Links** is checked, or verify the  (Select Link) icon in the Status Bar does not have a red X on it.
6. Select the linked model in the view and in the *Modify | RVT Links* tab>Modify panel, click  (Pin). This will ensure that the linked model will not be accidentally moved in the view.
7. If needed, click in an empty space in the view and zoom to see the view. (Hint: Type **ZF** or **ZA**.)
8. In the View Control bar, change the visual style to **Consistent Colors**, as shown in Figure 2–29, to see the walls.

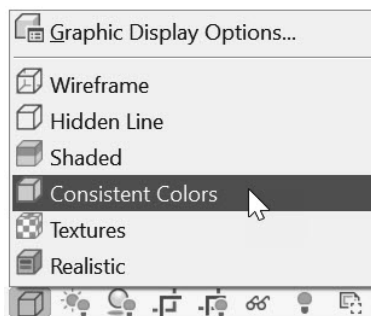


Figure 2–29

9. With nothing selected, in Properties look at the *Discipline* and note that it is set to **Mechanical**. Because it is set to Mechanical, all of the architectural elements (walls, roofs, and windows) are grayed out.

10. Zoom and pan around the model. You can see the grids from the DWG file and the RVT linked model's MEP-related elements that display darker than the architectural elements that display grayed out, as shown in Figure 2–30.

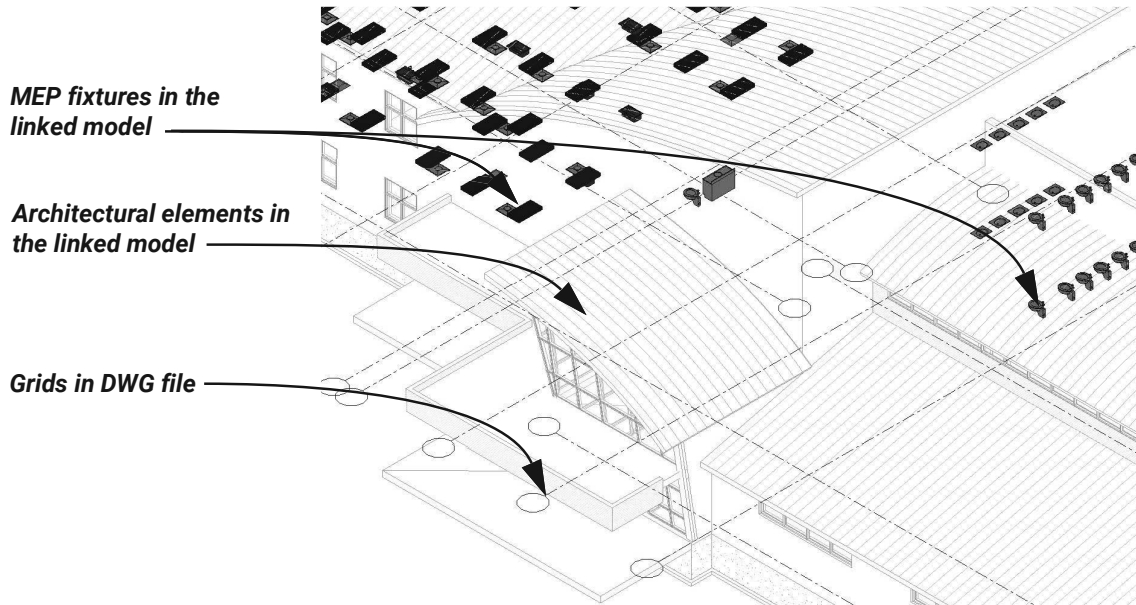


Figure 2–30

11. Zoom to fit the view.
12. Save and close the project.

**End of practice**

## 2.5 Setting Up Levels

Levels define stories and other vertical heights, such as the parapet and other reference heights shown in Figure 2–31. The default template includes two levels, but you can define as many levels in a project as required. They can go below 0'-0" or in the negative (for basements) as well.

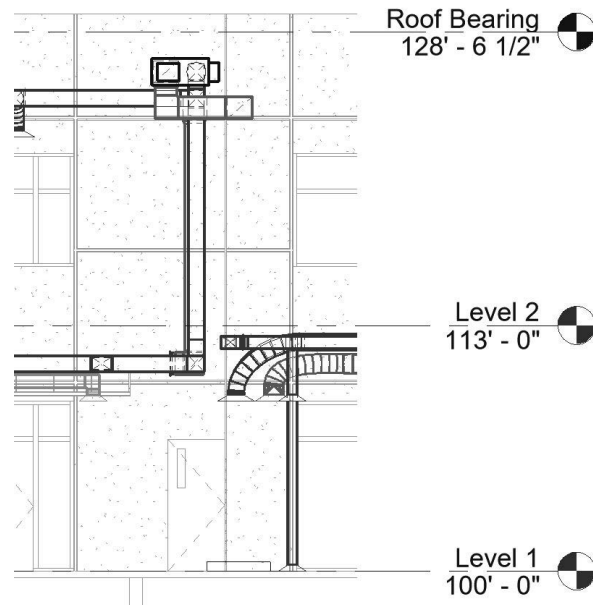






Figure 2–31

- You must be in an elevation or section view to define levels.
- Once you constrain an element to a level, it moves with the level when the level is changed.

### How To: Create Levels

1. Open an elevation or section view.
2. In the *Architecture* tab>Datum panel, click  (Level), or type **LL**.
3. In the Type Selector, set the level head type, if needed.
4. In the Options Bar, select or clear **Make Plan View** as needed. You can also click **Plan View Types...** to select the types of views to create when you place the level.
5. In the *Modify | Place Level* tab>Draw panel, click either  (Pick Lines) to select an element or  (Line) to sketch a level.
6. Continue adding levels as needed.

- Level names are automatically incremented as you place them. This automatic numbering is most effective when you use names such as Floor 1, Floor 2, etc. (as opposed to First Floor, Second Floor, etc.). In addition, this makes it easier to find the view in the Project Browser.
- A fast way to create multiple levels is to use the  (Pick Lines) option. In the Options Bar, specify an *Offset*, select an existing level, and then pick above or below to place the new level, as shown in Figure 2–32.

**Note:** You specify above or below the offset by hovering the cursor on the needed side.

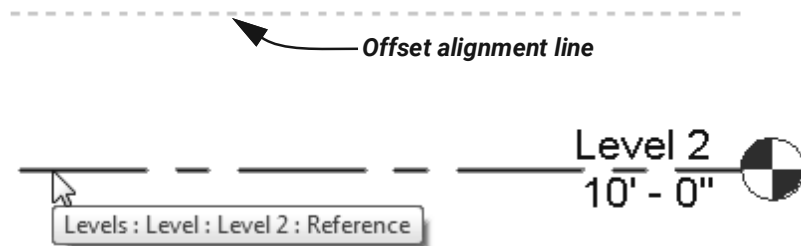



Figure 2–32

- When using the  (Line) option, alignments and temporary dimensions help you place the line correctly, as shown in Figure 2–33.

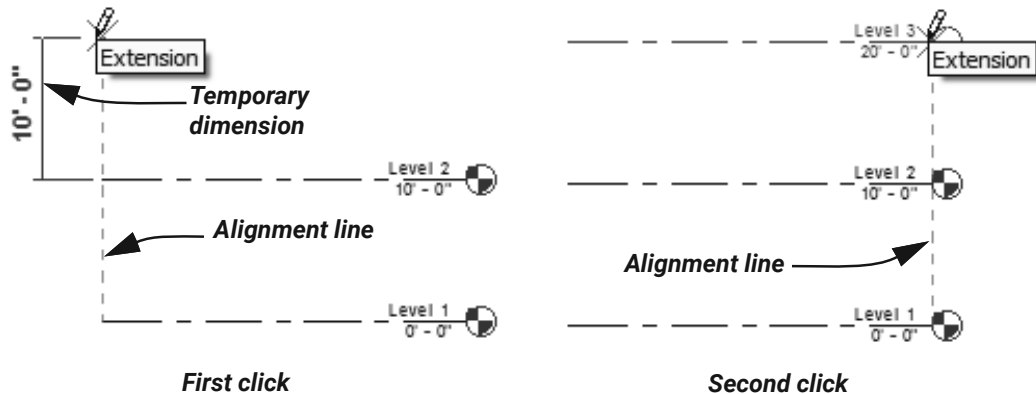



Figure 2–33

- Sketch the level lines from left to right or right to left to keep consistent.
- You can also use  (Copy) to duplicate level lines. The level names are incremented but a plan view is not created. These are called **reference levels**.

- Levels display in the default 3D view. They can be modified and copied, but cannot be created in this view.
- Levels can be hidden in any view.

## Modifying Levels

You can change levels using standard controls and temporary dimensions, as shown in Figure 2–34 to the levels' appearance. You can also make changes to the name and height of the level by selecting on the individual items in the view as well as change these in Properties. You can change just the name of the level in the Project Browser but not the height.

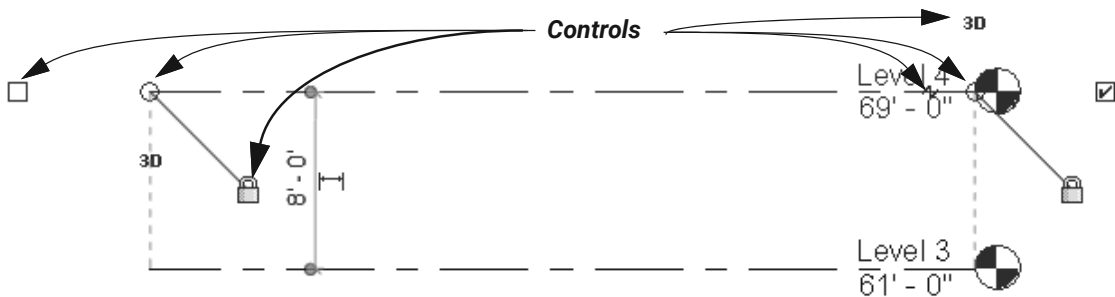






Figure 2–34

- (Hide / Show Bubble) displays on either end of the level line and toggles the level head symbol and level information on or off.
- **2D** **3D** (Switch to 3d / 2d extents) controls whether any movement or adjustment to the level line is reflected in other views (3D) or only affects the current view (2D).
-  (Modify the level by dragging its model end) at each end of the line enables you to drag the level head to a new location.
-   (Create or remove a length or alignment constraint) controls whether the level is locked in alignment with the other levels. If it is locked and the level line is stretched, all of the other level lines stretch as well. If it is unlocked, the level line stretches independent of the other levels.

- Click  (Add Elbow) to add a jog to the level line, as shown in Figure 2–35. Drag the shape handles to new locations as needed. This is a view-specific change.

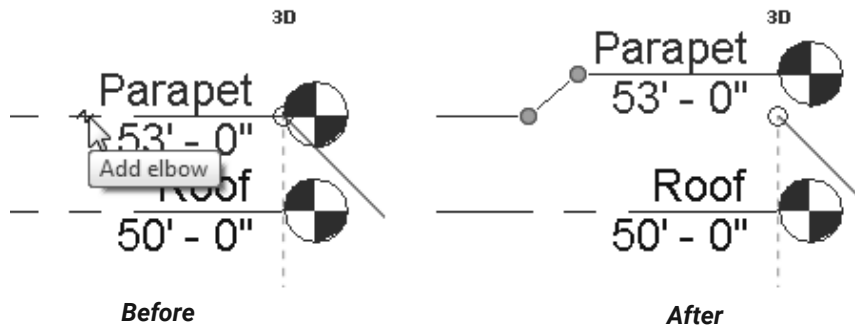


Figure 2–35

- To change the level name or elevation, double-click on the information next to the level head, or select the level and modify the *Name* or *Elevation* fields in Properties, as shown in Figure 2–36.

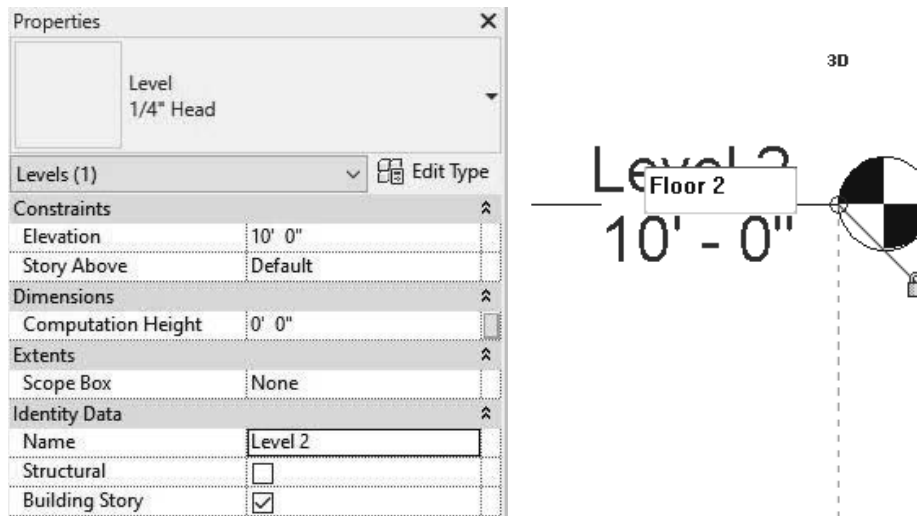


Figure 2–36

- When you rename a level, an alert box opens, prompting you to rename the corresponding views, as shown in Figure 2–37.

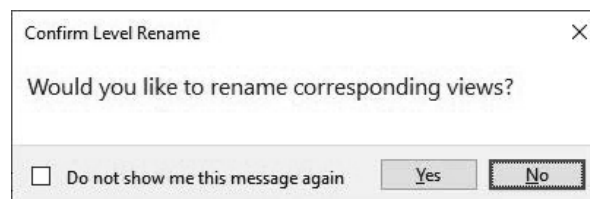


Figure 2–37

- The view is also renamed in the Project Browser.



### Hint: Modifying Measurements

For imperial measurements (feet and inches), the software uses a default of feet. For example, when you type **4** and press <Enter>, it assumes **4'-0"**. For a distance such as 4'-6", you can type any of the following: **4'-6"**, **4'6**, **4-6**, or **4 6** (the numbers separated by a space). To indicate distances less than one foot, type the inch mark (") after the distance, or enter **0**, a space, and then the distance.

- If you delete a level, the views related to that level are also deleted. A warning displays, as shown in Figure 2–38.

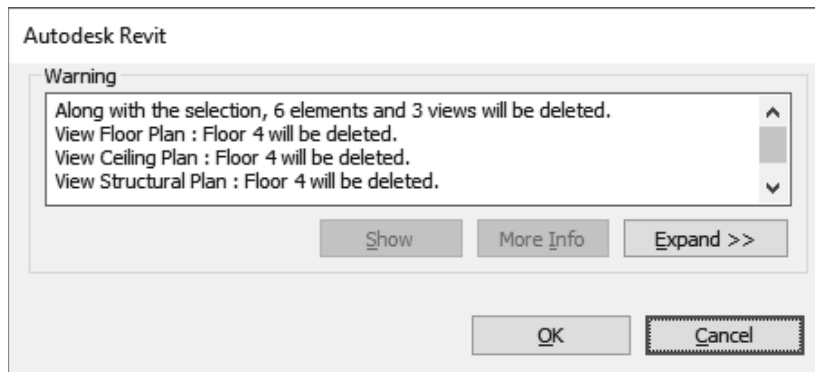


Figure 2–38



### Hint: Copying Levels and Grids from Other Projects

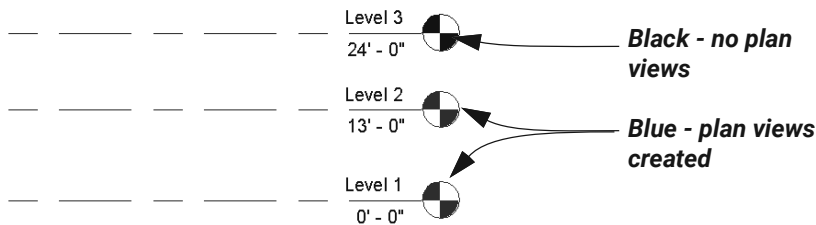
Levels and grid lines can be added by drawing over existing levels or grids in an imported or linked CAD file. It can also be copied and monitored from a linked Revit file. Some projects might require both methods.

- For more information on using the Copy/Monitor tools, see the *Copy/Monitor Elements* chapter.

## Creating Plan Views

By default, when you place a level, plan views for that level are automatically created. If **Make Plan View** was toggled off when adding the level, or if the level was copied, you can create plan views to match the levels.

- Level heads with views are blue and level heads without views are black, as shown in Figure 2–39.

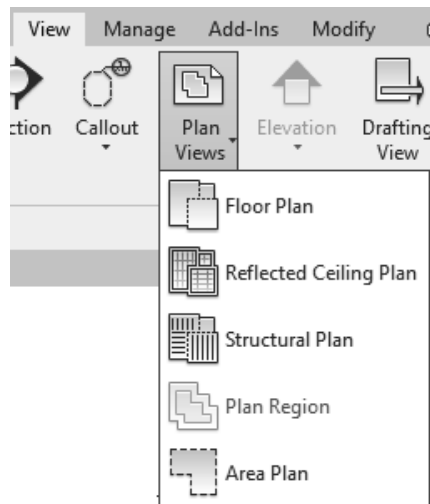


**Figure 2–39**

**Note:** Typically, you do not need to create plan views for levels that specify data, such as the top of a storefront window or the top of a parapet.

### How To: Create Plan Views

- In the *View* tab > Create panel, expand  (Plan Views) and select the type of plan view you want to create, as shown in Figure 2–40.



**Figure 2–40**

- In the New Plan dialog box (shown in Figure 2–41), select the levels for which you want to create plan views. Hold <Ctrl> to select more than one level.
  - Clear **Do no duplicate existing views** to create a copy of an existing view.





Figure 2–41

3. Click **OK**.

- Once a plan view is made from a level, you can double-click on the level head to open the related floor plan view. You create other plan views similar to creating a floor plan. Ceiling plans are typically created by default when you add a level with a view. If you do not want a level to have a ceiling plan, you can right-click on its name in the Project Browser and select **Delete**, as shown in Figure 2–42.

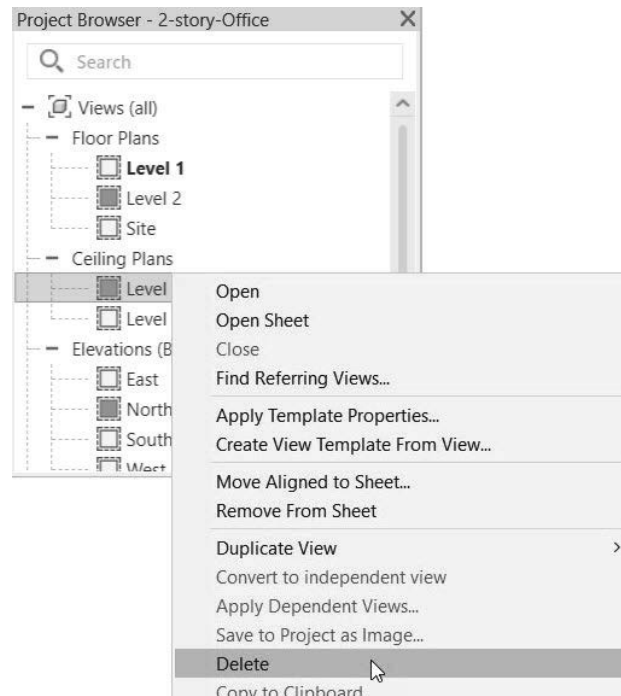


Figure 2–42

## Practice 2b

# Set Up Levels - All Disciplines

### Practice Objective

- Add and modify levels

In this practice, you will set up the levels required in the project, as shown in Figure 2–43. You will then modify the levels' names and create plan views.

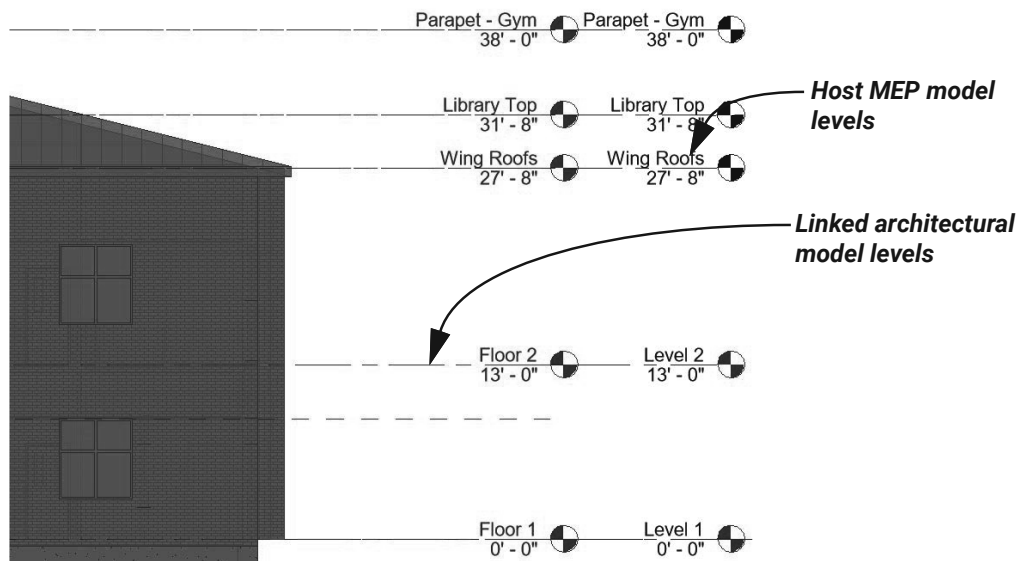



Figure 2–43

### Task 1: Modify existing levels.

1. In the practice files *Working Models>General* folder, open **Gen-Levels.rvt**.
2. Open the Mechanical>HVAC>Elevations (Building Elevations)>**North - Mech** view.
3. In the *View* tab>Graphics panel, click  (Visibility/Graphics), or type **VG** or **VV** to open the Visibility/Graphic Overrides dialog box.
4. On the *Revit Links* tab, check the checkbox in the *Halftone* column for **School-Arch.rvt**, as shown in Figure 2–44.

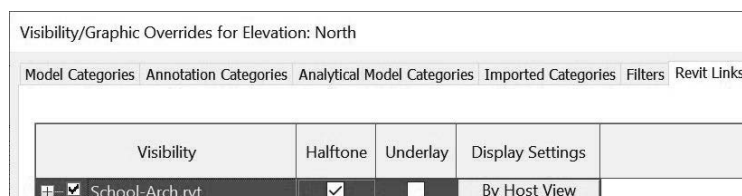


Figure 2–44

5. Click **OK**.
6. Zoom in to the level markers to the right of the building.
7. There are two levels in the host project. Select the linked architectural model to help you distinguish between them, as shown in Figure 2–45.

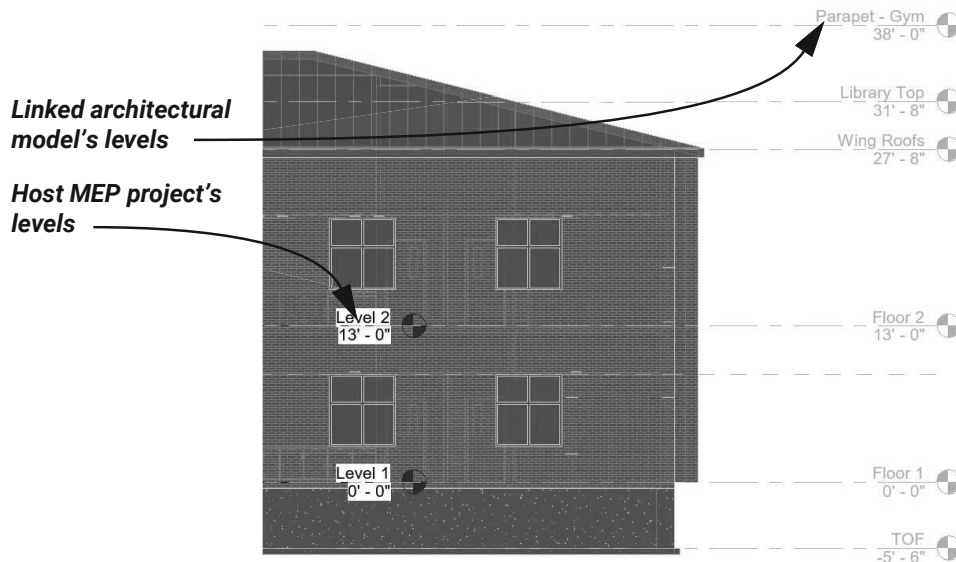




Figure 2–45

8. Click  (Modify).

**Note:** If required, press <Tab> to select the level in the host project and not the linked model. If your levels disappear when dragging them, click  (Do Not Crop View) in the View Control bar to turn off the crop region (which will look like this: .

9. Select one of the level lines (e.g., click on Level 2) in the host project. Select the control and drag it to the side past the linked model's levels, as shown in Figure 2–46. Both of the host levels move together.

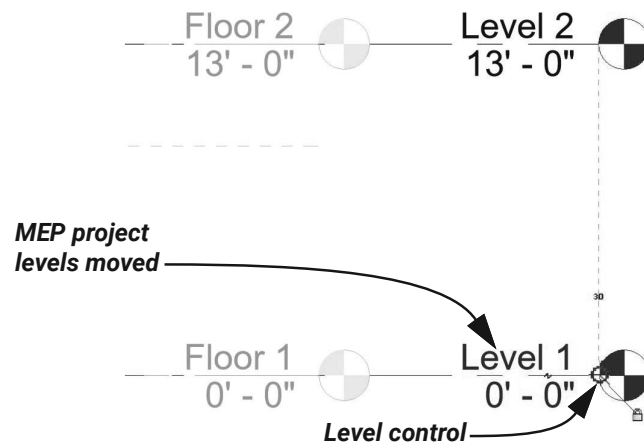




Figure 2–46

10. Save the project.

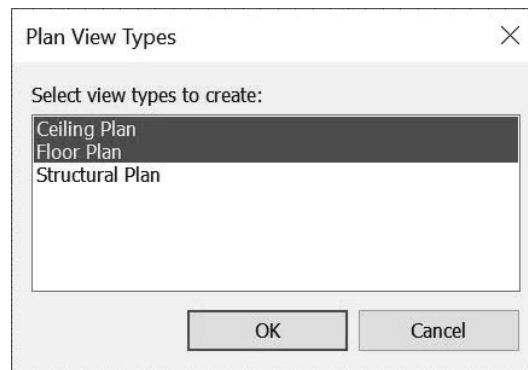
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## Task 2: Create new levels.

---

1. In the *Architecture* tab>Datum panel, click  (Level).
2. In the *Modify | Place Level* tab>Draw panel, click  (Pick Lines).
3. In the Options Bar, verify that **Make Plan View** is checked. Click **Plan View Types....**
4. In the Plan View Types dialog box, click **Structural Plan** to clear it, as shown in Figure 2–47, then click **OK**.

**Note:** If you have *Structural Tabs and Tools* turned off in *Revit Options>User Interface*, you will not see the *Structural Plan* in the *Plan View Types* dialog box.



**Figure 2–47**

5. In the Options Bar, set the *Offset* to **14'-8"**.
6. Hover the cursor over the project's **Level 2** level line and move the cursor slightly upward until you see the dashed alignment line display in line with the Wing Roofs level, as shown in Figure 2–48. (Alignment line in figure has been enhanced for clarity.) Click to place it.

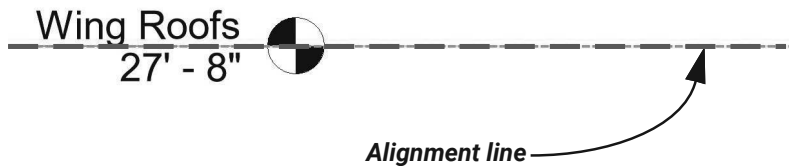



Figure 2-48

7. Click  (Modify).
  - Note that the new level appears in the Project Browser under Mechanical>HVAC>Floor Plans.
8. In the view, click on the new level name and type **Wing Roofs**, as shown in Figure 2-49, then press <Enter>.

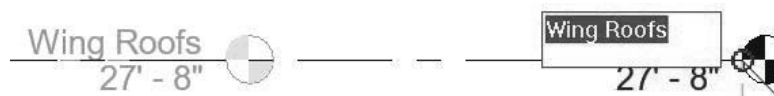




Figure 2-49

9. Click **Yes** or press <Y> when prompted to rename the corresponding views.
10. In the Project Browser, expand **Mechanical>???**>**Ceiling Plans** and select the **Wing Roofs** view.
11. In Properties, change the *Sub-Discipline* to **HVAC**. In the Project Browser, the view moves to be under the HVAC> Ceiling Plans node.
12. Click  (Modify).
13. In the **North - Mech** view, start the **Level** command again. In the *Modify | Place Level* tab>Draw panel, click  (Pick Lines).
14. In the Options Bar, clear the **Make Plan View** option and verify the *Offset* is set to **0'-0"**.
15. Hover your cursor over the linked model's **Library Top** level. Click to place the new level.

16. With the new level still selected, click and drag the level control (as shown in Figure 2–50) to the right.



Figure 2–50


17. Click  (Modify).
18. Select the level and in Properties, in the *Identity Data* section, change the name to **Library Top**, as shown in Figure 2–51. Move the cursor into the view area to apply the changes.



Figure 2–51

- Note in the Project Browser that a plan view was not created.
19. In the North - Mech view, start the **Level** command again and note that the **Make Plan View** option is checked again.
20. Click **Plan View Types...** and select **Ceiling Plan** and **Structural Plan** so that only **Floor Plan** is highlighted, as shown in Figure 2–52. Click **OK**.

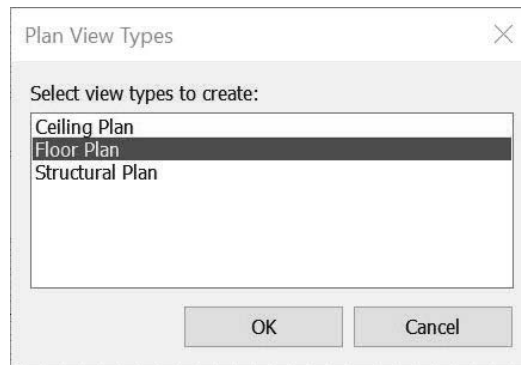


Figure 2–52


21. In the *Modify | Place Level* tab > Draw panel, click  (Pick Lines).
22. Add another level for the **Parapet - Gym**. Use the level control to drag the level to the right.
23. Select the new level and change the name to **Parapet - Gym**, as shown in Figure 2–53.





Figure 2–53

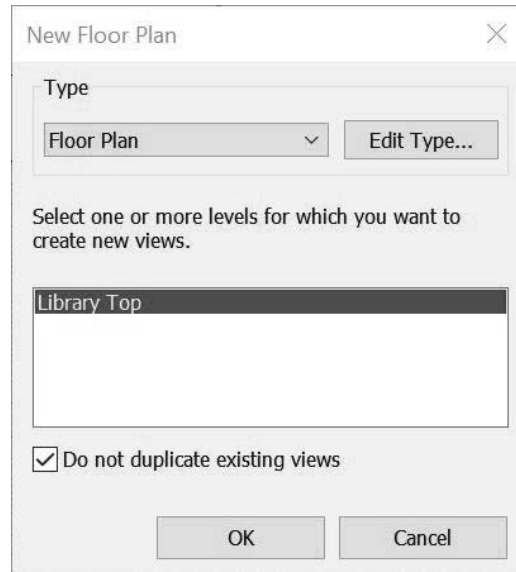
24. Click **Yes** to rename the corresponding views.
25. Save the project.

---



### Task 3: Create a ceiling and plan view.

---

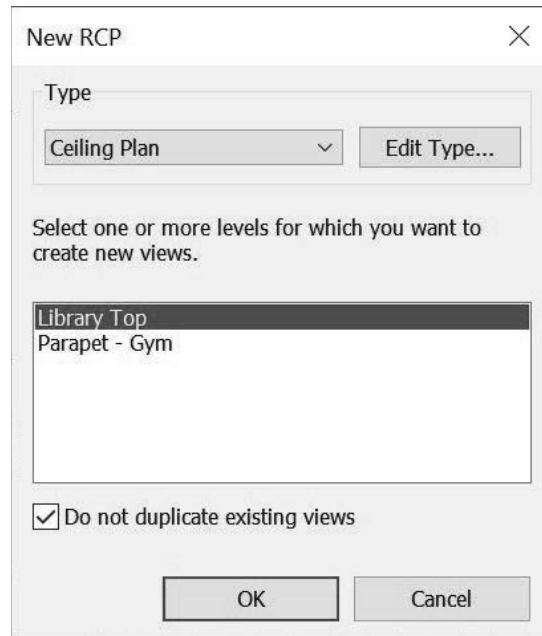
1. In the *View* tab>Create panel, expand  (Plan Views) and click  (Floor Plan).
2. In the New Floor Plan dialog box, select the **Library Top** level, as shown in Figure 2–54, and click **OK**.



**Figure 2–54**

3. The new view opens and displays in the Project Browser.
4. In the *View* tab>Create panel, expand  (Plan Views) and click  (Reflected Ceiling Plan).

5. In the New RCP dialog box, select the **Library Top** level, as shown in Figure 2–55, and click **OK**.



**Figure 2–55**

6. The new view opens. In the Project Browser, the new view can be found in the Coordination>???>Ceiling Plans node. In Properties, set the *Discipline* to **Mechanical** and the *Sub-Discipline* to **HVAC** to move the ceiling plan view into the correct node in the Project Browser.
7. Save and close the project.

**End of practice**



## 2.6 Creating Grids

Grids are annotation elements that display in most views, including plan, ceiling, section, and elevation views. They help organize your design when developing a layout and describe the pattern and location for columns, as shown in Figure 2–56. Grids can be multi-segmented, arcs, or straight lines, and they can be hidden in the view if needed.

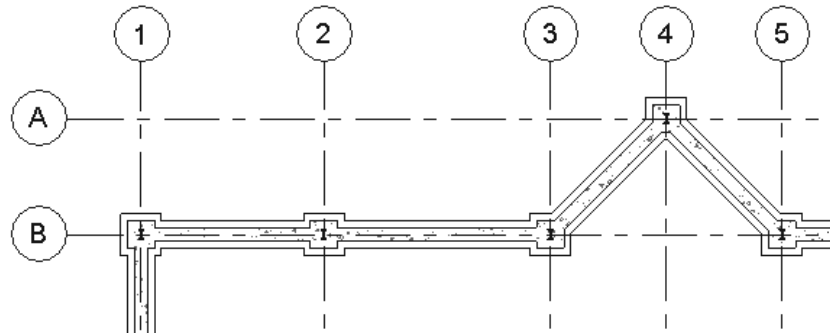


Figure 2–56

Each line or arc in a grid is a separate entity and can be placed, moved, and modified individually.

Grids cannot be drawn in a 3D view but grids can be displayed in a 3D view, perspective view, or in a 3D view with a selection box, and when you click on a grid, the surface contour displays.

**Note:** If you are upgrading a model to the 2024 version, you will need to turn on the grids.

### How To: Create a Grid


1. In the *Architecture* tab>Datum panel, click  (Grid), or type **GR**.
2. In the Properties Type Selector, select the grid type, which will control the size of the bubble and the linestyle.
3. In the *Modify | Place Grid* tab>Draw panel (shown in Figure 2–57), select the draw method you want to use.



Figure 2–57

4. In the Options Bar, set the *Offset* if needed.
5. Start drawing grid lines.

- Grids can be sketched at any angle, but you should ensure that all parallel grids are sketched in the same direction (e.g., from left to right or from bottom to top).
- When using the Multi-Segment tool (shown in Figure 2–58), sketch the line and click  (Finish Edit Mode) to complete the command.

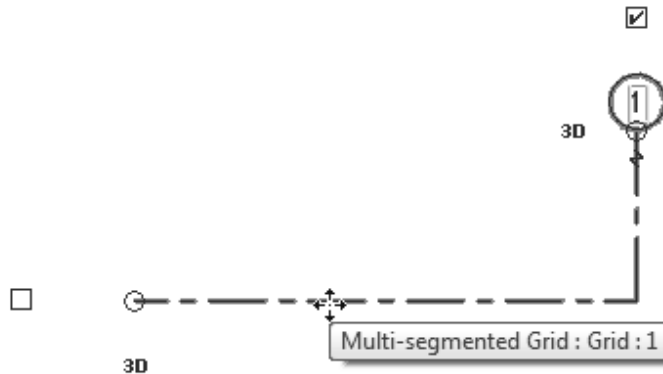


Figure 2–58

## How To: Show Grids in 3D

1. Open a 3D or perspective view and press <Esc> twice to verify nothing is selected.
2. In Properties, click **Edit...** next to *Show Grids*, as shown in Figure 2–59.

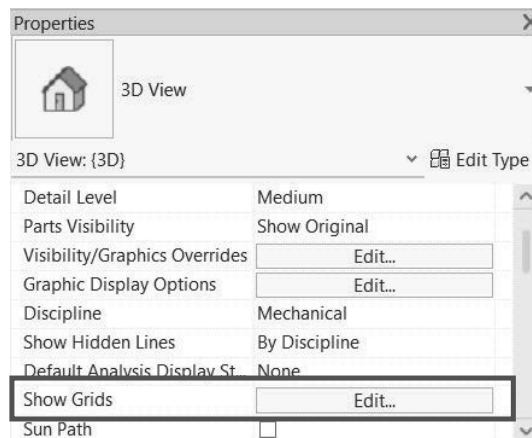


Figure 2–59

- In the Show Grids dialog box, select the level(s) that you want the grids to display at in the 3D view, as shown in Figure 2–60.

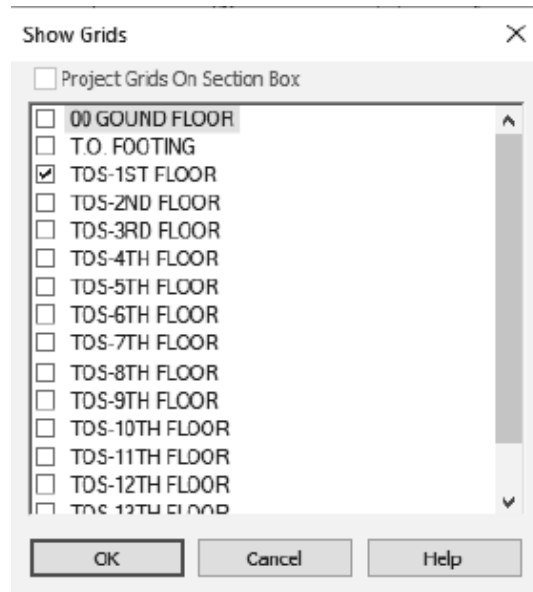


Figure 2–60

- Click **OK**.
- (Optional) To display the grids on the bottom of a section box, in Properties, verify that **Section Box** is selected, and click **Edit...** next to *Show Grids*.
- In the Show Grids dialog box, select only the **Project Grids On Section Box** option, as shown in Figure 2–61, and click **OK**.

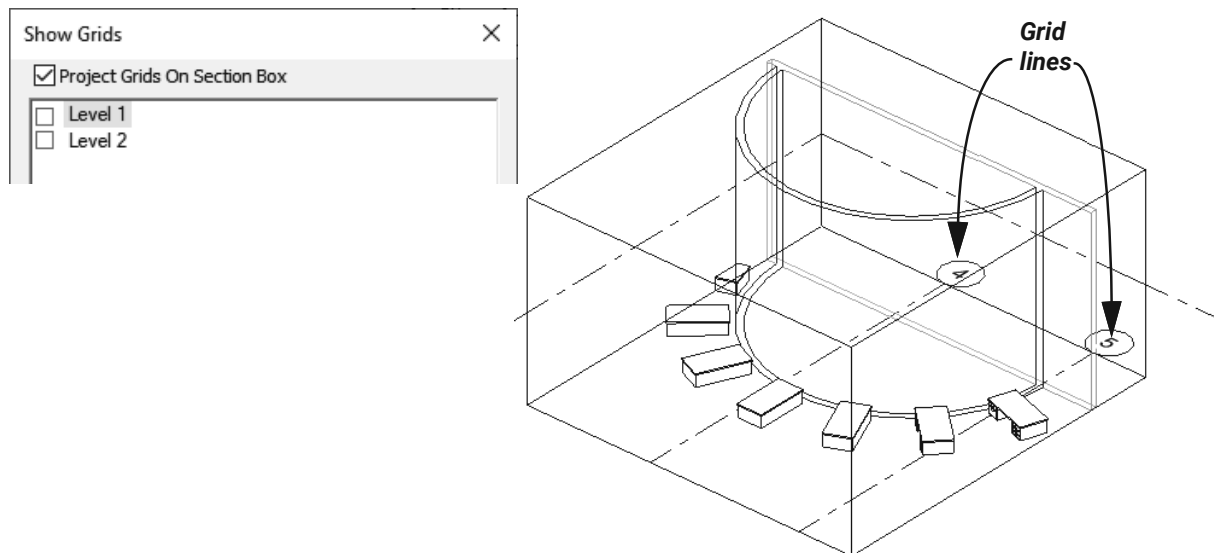


Figure 2–61

## Modifying Grid Lines

Grid lines, like levels, are data elements. You can modify grid lines using controls, alignments, and temporary dimensions in the view (as shown in Figure 2–62). You can change the bubble type using the Type Selector.

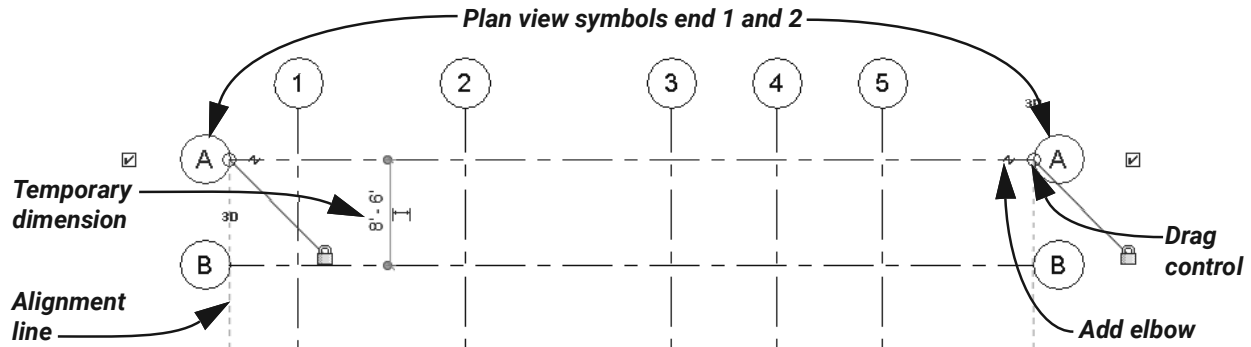



Figure 2–62

- Grid numbers can be numbers, letters, or a combination of the two. To modify a grid number, double-click on the number in the bubble and type the new letter/number. You can also change the grid number by entering a new *Name* in Properties.
- Grid numbers increment automatically.
- In a 3D view, you can modify the grid line name and adjust the grid line and grid distance.
  - Click the  (Drag the extents of the grid in the model) control to lengthen the grid line.
  - Modify the temporary dimension (as shown in Figure 2–63) to change the grid line's distance from another grid line.

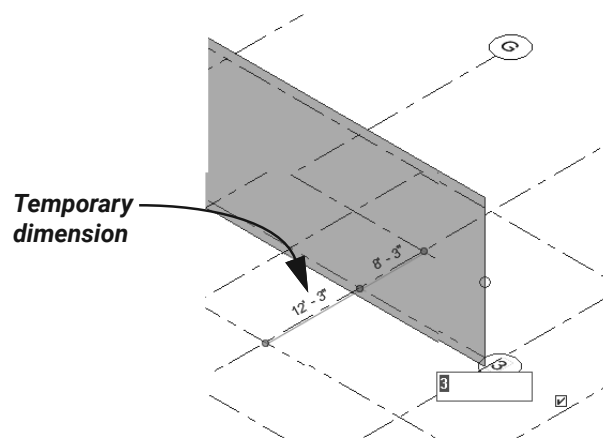


Figure 2–63

- Change the grid line name by selecting the bubble and typing in a new name; alternatively, the name can be changed in Properties.

- In Type Properties, change the way the grid **Plan View Symbols Ends** display, as shown in Figure 2–64. The first pick point is plan view symbol end 1 and the second pick point is plan view symbol end 2.

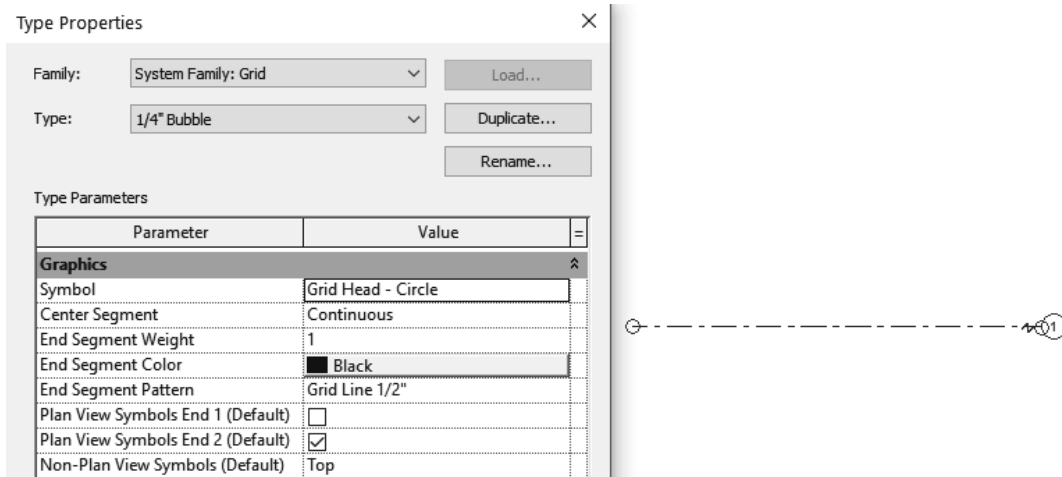

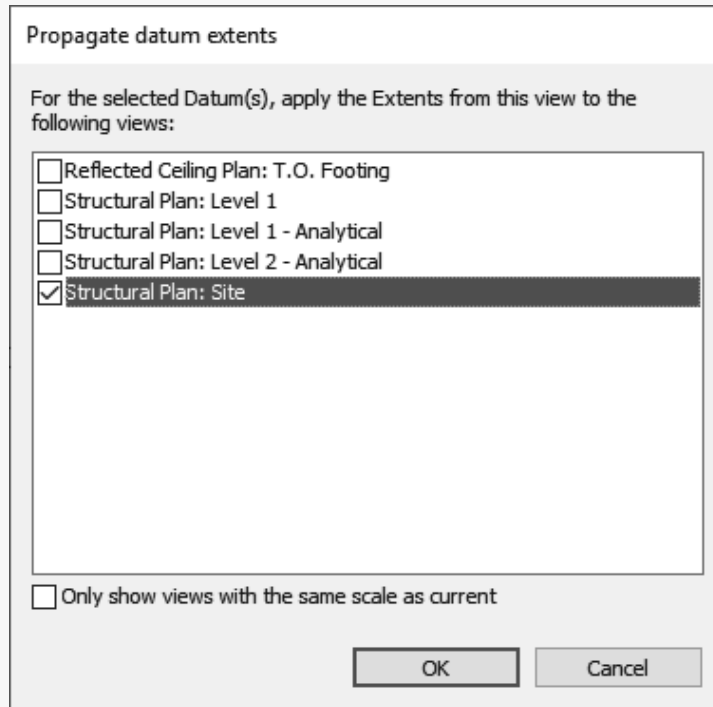



Figure 2–64

**Hint: Propagating Datum Extents**

If column grids do not display in a view, this might be due to adding a level after the grid lines were added. To display the grid lines in plan views, select the grid lines in a view in which they are displayed. In the *Modify | Grids* tab>Datum panel, click  (Propagate Extents). In the Propagate datum extents dialog box (shown in Figure 2–65), select the views to project the grid lines to.

**Figure 2–65**

- This also works for levels.
-  (Propagate Extents) is particularly useful to make grid lines display the same in all views.

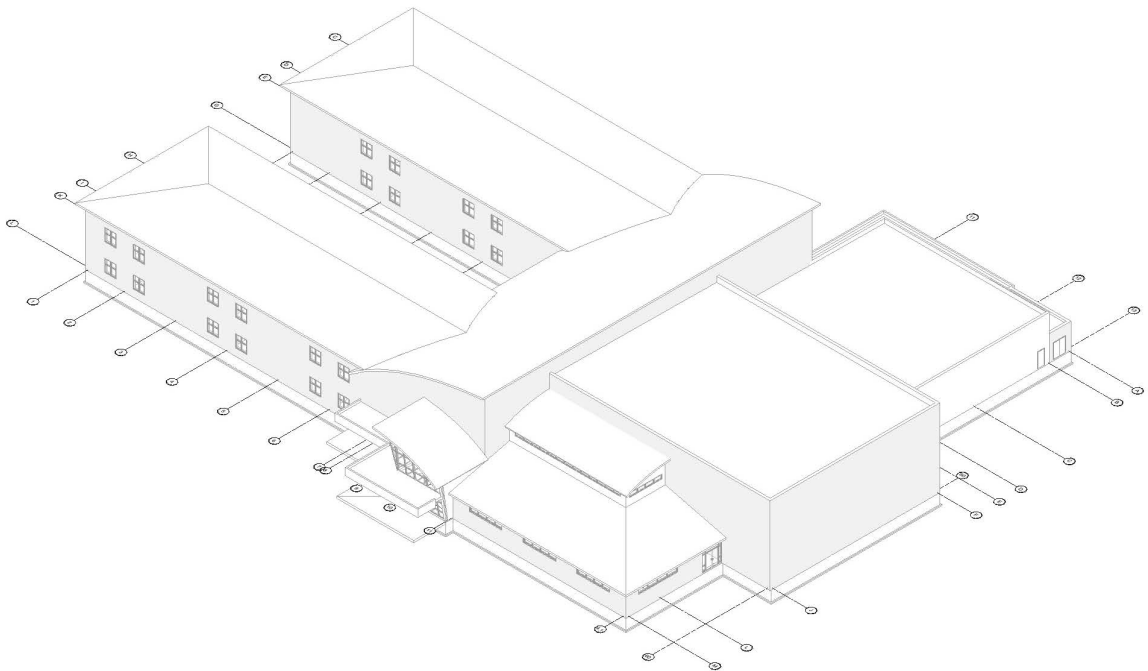
## Practice 2c

# Add Grids - All Disciplines

### Practice Objective

- Add and modify grid lines.

In this practice, you will place grid lines using the linked CAD model as a guide. You will then turn grid lines on in a 3D view, as shown in Figure 2–66.



**Figure 2–66**

- Note that grids are being used in this practice only so you can learn how to place them in a project; they do not appear in other practices in this guide.
1. Open **Gen-Grids.rvt** from the practice files *Working Models>General* folder.
  2. Open the Coordination>All>FloorPlans>**Level 1** view.
  3. Type **VV** to open the Visibility/Graphic Overrides dialog box.

- Click on the *Revit Links* tab. In the *Visibility* column, clear the checkbox next to **School-Arch.rvt**, as shown in Figure 2–67, to turn off the RVT file in the view.

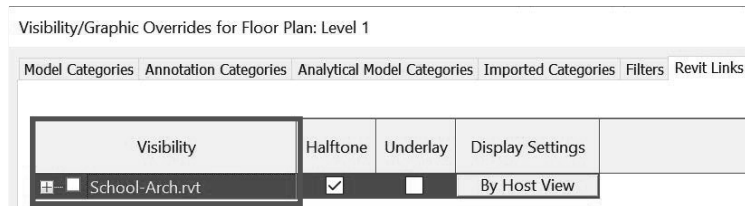





Figure 2–67

- Click **OK**.
- The linked architectural model is turned off in the view and only the DWG's grid displays.
- Zoom and pan to the upper right corner of the grids to grids A and B.
- In the *Architecture* tab>Datum panel, click  (Grid).
- In the *Modify | Place Grid* tab>Draw panel, click  (Pick Lines).
- Using the linked DWG as a guide, select the horizontal grid line **A** on the linked file to create a grid line in the host project. Zoom in to the grid head and click inside the bubble, type **A**, and press <Enter>.
  - Note that the host grid line is darker than the grid lines in the linked DWG file.
- Starting from the next horizontal grid line, which is **B**, continue selecting the rest of the horizontal grid lines in alphabetical order. Note that the grid lines for **G**, **H**, **I**, and **K** are indented to the left. The letters automatically increment.
- Click the first vertical grid line on the linked file to create a grid line in the host project. Change the letter in the bubble to **1**.
- Continue selecting the vertical grid lines. The numbers automatically increment. Pay close attention when you get to grids **10** and **11**.
- Zoom in to the lower right corner and note that there are grid lines **4.1** and **60** in this linked file.
- You should still be in the **Grid** command. Select grid line **4.1** to place a grid line in the host project. Zoom in to the grid head and click inside the bubble, type **4.1**, and press <Enter>.
- Repeat this for grid line **60**.
- Click  (Modify) to end the command.



18. Check the lengths of all grid lines. Modify the length by dragging the ends if needed. Figure 2–68 shows the grids all placed.

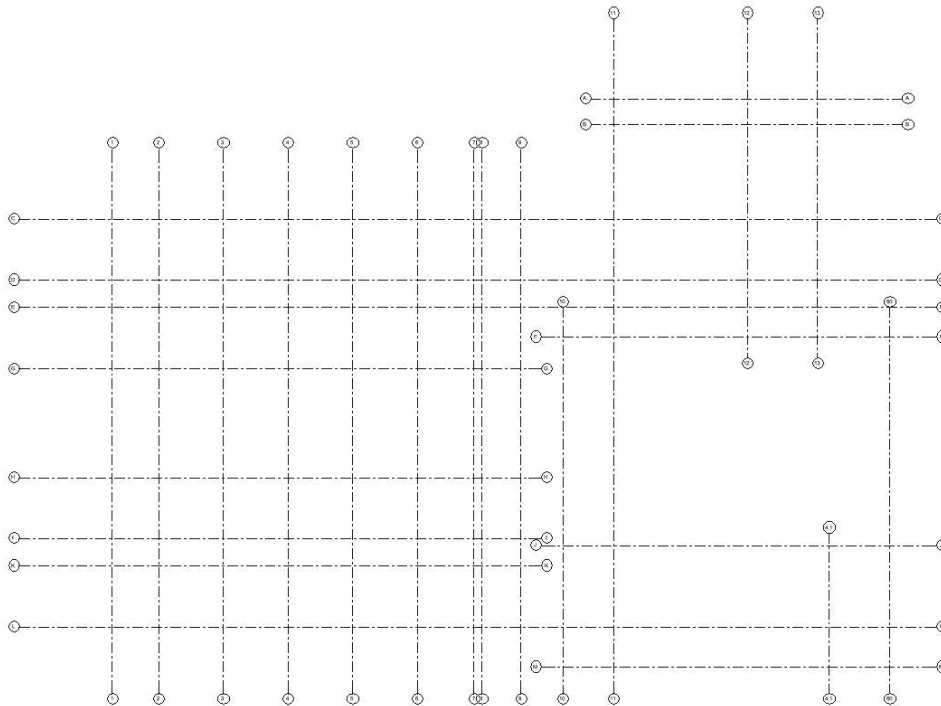


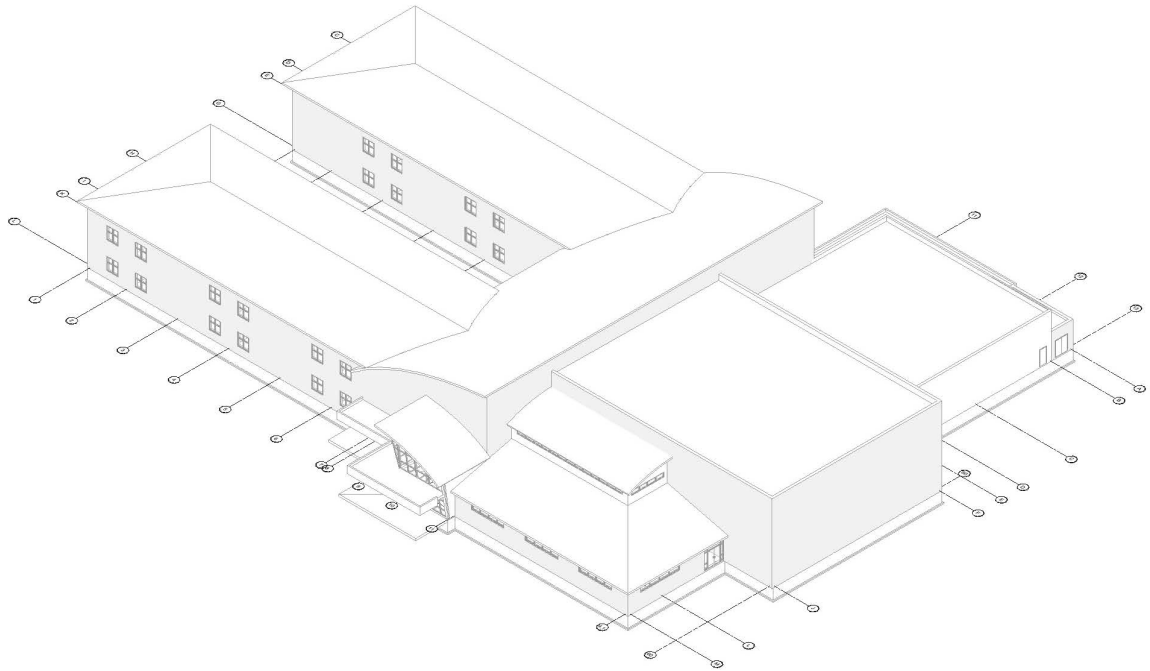


Figure 2–68

19. In the Quick Access Toolbar, click  (Default 3D View).
20. Click  (Modify) to ensure nothing in the view is selected.
21. In Properties, in the *Graphics* section, click **Edit...** next to *Show Grids*.
22. In the Show Grids dialog box, select **Level 1** and click **OK**.

23. The grids now display as shown in Figure 2–69.



**Figure 2–69**

24. Save and close the project.

**End of practice**

# Chapter Review Questions

1. What type of view do you need to be in to add a level to your project?
  - a. Any non-plan view.
  - b. As this is done using a dialog box, the view does not matter.
  - c. Any view except for 3D.
  - d. Any section or elevation view.
  
2. How do you line up grid lines that might be different lengths, as shown in Figure 2–70?

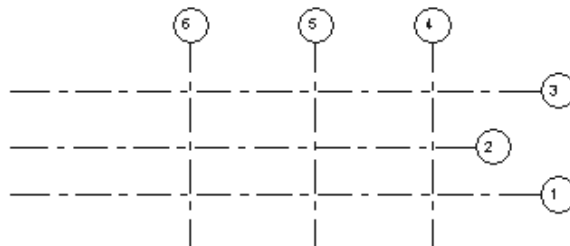














Figure 2–70

- a. Use  (Trim/Extend Multiple Elements) to line them up with a common reference line.
  - b. Select the grid line and use the drag control to line up with the other grid lines.
  - c. Select the grid line, right-click and select **Auto-Align**.
  - d. In Properties, change the *Length* and then use  (Move) to get them into position.
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3. Grids can be displayed in a 3D view.
    - a. True
    - b. False
  
  4. In order for architectural columns to move with grids, what needs to be selected when placing the column?
    - a. In the ribbon, select **At Grids**.
    - b. Set the *Top Constraint* to grids.
    - c. Columns always move with grids no matter what type.
    - d. In Properties, select **Moves With Grids**.

5. Which of the following types of CAD formats can you import into Revit? (Select all that apply.)
  - a. .DWG
  - b. .XLS
  - c. .SAT
  - d. .DGN
  
6. Imported CAD files cannot be reloaded in the Manage Links dialog box.
  - a. True
  - b. False
  
7. To modify linked CAD files, you need to open what dialog box?
  - a. Type Properties
  - b. Link CAD
  - c. Manage Links
  - d. Insert from File

# Command Summary

Button	Command	Location
	<b>Grid</b>	<ul style="list-style-type: none"> <li>• <b>Ribbon:</b> <i>Architecture</i> tab&gt;Datum panel</li> <li>• <b>Shortcut:</b> GR</li> </ul>
	<b>Import CAD</b>	<ul style="list-style-type: none"> <li>• <b>Ribbon:</b> <i>Insert</i> tab&gt;Import panel</li> </ul>
	<b>Import PDF</b>	<ul style="list-style-type: none"> <li>• <b>Ribbon:</b> <i>Insert</i> tab&gt;Import panel</li> </ul>
	<b>Level</b>	<ul style="list-style-type: none"> <li>• <b>Ribbon:</b> <i>Architecture</i> tab&gt;Datum panel</li> <li>• <b>Shortcut:</b> LL</li> </ul>
	<b>Link CAD</b>	<ul style="list-style-type: none"> <li>• <b>Ribbon:</b> <i>Insert</i> tab&gt;Link panel</li> </ul>
	<b>Link PDF</b>	<ul style="list-style-type: none"> <li>• <b>Ribbon:</b> <i>Insert</i> tab&gt;Link panel</li> </ul>
	<b>Link Revit</b>	<ul style="list-style-type: none"> <li>• <b>Ribbon:</b> <i>Insert</i> tab&gt;Link panel</li> </ul>
	<b>Multi-Segment (Grid)</b>	<ul style="list-style-type: none"> <li>• <b>Ribbon:</b> <i>Modify   Place Grid</i> tab&gt;Draw panel</li> </ul>
	<b>Propagate Extents</b>	<ul style="list-style-type: none"> <li>• <b>Ribbon:</b> <i>Modify   Grids</i> or <i>Modify   Levels</i> tab&gt;Datum panel</li> </ul>
	<b>Temporary Hide/Isolate</b>	<ul style="list-style-type: none"> <li>• <b>View Control Bar</b></li> </ul>

