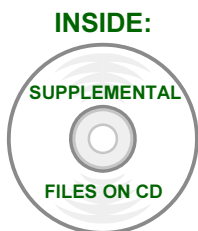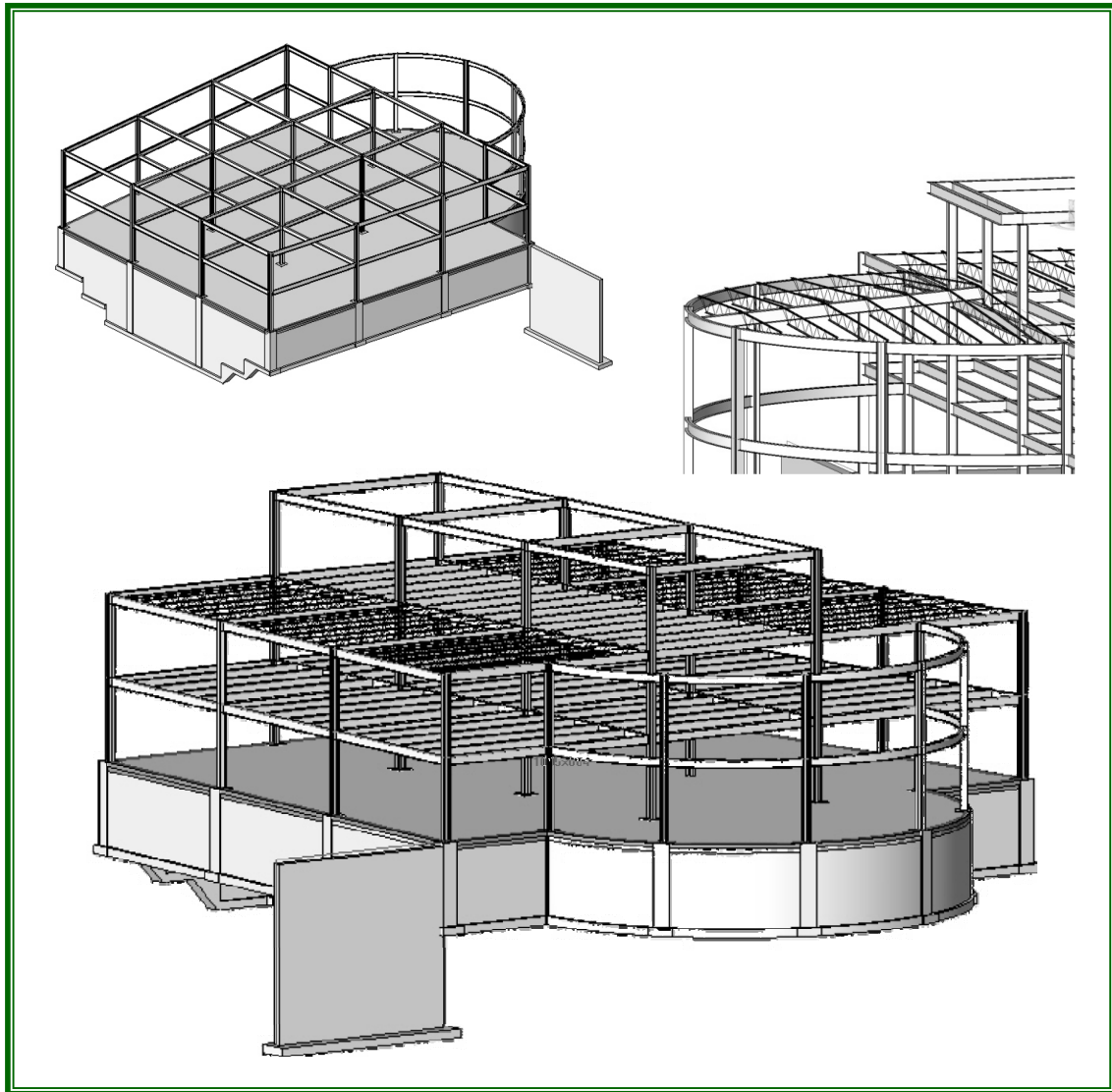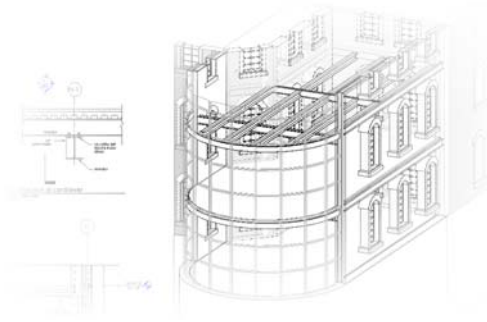# Revit Structure 2009
# FUNDAMENTALS

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# Module 1:

# The Basics of Revit Structure

This module contains:

■ Section 1: Introduction to Revit Structure

What is Revit Structure?
Revit Structure Projects
The Revit Structure Interface

■ Section 2: Setting up Levels and Working with Views

Creating and Using Levels
Creating Elevations
Creating Sections
Creating Callouts

# Section 1:
# Introduction to Revit Structure

In this section you will learn:

- About Revit Structure and what it can do

- An overview of the interface

- How to start Revit projects

- About General drawing and editing tools

# What Is Revit Structure?

Revit Structure is a modeling program. This means that everything placed into a model simulates a true building material. It is important to note that there is a distinct difference between the term *modeling* and the term *3D*. While Revit Structure has many advanced 3D capabilities, it is foremost a modeling program. Most of your modeling occurs in a 2D environment, with 3D views easily accessible at any time.

## BIM and Structural Engineering

BIM stands for *Building Information Modeling*. BIM is the process of creating a single, database-driven model by placing actual building components and materials.

Therefore, for the structural engineer and designer the BIM model does not stop at the actual building. Since the components used in the model represent real-life members, you can design for stresses as you draft and vice-versa. Additionally, in a Revit/BIM environment when beams are attached to columns, and columns to grids, the application understands that these items belong together. In plan, if a gridline moves, so do the columns and subsequently the beams. In elevation, if a level moves, the columns increase in length and any framing on that floor moves with it. Revit also automatically updates the column schedule to reflect the change.

Drawings are now based on a model that is as close to an actual building as possible. A design change can influence the building in another area. This is known as *parametric design*. The move to this kind of modeling is becoming the industry standard. As BIM applications become smarter, so does the industry.
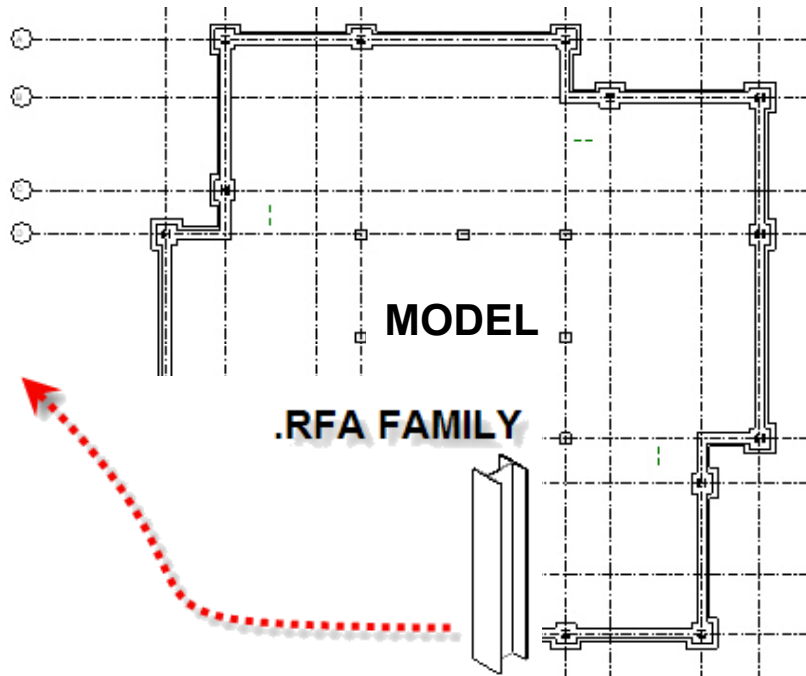
# Revit Structure Projects

A *project* is a complete description of a building and the information associated with it for displaying 2D and 3D views, as well as schedules. When you open a Revit Structure project file, it opens the entire project or building model. You can then work in different views, such as plan, section, elevation, and 3D model, all within the same project.

- All of the views are associative. What you change in one is automatically updated in all of the others. For example, if you add an opening to a wall in a plan view, it also appears in the related elevation view and possibly in a lintel schedule.

- You create construction drawings on *sheets* in a Revit Structure project using the various views. Callouts of details and elevations are automated with tags and titles on the sheets.

## File Types

The following explains each Revit file type:

| | |
|---|---|
| **.RVT** | The file format of a Revit model. There are three separate Revit applications: Revit Structure, Revit Architecture, and Revit MEP. Each of these applications saves as the RVT format. Each file can be opened directly in any of the three applications. RVT files can also be inserted and linked into one another. This is crucial for coordination between disciplines. |
| **.RFA** | The file format of a Revit Family. These files can be opened directly, inserted, or loaded into an RVT file. |
| **.RTE** | The Revit template file. When a new model is started, an RTE file is used to create the model. When you save the file, it is saved as a new RVT model. This file contains all of your company's standards and settings. Views, sheets, and families should be set up and ready to use. |

**MODEL**

**.RFA FAMILY**

## Types of Elements

There are five main types of elements in a Revit Structure project, as explained below:

| | |
|---|---|
| **Host** | Host elements are the *built-in-place* construction objects, such as floors, walls, roofs, ceilings, stairs, and ramps. They can stand alone in the project. |
| **Component** | Component elements are objects that need to be attached to host elements, such as doors, windows, and railings, as well as stand-alone items, such as furniture and equipment. |
| **View** | Views enable you to see and manipulate the project. For example, you can view and work in floor plans, ceiling plans, elevations, sections, schedules, and 3D views. You can change a design from any view. All views are stored in the project. |
| **Datum** | Datum elements define the project context. These include levels for the floors, column grids, and reference planes that help you draw. |
| **Annotation** | Annotation elements are 2D objects that you place on views to define the information drawn in the project. These include dimensions, text, tags, and symbols. The view scale controls their size. |

## Families

You create a Revit model by adding pre-defined items (e.g., columns, beams, joists, trusses, footings, pile caps, doors, windows, openings, brace plates, detail components, and even items such as annotations). These items are called *Families* and they are a single file (RFA file extension) that can contain hundreds of choices when being added to the model. For example, one type of column family file is called **W-Wide Flange-Column.rfa**, as shown below. This file is broken down into multiple sizes for wide flange columns. When creating a Revit model family, members are selected and loaded as needed to create the model.
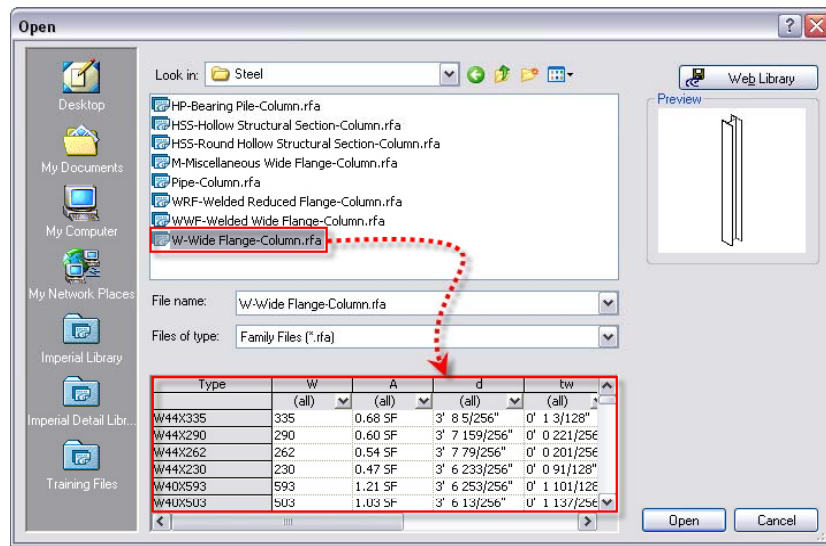


- ◼ Revit Structure includes many families in its Library. You can also create your own family types.

Items such as walls, floors, and roofs are called *system families*. This type of family is not loaded as a separate entity but is inherent to the project. To create a new system family, an existing item is copied and re-defined to fit the project's specific needs. System families can also be copied to the Windows clipboard and pasted into another project.
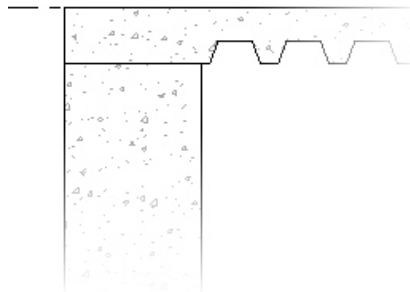
# The Revit Structure Interface

Revit Structure models are entirely driven by placing components; therefore, the interface is different from the AutoCAD interface. There is no command prompt, no layers, and fewer icons. Revit Structure is an application designed solely for structural design.
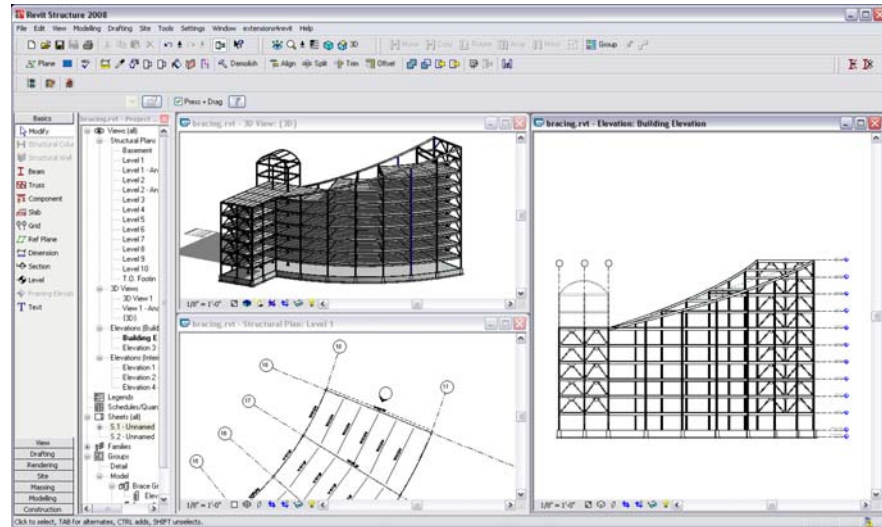


## Menus
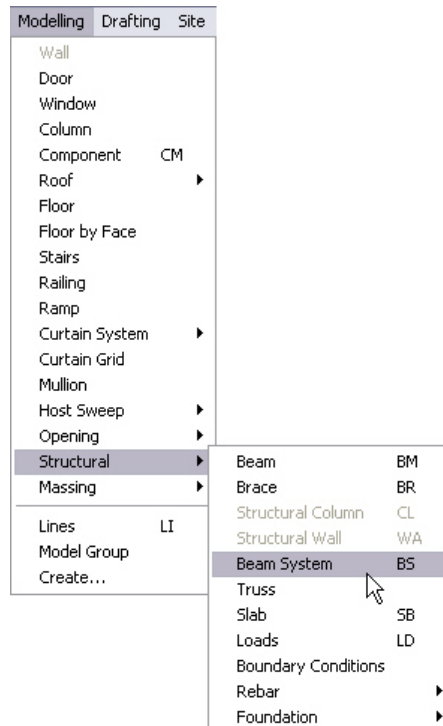
Menus in Revit Structure are similar to standard **Windows** menus. The Revit menus include the common **File**, **Edit**, and **View** menus. In addition, you can access more commands in the Design Bar.

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**Hint: Menu Shortcuts**

Revit has a file called **Keyboardshortcuts.txt**, located in *C:\Program Files\Revit Structure 2009\Program\*. This file is similar to the **Acad.pgp** file in that you can create shortcuts to your favorite commands.

For example, if you wanted a shortcut to the **Copy to clipboard** command, open the **Keyboardshortcuts.txt** file and scroll down to the following line:

**; ""  menu:"Edit-Copy to Clipboard"**

Replace the **; ""** with **"CL"** so the string appears as follows:

**"CL"  menu:"Edit-Copy to Clipboard"**



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## General Toolbars
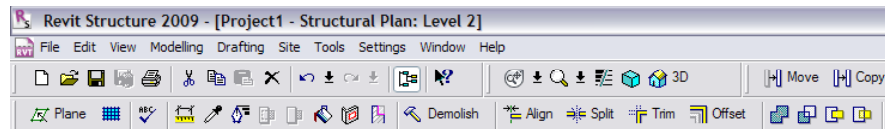


Many of the toolbars available in Revit Structure are different from most other CAD applications. Right-click on any toolbar to see a list of toolbars. You can toggle their display on and off by adding and removing the check marks in the shortcut menu.

### Standard



The Standard toolbar consists of the basic tools found in any PC-based application. This toolbar includes the following options:

- File management tools: **New**, **Open**, **Save**, and **Print**

- Clipboard tools: **Cut**, **Copy**, **Paste**, and **Delete**

- **Undo/Redo**

- **Project Browser** (toggle on and off)

- Help by selection

### View
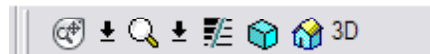


The View toolbar enables you to control the visual movement of the model. This toolbar includes the following options:

*NEW IN 2009!*

- **Steering Wheels**

- **Zoom**

- **Thin Lines** (Used to display line thickness. With this function off, the model can be viewed with all lines and objects on the same line weight.)

- **Show Mass**

- **3D View**

### Edit



The Edit toolbar enables you to modify your model using a variety of manipulation techniques.

---

### Tools

The Tools toolbar aids in the placement and aesthetic modification of items in a model (e.g., work plane creation and visibility, spell check, measuring tools, etc.). This toolbar is often overlooked, but can provide some very powerful tools.

### Tools 2

The Tools 2 toolbar is designed specifically to copy framing members and setting rebar cover to elements. It is crucial to the drafting process.

### Worksets
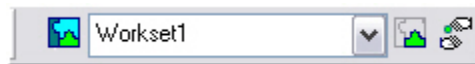
The Worksets toolbar enables file sharing among multiple people who are working on the same project. When more than one person is working on a project, worksets and file sharing are enabled.

### Design Options

The Design Options toolbar enables the design team to keep their design changes and possible design options in one model.

### Options Bar

The options available in the Options Bar depend on the component or command you are currently operating. Refer to this toolbar for additional functionality to manipulate your model.

## Design Bar
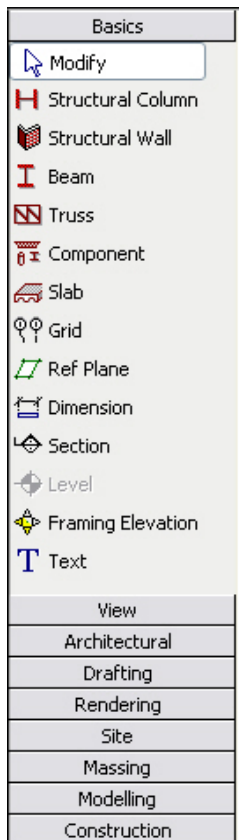
The Design Bar is the backbone of Revit. Most commands are initiated from this toolbar. Once a command is initiated, you can set options in the Options Bar.

The Design Bar is divided into nine categories (tabs). When Revit is first loaded, not all categories are visible. To view all of the available categories, right-click on any visible column header and select the tab you want to add to the Design Bar.
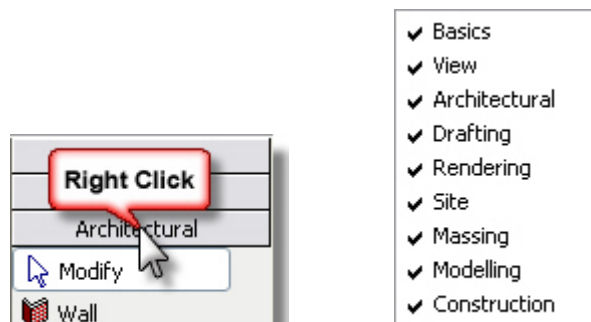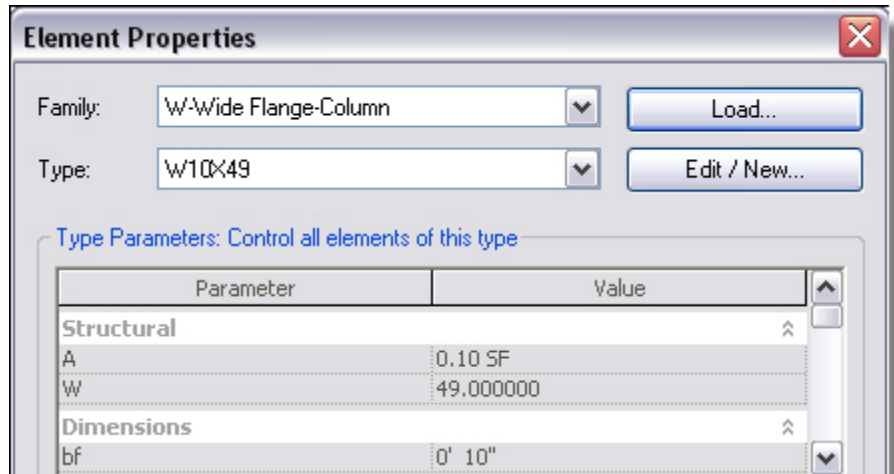
The header of each category is called a tab. Each tab contains a number of commands related to the tab's description. For example, you can find the **Elevation**, **Section**, and **Camera** commands in the *View* tab. You might run into the same command on different tabs. These commands are identical and are only duplicated for convenience.

### To Use the Design Bar:

1. Select the *Basics* tab in the Design Bar.
2. Start a command by clicking the button, such as **H Structural Column**. The Options Bar now opens to aid in the placement of a structural column.
3. The first item in the Options Bar is called the *Type Selector*. When a command is activated, Revit provides a type for the specific command. This list reflects the items that are currently loaded into the model. Select a column from the list.
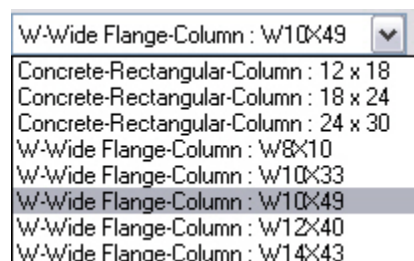
4. To the right of the Type Selector, click ⬚ (Element Properties). Study some of the items, and click ⬚ OK ⬚.

**Element Properties**

Family: W-Wide Flange-Column ▾  Load...

Type: W10X49 ▾  Edit / New...

Type Parameters: Control all elements of this type

| Parameter | Value |
|---|---|
| **Structural** | |
| A | 0.10 SF |
| W | 49.000000 |
| **Dimensions** | |
| bf | 0' 10" |

5. Select a spot on the screen for the placement of the column. The command keeps running.

6. Click ⬚ Load... ⬚ in the Options Bar. You should be directed to the Imperial Library or your company's default library.

7. Select **Structural>Columns>Steel** and select (do not double-click) one of the column types.

📁 Imperial Library
📁 Structural
📁 Columns
📁 Steel
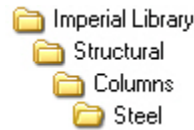
Notice the list of columns within that category.

| Type | W | A | d | tw |
|---|---|---|---|---|
| | (all) ▾ | (all) ▾ | (all) ▾ | (all) |
| W44X335 | 335 | 0.68 SF | 3' 8 5/256" | 0' 1 3/128" |
| W44X290 | 290 | 0.60 SF | 3' 7 159/256" | 0' 0 221/256 |
| W44X262 | 262 | 0.54 SF | 3' 7 79/256" | 0' 0 201/256 |
| W44X230 | 230 | 0.47 SF | 3' 6 233/256" | 0' 0 91/128" |
| W40X593 | 593 | 1.21 SF | 3' 6 253/256" | 0' 1 101/128 |
| W40X503 | 503 | 1.03 SF | 3' 6 13/256" | 0' 1 137/256 |

8.  Click [ Cancel ]. In the Options Bar, you can place the columns freely or use an existing grid system. You can place an *architectural column* and change the height and depth.

Place By: 🗗 🔩   Depth: ▾   Level 1 ▾
                 Depth:
                 Height:

---
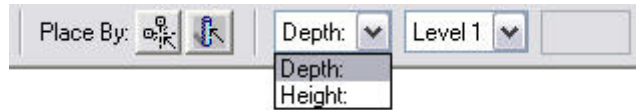
Revit always remains in a command. There are three ways to exit a command:

- Press <Esc>.

- Start another command.

- Click [ ▷ Modify ] in the Design Bar (recommended).

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9.  Click [ ▷ Modify ] in the Design Bar or press <Esc> twice to exit the command.

## The Project Browser

Revit, like any drafting program, deals with plans, elevations, sections, details, schedules, and sheets. Most of these items are at different scales. Revit organizes them in the Project Browser. To go to one of the items, double-click on it in the Project Browser. These views all reside in the same file.

**Project1 - Project browser**
```
⊟ 👁 Views (all)
    ⊟ Structural Plans
        Level 1
        Level 1 - Analytical
        Level 2
        Level 2 - Analytical
    ⊟ 3D Views
        View 1 - Analytical
    ⊟ Elevations (Building Elevation)
        Building Elevation
    Legends
    Schedules/Quantities
    Sheets (all)
⊞ Families
⊞ Groups
    Revit Links
```
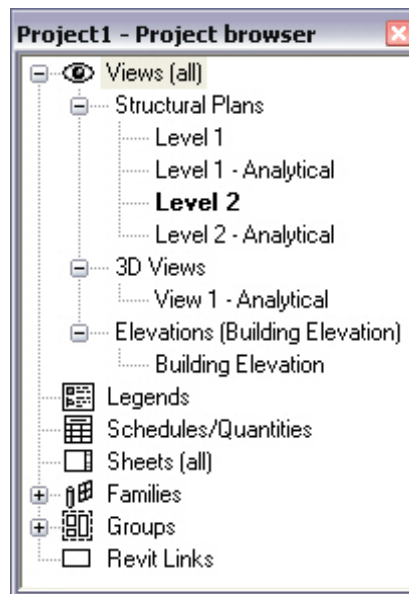
### Views

A Revit Structural project is one model. All plans, elevations, sections, and details are contained in the model. Revit breaks each of these items down into views.

Based on what the view represents, Revit includes it in the appropriate category. For example, Level 1 is categorized under floor plans. If you were to create an elevation, the new view is placed under the Elevations category.

Views can be created using the *View* tab in the Design Bar, by copying an existing view, or by adding a level in the elevation.

The view categories that are available include the following:

- Structural Plans

- 3D Views

- Elevations (Building Elevation)

- Elevations (Interior Elevation) - This includes bracing elevations.

- Sections (Building Section)

- Sections (Wall Section)

- Detail Views

- Drafting Views

- Renderings

- Graphical Column Schedules

- Walkthroughs

- Legends

- Schedules/Quantities

- Sheets

- Families

- Groups

- Revit Links

Some of the less common categories are not shown if that type of view does not exist. For example, if no renderings of the model have been created, there the Renderings category is not shown.

The Project Browser is set up as a tree similar to Windows Explorer, where categories can be expanded and collapsed. This is useful when you have a large project and are accumulating a large number of views.

### To Navigate the Project Browser:

1. Find and expand a category, such as Elevations (Building elevation).
2. Double-click on a view (e.g., Building Elevation). The building Elevation View is now open, as shown below.
3. To open another view, double-click on the name in the Project Browser. The views shown below are the default views supplied with Revit Structure. You can also create and name your own views based on your project.
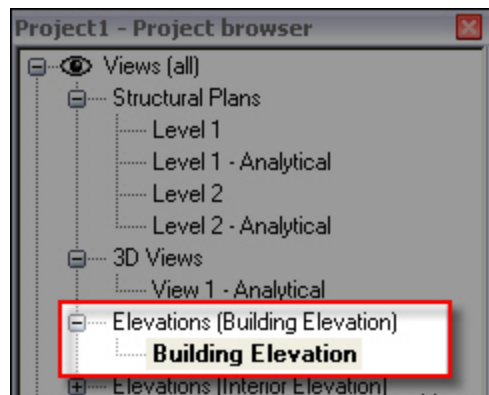
## View Windows

As views are opened from the Project Browser, a new view window appears. Each window contains its own view properties. It is here that you can apply aesthetic properties.
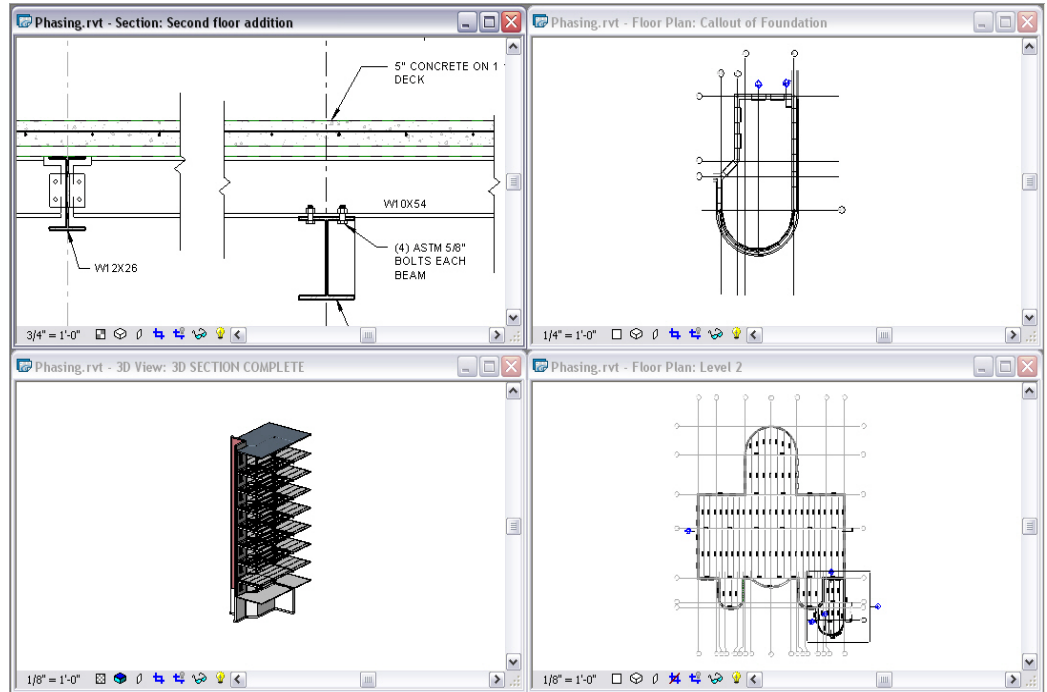


### Window Pull-down Menu
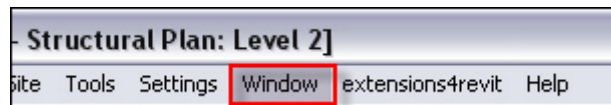


Each model that is open can each have multiple windows open, which can affect the speed at which Revit performs functions. It is recommended that only the necessary windows are open. To control this, select the **Window** pull-down menu and notice the list of open views at the bottom of the menu. Select **Close Hidden Windows** to reduce memory usage.
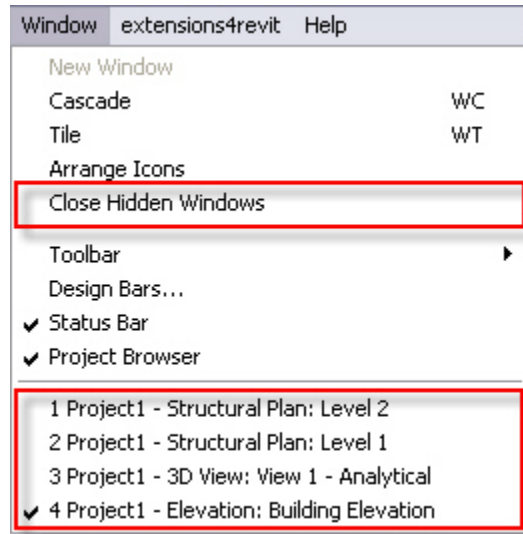
The remaining options in the **Window** pull-down menu enable you to configure the window display (**Cascade**, **Tile**, **Arrange Icons**), control the toolbars that are displayed, and navigate between active windows.

### View Control Bar
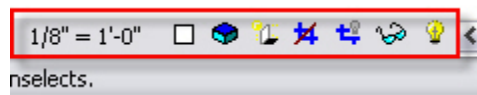


The View Control Bar is at the bottom of the view window. This toolbar is mainly responsible for the display of the model for a particular view. These settings are permanent, and affect the plotted results of your model. Select these settings with careful consideration.

**Scale:** Controls the size of annotations and symbols at the specified scale. Click this button to select from a list. If you change the scale, you need to inspect the view. You might need to rearrange some items based on the new scale value.
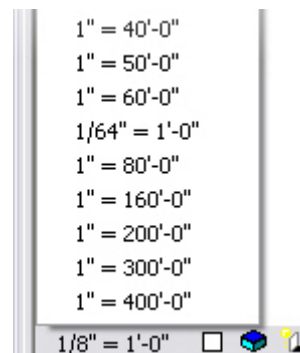
**Detail Level:** Determines the level in which the finite graphics of an item are viewed. There are three detail levels: **Coarse**, **Medium**, and **Fine**. Viewing a model at a Fine detail level shows everything about the components, but affects the speed at which you can pan and zoom the model.
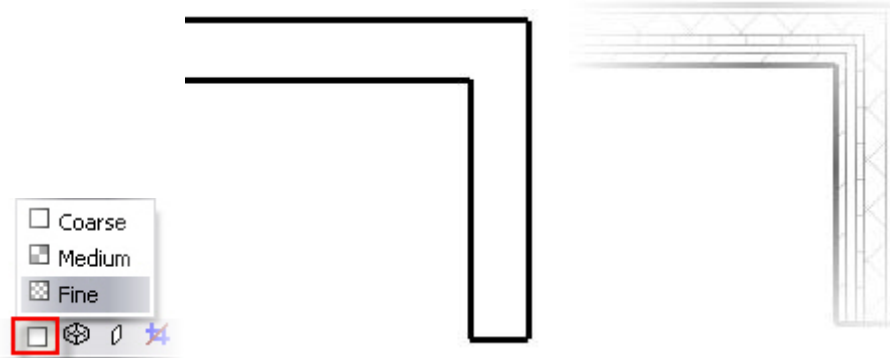


**Model Graphics Style:** Determines the display style of the model. There are four model graphics styles to select from: **Wireframe**, **Hidden Line**, **Shading**, and **Shading with Edges**.



- **Wireframe:** Default style for a new view.

- **Hidden:** Typically the first choice for plans and elevations. Any obscured objects show as hidden line, while objects that are not obscured show as continuous lines. Different displays in a typical foundation plan view are shown below. One is shown wireframe and the other is shown as hidden.
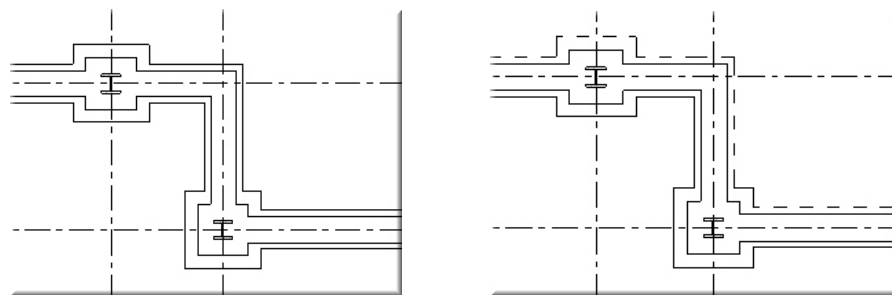


*Wireframe*                    *Hidden*

■ **Shading:** Shown for 3D illustrations. It shades the model but does not show the lines defining the objects being shaded. It can also be shown in elevation and plan, but becomes cumbersome when it comes time to plot the model. Shading in plan or elevation using the Display toolbar is not recommended.
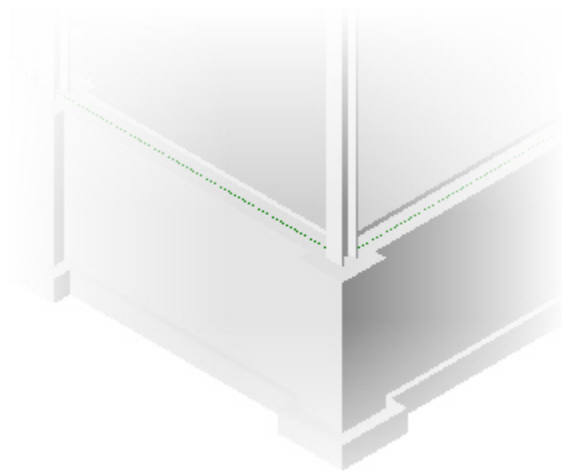
■ **Shading with Edges:** The natural choice for 3D. It shades the model and leaves the outline edges. This mode is also not recommended for plan and elevation. You can use a simple hidden view on 3D and perspective views.
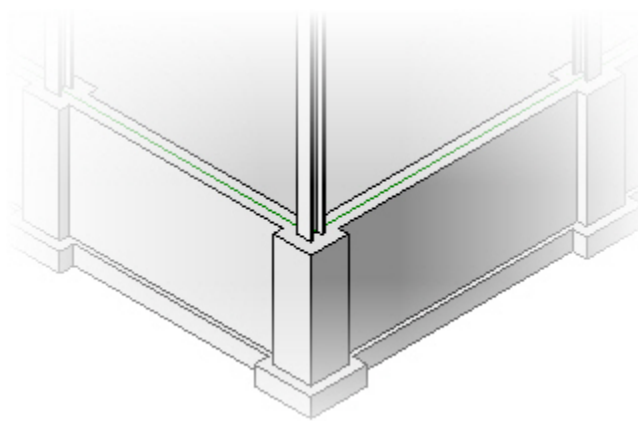
■ **Shadows:** Used for presentations. Showing a shadowed model slows the system dramatically.
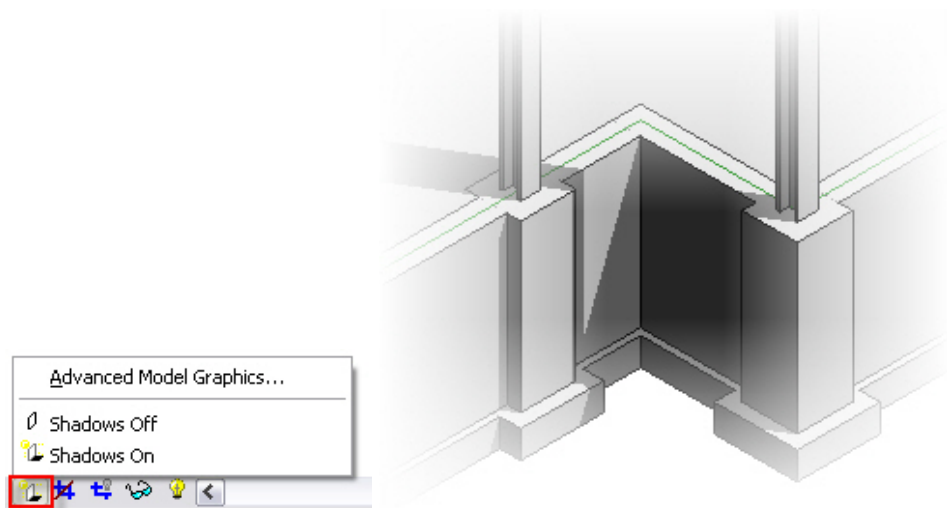


■ **Do Not Crop** and **Hide Crop Region** are designed to behave similar to viewports in AutoCAD. Cropping a plan region involves showing the crop region and moving the boundary to the desired location. Column bubbles and grids still display if this is done properly.
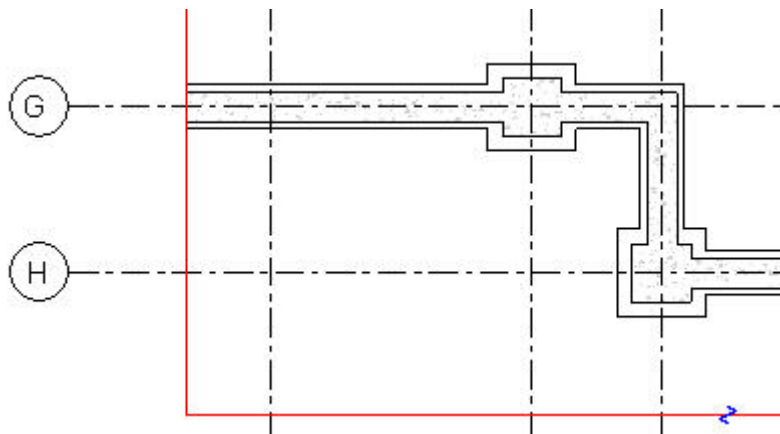
■ **Temporary Hide/Isolate** and **Reveal Hidden Elements** are used frequently. In some cases, you need to hide specific elements from view to enable you to work on the model more efficently. You might also be required to see which elements have been turned off in the view. These two options enable you to toggle through the visibility modes to see what has been turned off. It also enables you to select items to be removed from view. This function only hides items in a view; it does not remove them from the actual model.
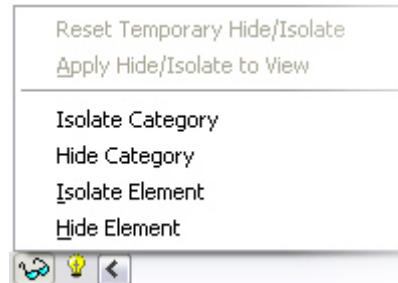
When an object is hidden from view, the Sunglass icon turns to a turquoise color. A turquoise band around the entire view indicates that some elements are temporarily turned off.
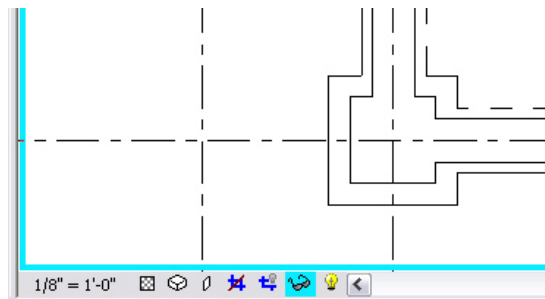
To reveal hidden elements, click the Lightbulb icon. It turns to a magenta color and the hidden elements appear in the same color. You can then select the Sunglass icon and reset the view. You can also make the hidden objects become permanently hidden.
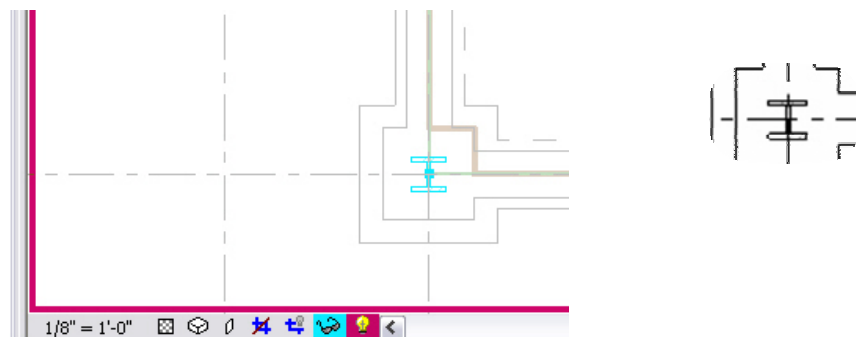
## View Properties

Each view has independent properties, enabling different graphical representations based on that view's function. Views can also be duplicated, enabling different sets of information to be displayed on a sheet. For example, a foundation plan can be copied to show slab reinforcing next to a dimensional plan on a sheet.

There are two ways to access the properties of a view:

■ One way to access view properties is to right-click anywhere in the view window and select **View Properties…**
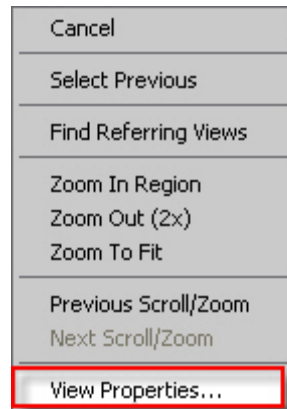


The properties of the view are displayed. Some of them are a duplication of the View Control toolbar.
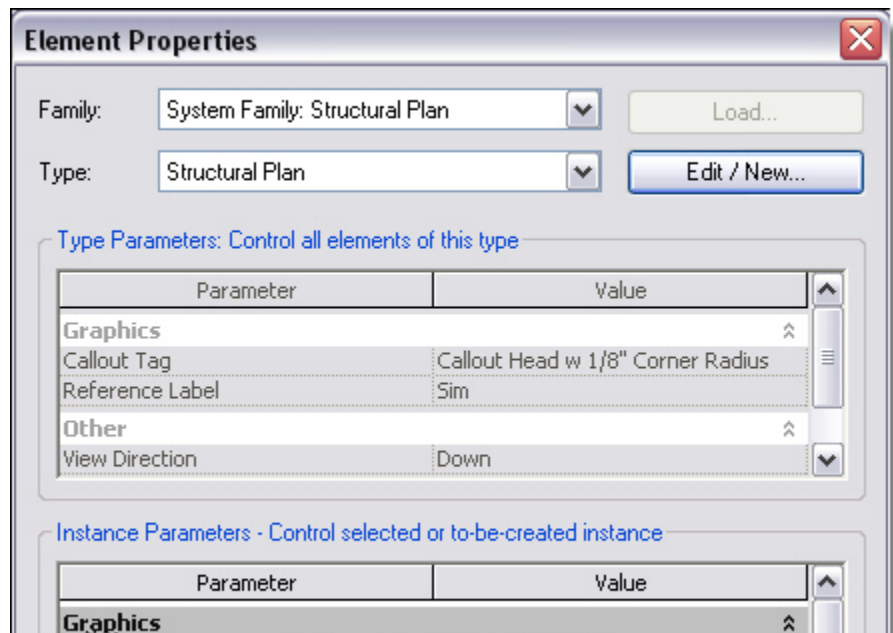
■ The second way to access view properties is to select a floor plan in the Project browser, right-click and select **Properties**. This is the same as right-clicking in the view window.

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The shortcut menu also has an option of duplicating a view. This makes a copy of the view. You can then add annotations and display configurations independent of any other view.
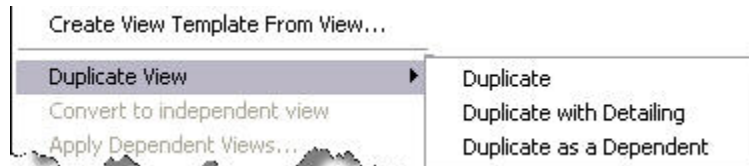


**Duplicating Types:**

**Duplicate:** Creates a copy of the view with only the building elements included. Building model objects change in all views automatically, but view-specific changes made to the new view are not reflected in the original view.

**Duplicate with Detailing:** Creates a copy of the view and includes view-specific elements (such as tags). Any new annotation and specific objects in the new view are not reflected in the original view.

**Duplicating as a Dependent:** Creates a copy of the view and links it to the original view. Changes made to the original view are also made in the dependent view and vice-versa. Use dependent views when the building model is so large that you need to split the building up on separate sheet, with views that are all at the same scale.

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### ⇪ ⇪ ⇪ *Practice - Introduction to Revit Structure*

*In this practice you will open an RVT file from the class directory and explore the tools used to navigate a Revit Structure project. This practice is designed for you to explore the functionality of the Project Browser and the command interface.*
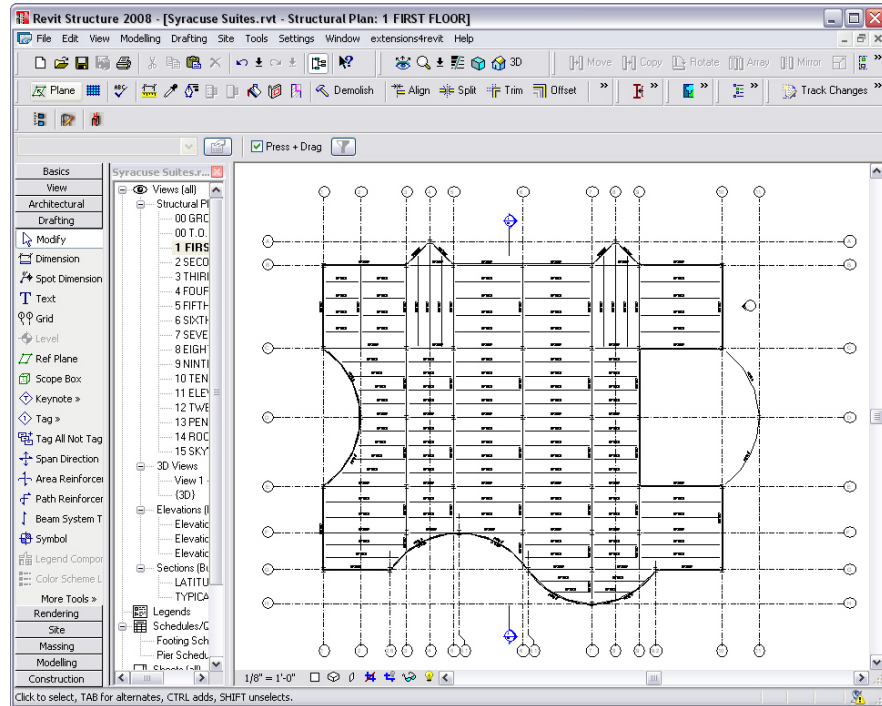


### Task 1 - Navigate Revit Structure

1.  Open the project file **Syracuse Suites.rvt**, found in your class directory. The project opens to the **1 FIRST FLOOR** framing plan.

2.  If the Project Browser is not displayed, click in the Standard toolbar.
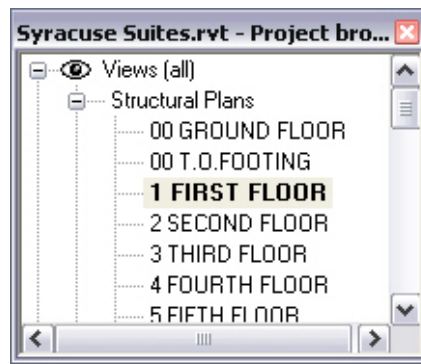
3.  In the Project Browser, double-click on the **00 GROUND FLOOR** structural plan. It opens to a plan showing footings and foundation walls.

4.  In the View Control toolbar, locate the Model Graphics Style icon and change the *model graphics* to **Hidden Line**.
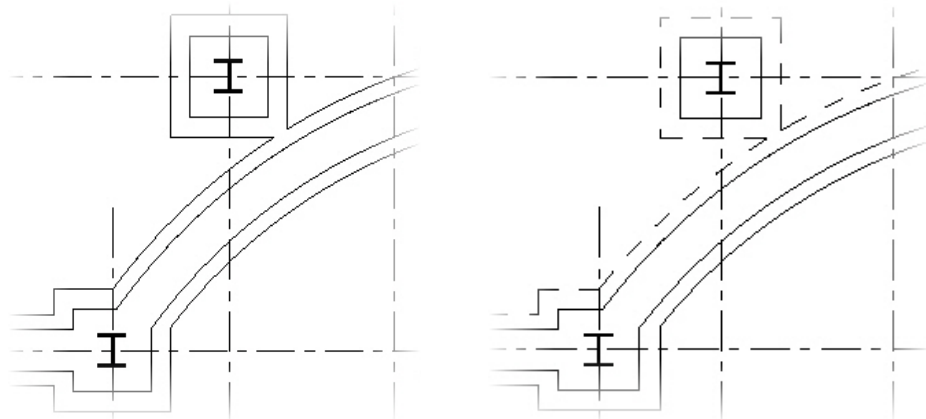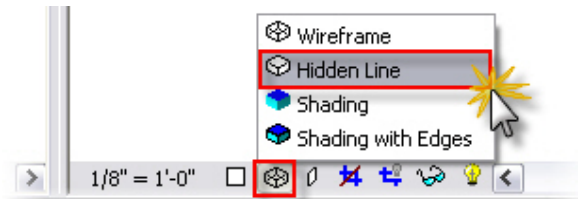


5.  In the Project Browser, double-click on the **00 T.O. FOOTING** structural plan. Notice that the foundation walls are in-filled with the appropriate concrete hatch. The strip footings and spread footings also show as continuous lines because there is no slab to obscure them.

6.  Type **ZE**. This zooms the extents of the view. (**ZA** zooms all). Find the section marker that extends vertically along the model.
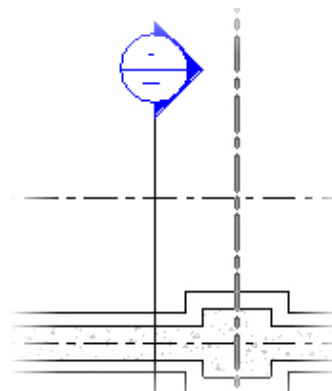
7. Double-click on the bubble. This opens the **LATITUDINAL SECTION**.

8. In the Project Browser, navigate to the Sections (Building Section) category and notice that **LATITUDINAL SECTION** is bold. You can navigate Revit by either double-clicking on the item in the Project Browser, or by using the graphical annotation elements in the model.

9. Zoom in on the area where the callout has been placed.
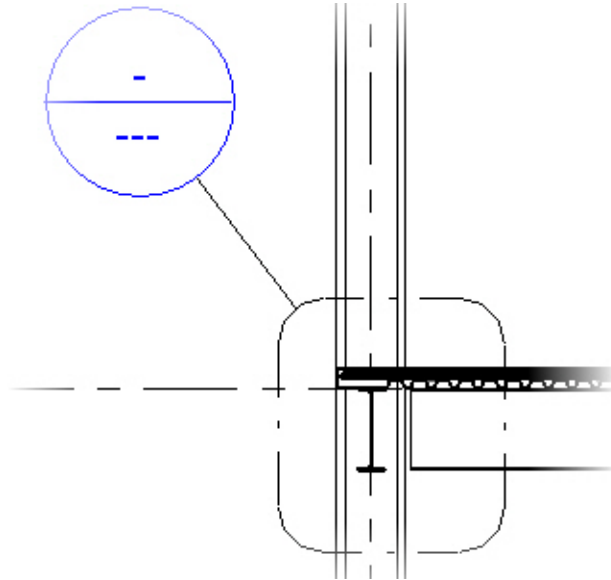


10. Double-click on the bubble. This opens the **TYPICAL EDGE DETAIL**.

11. Select the reinforcing. It is not just donuts and thick polylines.

12. Click ![icon] (Element Properties) in the Options Bar. Remember that when an item is selected, the Options Bar changes to aid you in the design of that specific element.

13. Scroll down to the *Instance Parameters* of the area reinforcing. The choices made here will drive the model. When it comes time to label the sections and details, these values become annotations. If these values change, they only need to be changed in one place. The new values are then propagated to all the views. Any change made here is only applied to the element that is selected. In this case, only the first floor area reinforcement changes.

| Parameter | Value | |
|---|---|---|
| **Construction** | | ⌃ |
| Layout Rule | Maximum Spacing | |
| **Structural** | | ⌃ |
| Estimated Reinforcement Volume | 38.38 CF | |
| **Layers** | | ⌃ |
| Top Major Direction | ☑ | |
| Top Major Bar Type | #4 | |
| Top Major Hook Type | None | |
| Top Major Hook Orientation | Down | |
| Top Major Spacing | 1' 0" | |
| Top Major Number Of Lines | 5 | |
| Top Minor Direction | ☑ | |
| Top Minor Bar Type | #4 | |
| Top Minor Hook Type | None | |
| Top Minor Hook Orientation | Down | |

*Instance Parameters - Control selected or to-be-created instance*

14. Click [ Edit / New... ] to access the Type Parameters. Any change made to these parameters changes all area reinforcing in the entire model. In this case, the area reinforcing is changed for all floors.

15. Click [ Cancel ].

16. Press <Esc> twice to clear the selection.

17. Select one of the bolted connections. This is a detail component.

18. Look in the Options Bar. It has loaded the options specific to this item.

19. Press <Esc> to clear the selection.

20. Double-click on the first floor datum mark. This up the **01 FIRST FLOOR** structural plan.

1 FIRST FLOOR
15' - 0"

Goto the floor plan that corresponds to this level

21. Expand the **Window** pull-down menu. There is a growing list of opened windows. This can quickly become a management issue once the model starts growing in size. You can select **Close Hidden Windows** so that only the current window remains open.
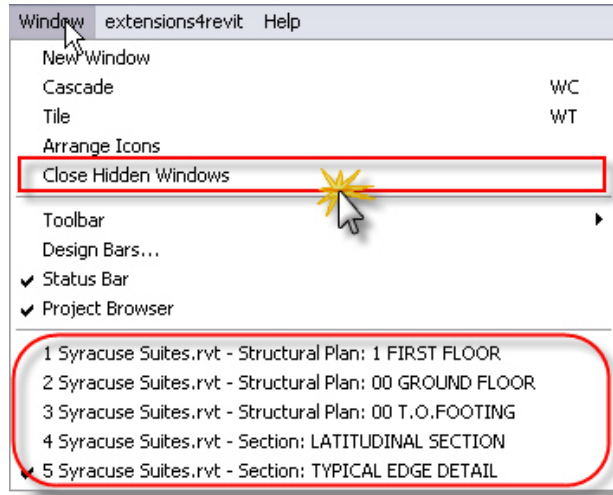


22. Click  in the View toolbar. Type **WT**. You now have two visible windows. This view configuration is useful when placing items in a model.

23. Click in the 3D view.

24. Press and hold <Shift> and then press and hold the wheel button on your mouse. Move the mouse to dynamically view the 3D model.

25. Click  (Close) to exit the 3D view (this also works when many views are open).
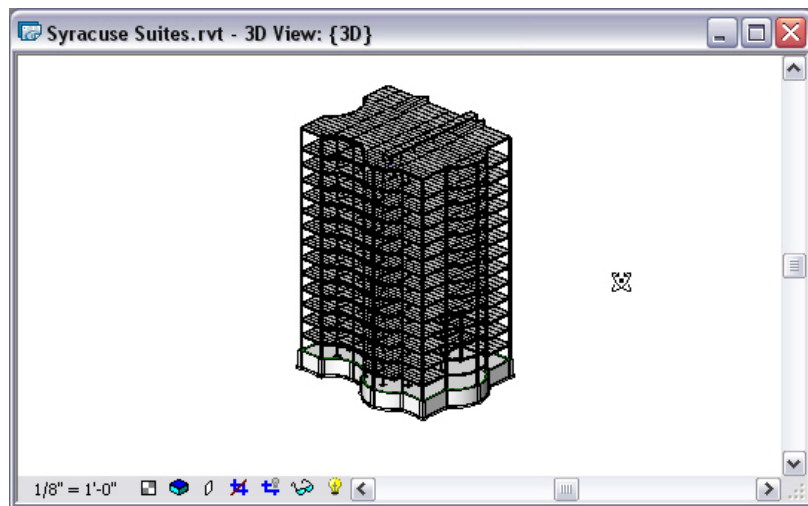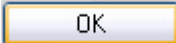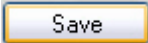
26. Select **File>Close** to exit the project. Do not save changes.
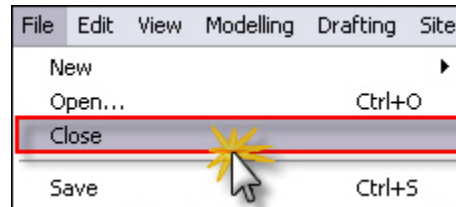


## Task 2 - Create a Project

1.  Click  (New) and then  (Save).

2.  Browse to your class directory.

3.  Click  (New Folder). Label the new folder with your name.

4.  In the lower left corner click .

5.  In the File Save Options dialog box, set the *Maximum number of backup(s)* to **1**.
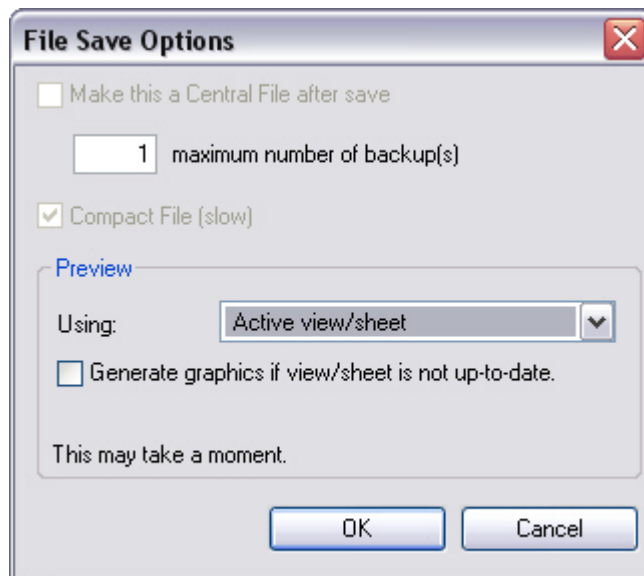


6.  Click .

7.  Name the file **Class Model**.

8.  Click .

# Self Check:
# Introduction to Revit Structure

1.  What is the name of the toolbar on the left side of Revit Structure that contains the design tabs?

2.  What is the name of the dialog box that enables you to access the project and its views?

3.  What is the name of the toolbar that changes according to the current command?

4.  Can you change how Revit controls the display of a view? How?

5.  When a component is *brought into* a Revit model, what is this dynamic component called?

6.  Can you open views by double-clicking on a datum or section?

# Section 2:
# Setting Up Levels and Working with Views

In this section you will learn how to:

- Create and use levels

- Create elevations

- Create a section view

- Create callouts

# Creating and Using Levels

One of the greatest benefits to using Revit is the ability to control datum elevations in real-time by using *levels*. Having this functionality in a single model without the need for external referencing systems is also advantageous. From a simple tool shed to a skyscraper, Revit is designed to manage an entire project, not just parts of a building. By adding and managing all of the building's levels in a single file, Revit increases efficiency in the typical workflow of a project. More time can be spent designing and less time spent managing files and folders.

13TH FLOOR
195' - 0"

12TH FLOOR
180' - 0"

11TH FLOOR
165' - 0"

10TH FLOOR
150' - 0"
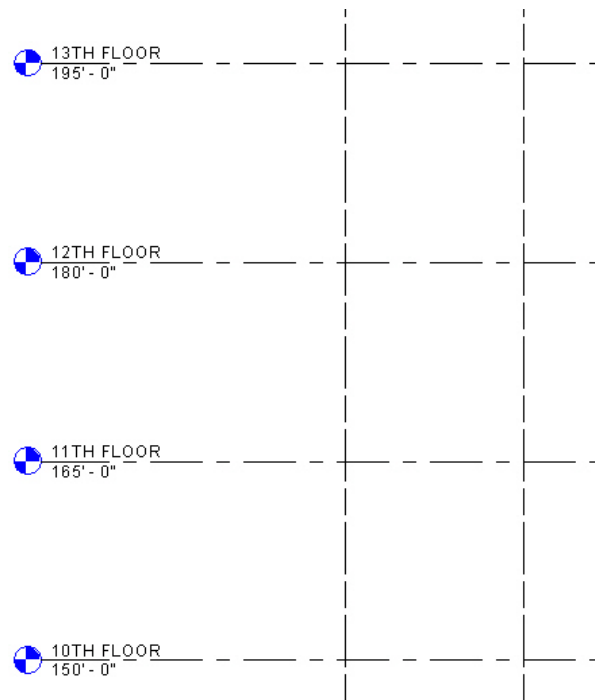
### To Create a Level

1. Create a new model in Revit Structure.
2. Double-click on the South Elevation under the *Building Elevations* category. Two elevations are present. This is typical of a default Revit template. Your company might have set up a different project template.
3. Click ⊕ Level in the *Basics* tab in the Design Bar.
4. Click ☒ (Pick) in the Options Bar.
5. Type **12** in the *Offset* field in the Options Bar.

☑ Make Plan View | Plan View Types | Offset: 12' 0
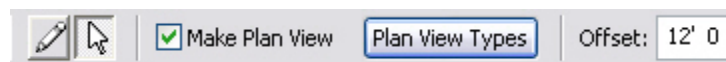
6. Move your cursor over the **Level 2** elevation line. A blue alignment line appears. If you move your cursor to either side, the alignment line moves with it. When you see the alignment line appear above Level 2, select it. Level 3 appears.

Level 2
10' - 0"

Levels : Level : Level 2 : Reference
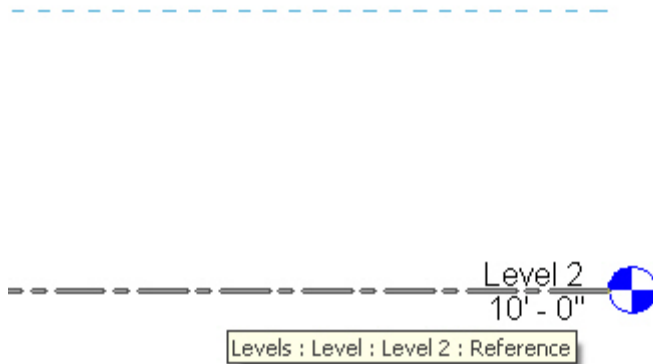
7. Notice a new floor plan has been created for this level. Click
Modify and select **Level 3**.
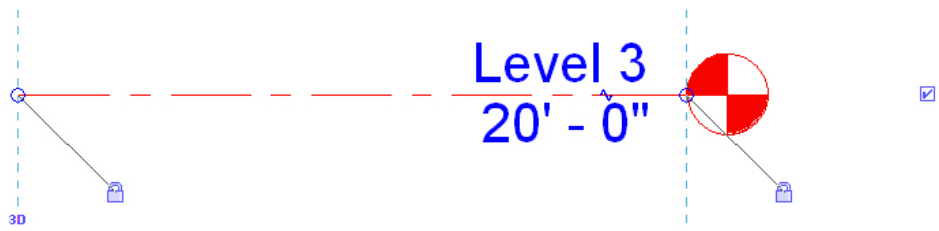
Level 3
20' - 0"

The following items that appear enable you to do the following:

■  The Checkmark icon that appears above the bubble is a toggle that controls whether the bubble is shown at that end of the level.

■  The 3D icon controls whether any movement or adjustment is pushed down to other elevations. If you select this icon, it displays as 2D. This is highly recommended in elevation, as it has a negative effect on other views.

■  The Padlock icon controls whether the level datum is positioned next to other datums. If the lock is on, you should see the blue alignment line. If the datum is moved, all datums move. This helps maintain conventional drafting standards. If the lock is shown unlocked, the datum moves independently of the other levels.

■  The Blue circle icon at the base of the datum enables you to drag the datum to a new location.
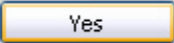
■ The blue dimension that appears between the levels can be edited. This is called a *temporary dimension*. Remember that any blue item can be modified.



12' - 0"
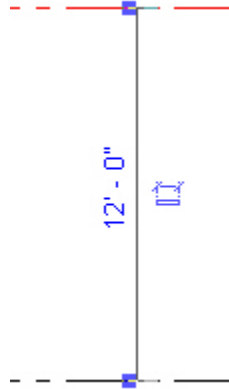
■ ⊟ The Dimension icon makes the temporary dimension permanent. If this occurs, you can still modify the increment by selecting the level. The permanent dimension temporarily turns blue enabling you to edit the value.

■ Additionally, the actual datum elevation can be selected and modified. Note that doing do affects the entire model. Be careful if you have to change the distance of an elevation. If it is late in the project, non-parametric drafting items might exist. Changes might leave these items in undesirable locations. Be sure to do a review of the project to ensure that all is as required.



Level 3
20' - 0"
Edit Parameter
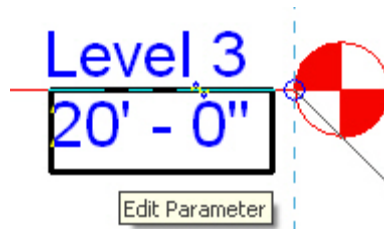
■ ⤳ The Add Elbow icon enables you to add a jog to the level line. In tight spaces, this becomes crucial.

8. Select the **12'-0"** dimension and change it to **10'-0"** (You can just type **10**). The level and anything associated with that level moves.

9. Rename **Level 3** as **Roof**.

10. A message appears, asking if you want to rename the corresponding views. Click [ Yes ].
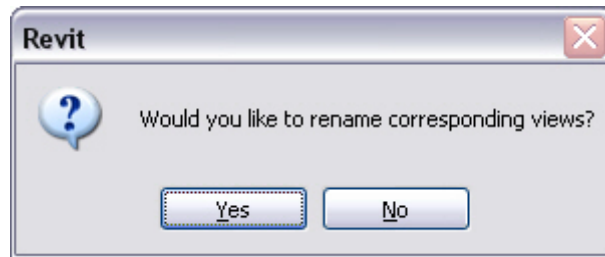
The Level 3 view under Structural Plans located in the Project Browser has also been renamed as Roof.

11. Select the **Level 1** level line.
12. Click [ Copy ] and select a point anywhere along the **Level 1** line. Move your cursor straight down.
13. Select the **Constrain** and **Copy** options in the Options Bar. Clear the **Multiple** option.

☑ Constrain ☑ Disjoin ☑ Copy ☐ Multiple
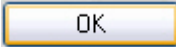
14. Type **10'-0"** at the cursor.
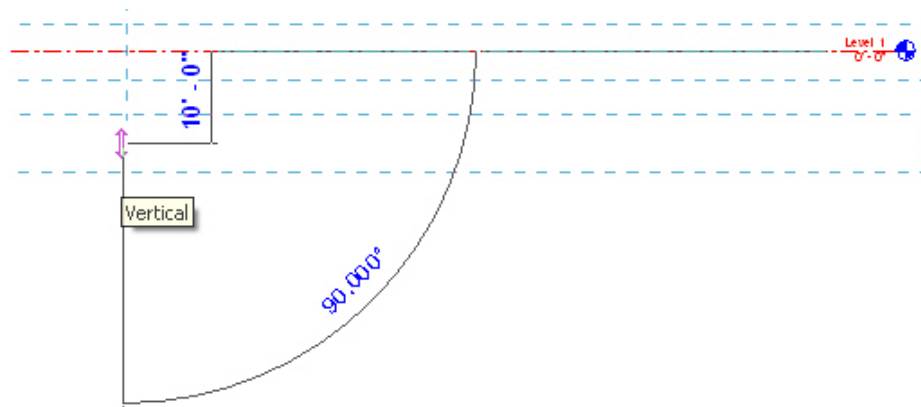
15. Once the level is copied, rename it as **T.O. footing**.
16. No additional floor plans have been added to the Project Browser. This is because you only copied a level. You did not create it using the conventional **Level** command. Therefore, you need to create a floor plan based on the new level.
17. Select the *View* tab in the Design Bar. Click [ Floor Plan… ].

18. Select the **T.O. Footing** level in the New Plan dialog box.



19. Click [ OK ]. A new floor plan now appears in the Project Browser

20. Close the project without saving.

# Creating Elevations

Two kinds of elevations can be created in Revit: Building elevations and Framing elevations. Each one is similar, but serve a different purpose. A building elevation can be placed freely, whereas a framing elevation requires you to select a specific framing bay.

**To Create Building Elevations**

1. Open the file **Bracing.rvt**.
2. Select **Level 1** in the Project Browser.
3. Click ⬧ Elevation in the *View* tab in the Design Bar.
4. Select a location west of the building to place the elevation. The arrow points toward the building.
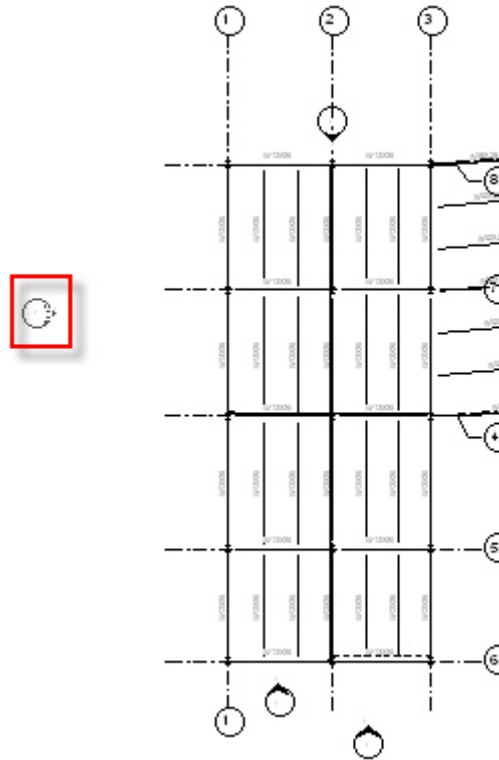
5.  A building elevation now appears in the Project browser. Right-click on the new building elevation and select **Rename...** Rename it as **West Elevation**.
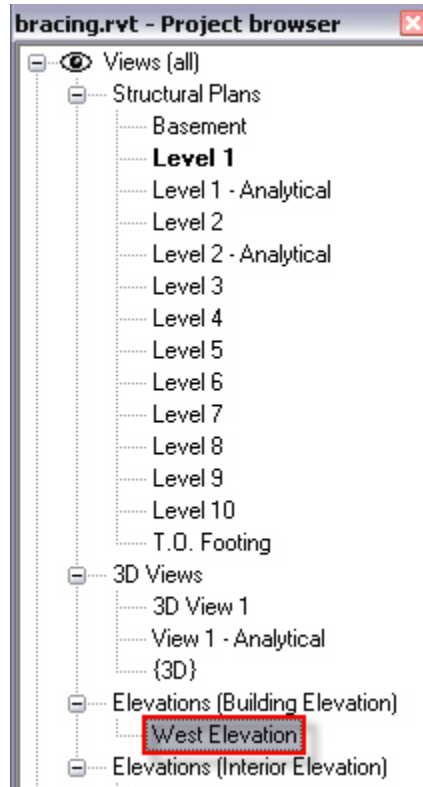


6.  Select the section you just added in the Level 1 floor plan. The section consists of two different parts. One is the *bubble*. The bubble holds the sheet information when the view is added to a sheet.
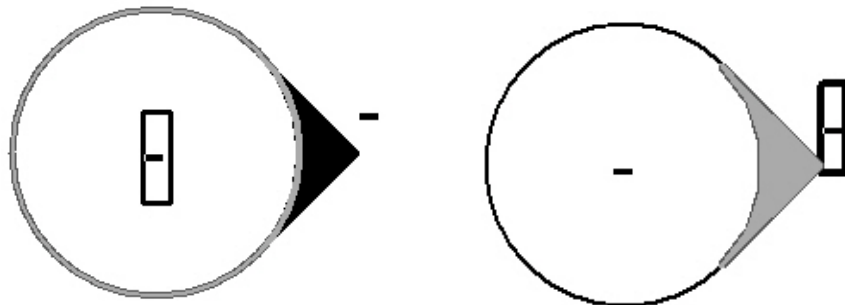


The second is the *target*. The target holds the physical properties of the view that it is calling out. The elevation markers are not just symbols. They hold the information for the corresponding view. If an elevation marker is deleted so is the view to which it was pointing. Additionally, if the target is moved, it must be selected using a window. Both items must move together or unexpected results occur.
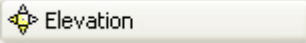
7. Press <Esc>. This time, only select the bubble. The familiar blue checkmarks appear. If you turn on the other three targets, you create three additional views.

8. Clear the West Elevation target.
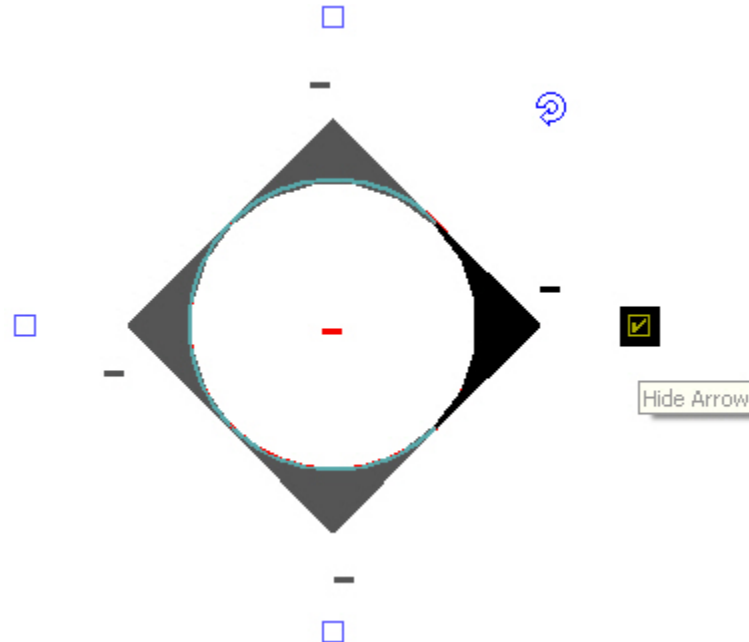


9. A Warning dialog box opens indicating that you are deleting a view. Click Cancel .
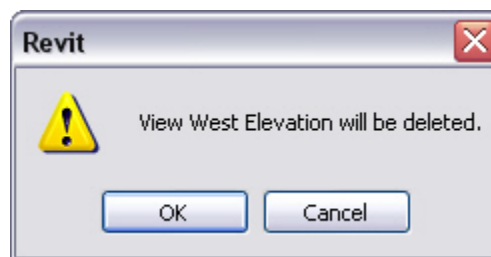


10. If you accidentally delete the view, click ⤺ (Undo).

11. Select the bubble again. The Rotate ⟳ icon appears. Use it to rotate the position in which the view is being taken from.

Be careful when using this functionality. This determines the exact rotational value of the elevation. If this is not accurately perpendicular to the structure, the view is off. If an elevation on an angled or radial surface is required, click Elevation and hover your cursor over the side of the building on which you want the elevation. It automatically positions itself perpendicular to the geometry of the building.

12. Press <Esc>.
13. Select the target. Notice the blue line with the blue grips on the end. A dotted line forms a box around a portion of the model. These are your view extents, which indicate exactly where the perimeter and depth of your elevation are going to land. The resulting elevation is cropped at these extents.
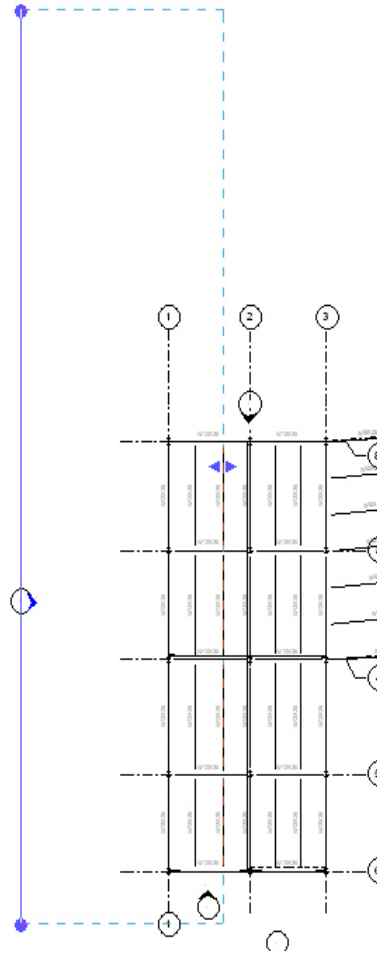


14. Select the blue grip (⬇) at the top of the line.
15. Move it down closer to the area on the west side of the building.
16. A Drag icon (◄►) appears in the middle of the line to indicate the view depth. By default, this lands directly on a framing member. It determines the depth to which the elevation clipped. You can adjust it as needed. Press <Esc>.
17. Double-click on West Elevation in the Project Browser or double-click directly on the elevation target in the floor plan to open that view.

18. In this elevation view, the default detail level is **Coarse**. At the bottom of the view, change the *detail level* to **Fine** ⊠.
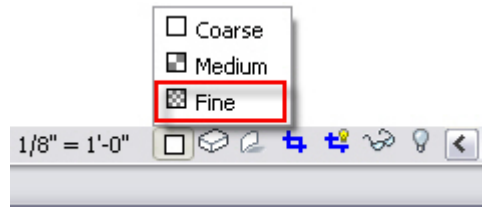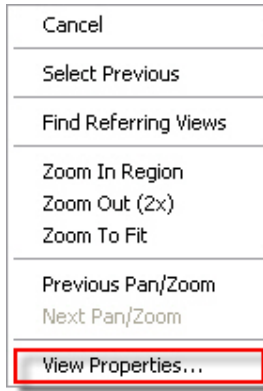


19. Notice a line at the perimeter of the view. This is called a *crop region*. The rectangle directly relates to the grips at the end of the elevation target in the plan view. By moving the crop region in elevation, you are moving the extents in plan.
20. Type **WT** to tile the elevation and the plan.
21. In elevation, select the crop region.
22. Click in the plan view. The elevation and elevation boundary lines are selected. Remember that changes in one view have a direct effect on many other views.
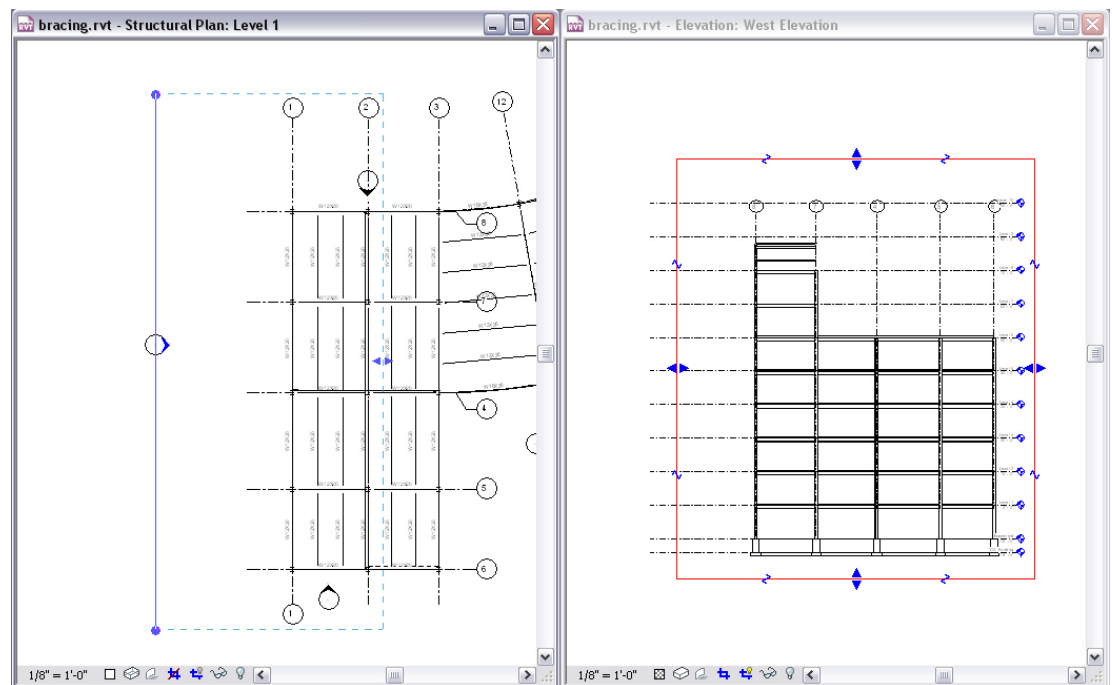


23. Maximize the west elevation (⬜).
24. Define the crop region using the View Control toolbar. You can define it using the following tools:

- ↳ **(Do not crop):** Turns off cropping. If you select an elevation marker in plan, you do not see the blue grips and the extent arrows.

■ ⬚ ⬚ **(Hide/Show Crop Region):** This retains the cropping but removes the box.

25. Click ⬚ (Show Crop Region) to show the crop region.
26. Right-click anywhere in the view and select **View Properties…**

| |
|---|
| Cancel |
| Select Previous |
| Find Referring Views |
| Zoom In Region |
| Zoom Out (2x) |
| Zoom To Fit |
| Previous Pan/Zoom |
| Next Pan/Zoom |
| View Properties… |

27. Additional Instance Parameters pertaining to the *extents* of the view appear in the View Properties dialog box. **Crop View** and **Crop Region Visible** are both controlled by the icons in the View Control toolbar.
28. The **Annotation Crop** enables the designer to retain text and symbols outside of the area that shows the lines of the building. Toggle this parameter on and click ⬚ OK ⬚.

Instance Parameters - Control selected or to-be-created instance

| Parameter | Value |
|---|---|
| Referencing Sheet | S.1 |
| Referencing Detail | 1 |
| Default View Template | Structural Framing Elevation |
| **Extents** | |
| Crop View | ☑ |
| Crop Region Visible | ☑ |
| Annotation Crop | ☐ |
| Far Clipping | Clip without line |
| Far Clip Offset | 45' 0 99/128" |
| Scope Box | None |
| Associated Datum | None |
| **Phasing** | |
| Phase Filter | Show All |
| Phase | New Construction |

29. Select the crop region. There is an additional region. Only annotative items appear in the area between the annotative region and the crop region.
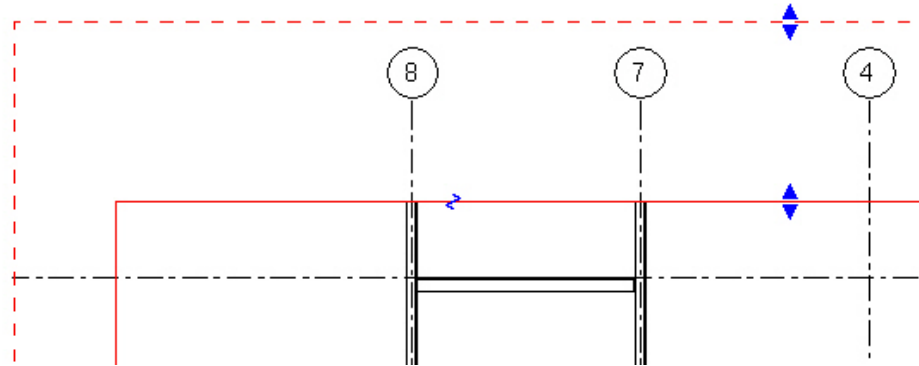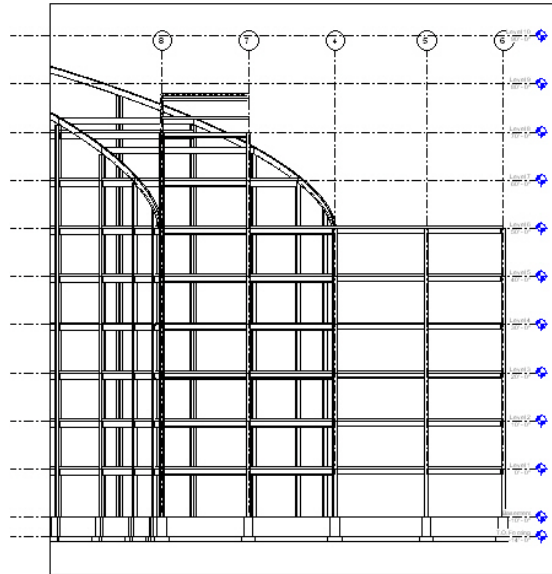


30. Right-click and select **View Properties** again.
31. Click ⬚ Clip without line ⬚ to open the Far Clipping dialog box.
32. Select the **No Clip** option.
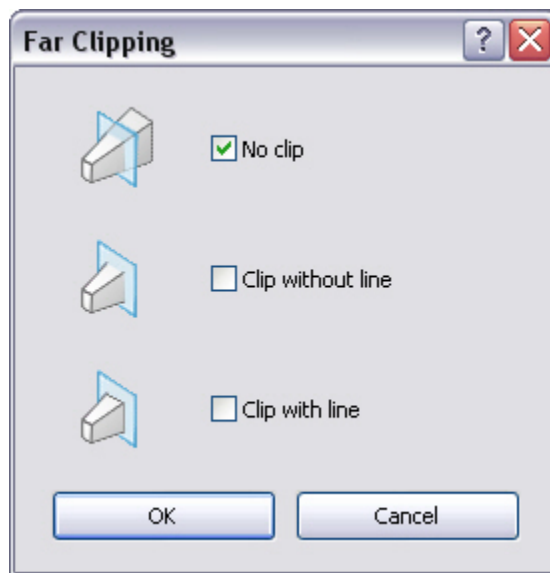


33. Click ⬚ OK ⬚.

34. Click [ OK ] again. The elevation now looks at the entire structure.



## To Create Framing Elevations

A framing elevation is set up to capture an elevation of a single area in a building. The most common use for a framing elevation is to generate bracing elevations and schematics. The output is the same as a building elevation. Both are views generated from a plan and both have the same properties.

1. Select **Level 1** under *Structural Plans* in the Project Browser.
2. Zoom the area along column line **6** between column lines **2** and **3**.
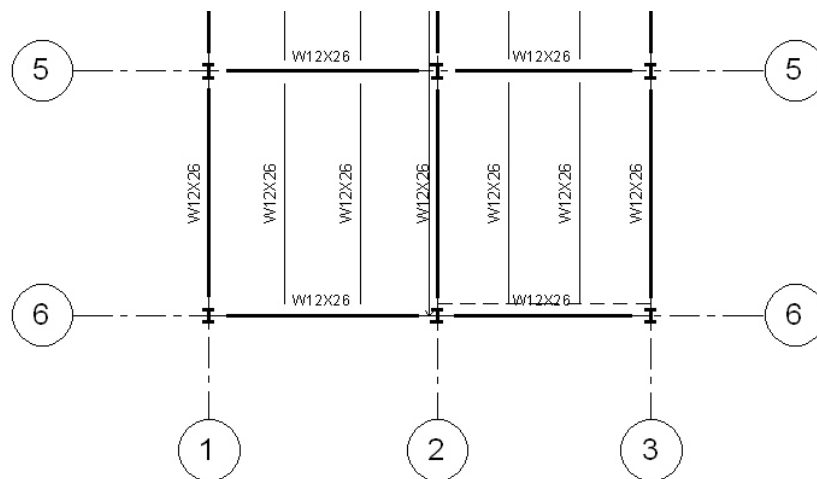
3. Click [Framing Elevation] in the *View* tab in the Design Bar.
4. Hover your cursor over column line **6** between **2** and **3.** An elevation appears.
5. Once the elevation marker appears, select the line (you can adjust it after placement if needed).
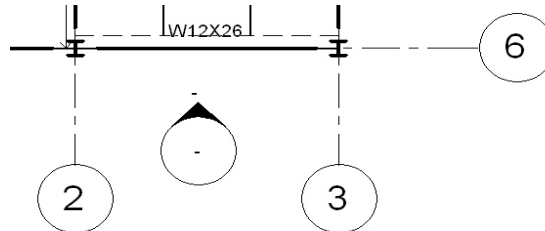


6. Select the target. The extents focus only on the bracing bay.
7. A new interior elevation appears in the Project Browser. Right-click on it and rename it as **Bracing Bay A**.
8. Double-click on Bracing Bay A to open it.
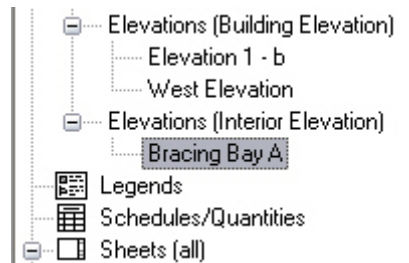


9. The crop region is too tall in the default view. Select it and stretch it down to a reasonable area. The grid bubbles move with it, keeping them visible.
10. Change the detail level to [⊠] (Fine).
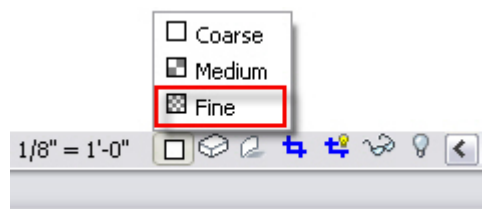
11. Drag (◄►) the crop region to the left to show both bays.
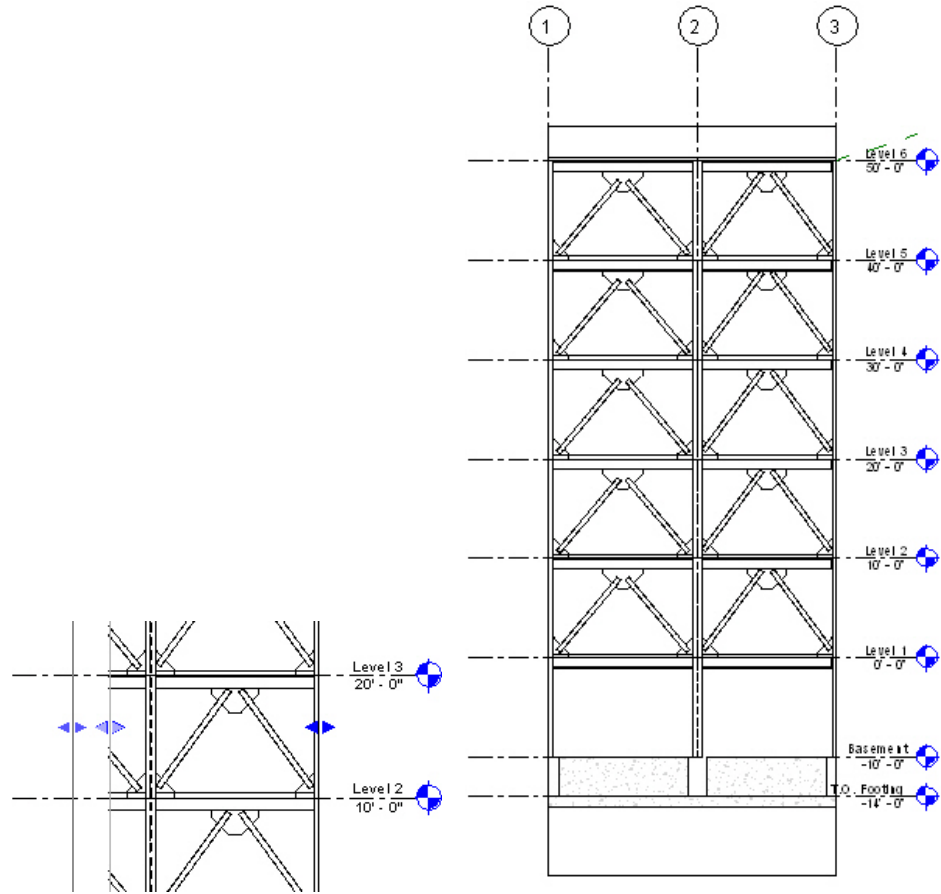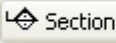


12. The framing elevation has been created. Remember that you can drag the elevation datum lines out of the way for a more organized view. Also remember to switch them to 2D, so that you do not affect the other elevations.

# Creating Sections

Creating sections is almost identical to creating an elevation. The same concept of creating a new view still applies. Sections are controlled by the crop region, as well as depth clipping. A section is simply an elevation taken through the middle of a building.

### To Create a Section

1. Open the first floor plan.
2. Click [Section] in the *View* tab in the Design Bar.
3. Select a point to the right of column line **1** and above column line **8**.
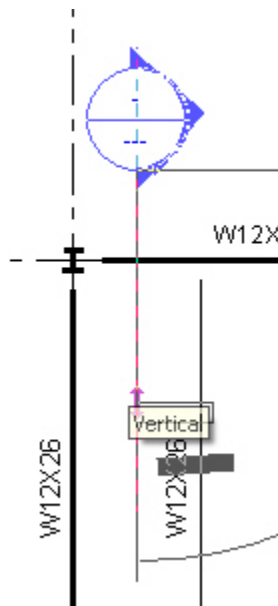


4. Select a second point parallel with column line **1** and below column line **6**.
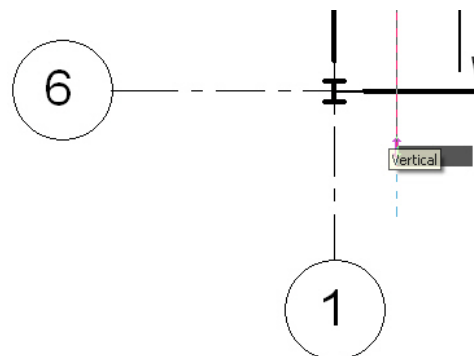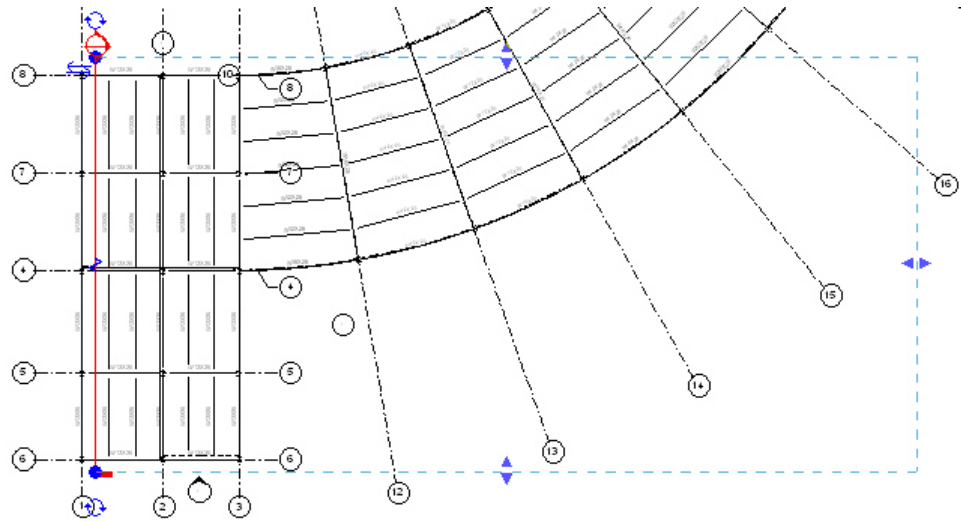
5. The extents of the section are probably outside a reasonable range. Select the drag (◄►) icon to the right of the view range window and drag it back to between column lines **1** and **2**.
6. With the section selected, you see the following blue icons:

■ ↻ The Cycle icon enables you to toggle through the head, tail, or blank options. The cycle icon appears on both sides of the section line.

■ ⇆ The Flip arrow changes the direction of the section.

■ ↲ The Break icon enables you to break section lines to avoid clutter and multiple annotation lines in the model. Once the Break icon is selected, you can slide the section lines to clear the building using the newly formed grips.
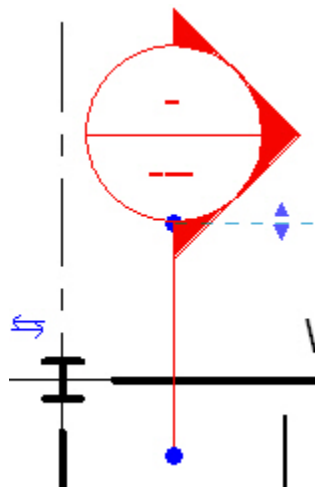


7. Click the ↲ (Break) icon. This joins the lines back together.

8. With the section selected, click [Split Segment] in the Options Bar.

9. Your cursor turns into the ✐ symbol. Select the section line anywhere along its length. The segment of the section now follows the movement of your cursor.
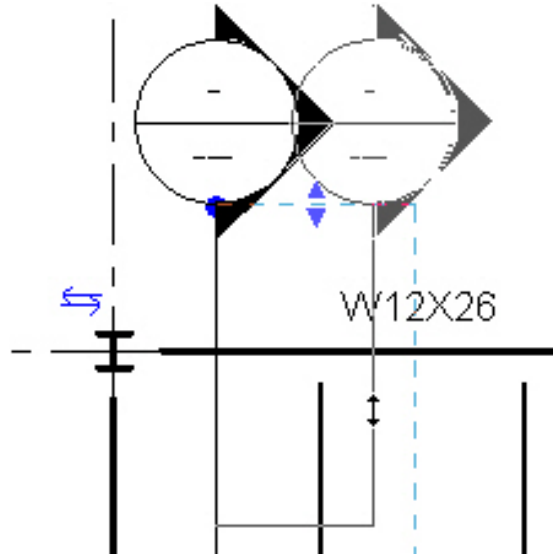


10. Exit the command. If the line was split, you can drag the split section and realign it.

11. A new building section appears in the Project Browser. Rename it as **Col A Section**.
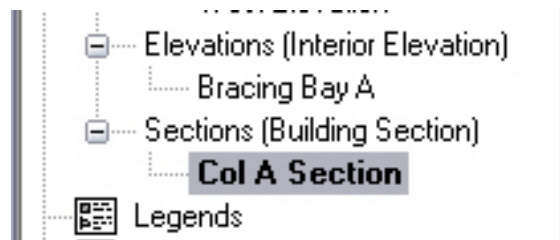
12. Double-click on Col A Section to open it.
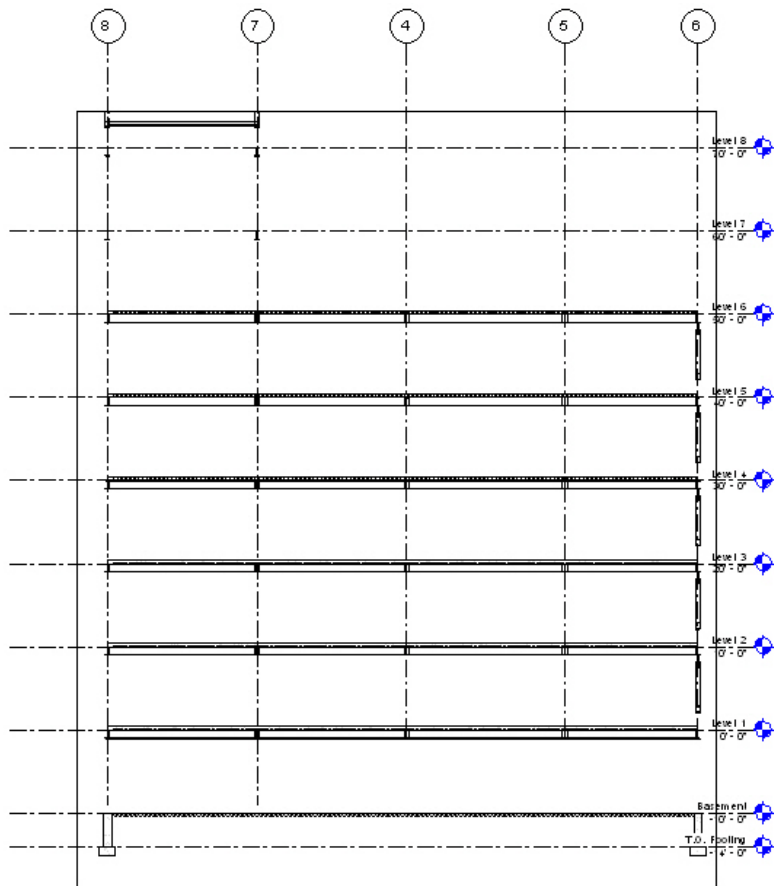


13. Change the detail level to ⊠ (Fine).
14. Zoom in on any area. The 1/8" line weight seems heavy.
15. Click 📝 (Thin Lines).
16. Close the section.

# Creating Callouts

Another way to generate a view is to create a callout. This command clips a region, copies it to a new view, and increases the scale by a factor of 2. Revit Architecture uses this feature predominantly for plan work, while Revit Structure uses it for sections and elevations.

### To Create a Callout

1. Open the **Bracing Bay A** elevation.
2. Click [Callout] in the *View* tab in the Design Bar.
3. Draw a window around a single bracing occurrence, as shown below.
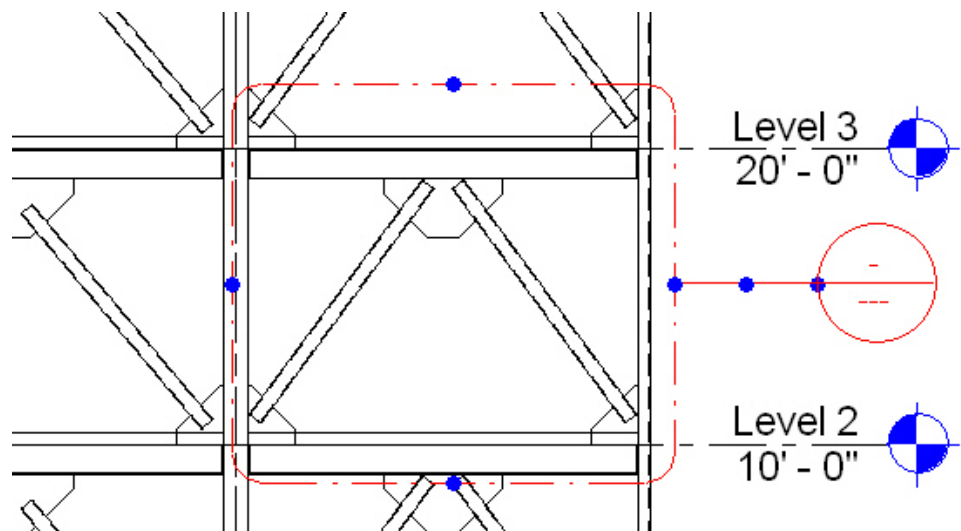


4. Place the callout bubble in an appropriate location. Notice the blue grips. This indicates that you can control the size and positioning of the bubble after placement.
5. Select the **Callout of Brace Bay A** elevation in the Project Browser.

6. Select the crop region and adjust it so that only the pertinent framing displays. You can also drag the elevation and grid lines out of the way. When you select them, the default changes to 2D.
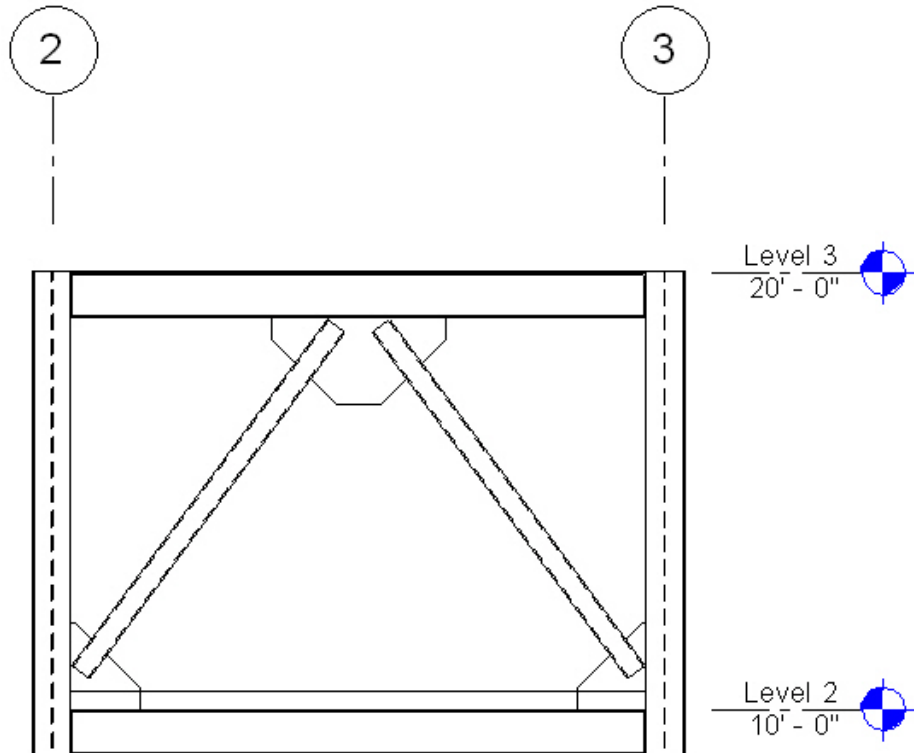


Callouts and sections contain text and dimensions that are unique to these views only, while the physical geometry is shared throughout the model. Any modification to the actual model requires an investigation of these views to determine if the text still applies, or if the text is still appended to the model.
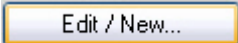
### ⇪ ⇪ ⇪  *Practice - Creating Levels, Sections, and Callouts*

*In this practice you will add levels to your model. Levels can be linked from a Revit architectural model, or they can be added one by one in the structural model. Care should be taken either way in regards to that level's actual height. Copying the architectural levels would put you at a finish floor system rather than a top of steel elevation.*

**Task 1 - Create Levels**

1.  Open the file **Syracuse Suites - Structural-01.rvt**.

## Projects



Syracuse Suites – Structural



bracing
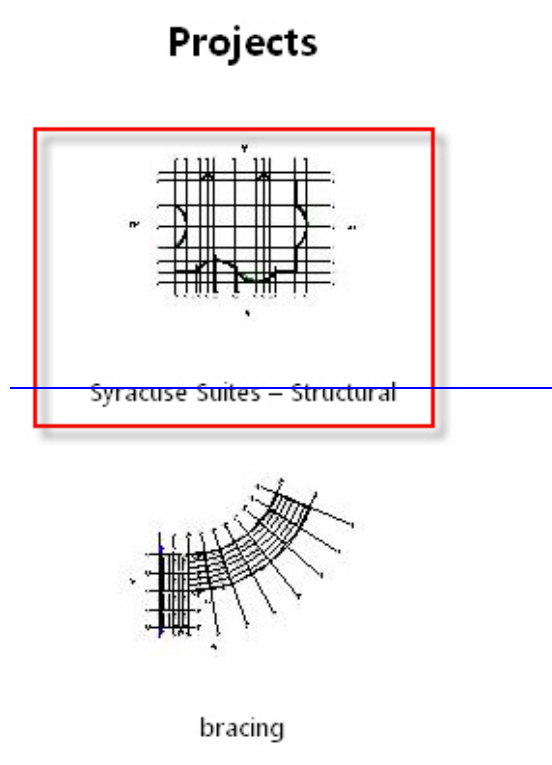
2.  Activate the **South Elevation**.

3.  Zoom in on the **1st Floor** elevation. This has been brought in from the architectural model.

4.  Click ⬥ Level  in the *Basics* tab in the Design Bar.

5.  Click 🖼 (Element Properties) in the Options Bar.

6.  Click  Edit / New... .

7. Toggle on the **Symbol at End 1 Default** option.

8. Click [ OK ] twice.

9. Click 🔧 (Pick) in the Options Bar. Type **6"** for the *Offset*.

| ✏️ ⬚ | ☑ Make Plan View | Plan View Types | Offset: 0' 6" |

10. Select the architectural **1st floor** level. Your structural level is the top of steel.

11. Select the blue alignment line once it appears below the level.

1ST FLOOR
15' - 0"

12. Rename the new level as **1ST FLOOR**.

13. Repeat the process for all of the floors. You can skip the parapet level. Do not forget the **00 GROUND FLOOR** and the **T.O. FOOTING** levels. These levels do not require an offset.

14. Select the **00 GROUND FLOOR** plan.

15. Right-click on one of the foundation walls and select **Select All Instances**.
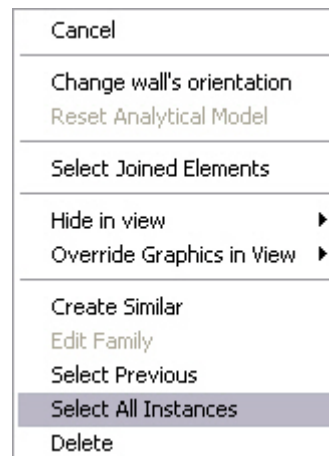
16. Click 🔲 (Element Properties).

17. Change the *Base Constraint* **to T.O. FOOTING** and the *Top Constraint* to **Up To level: 00 GROUND FLOOR**.
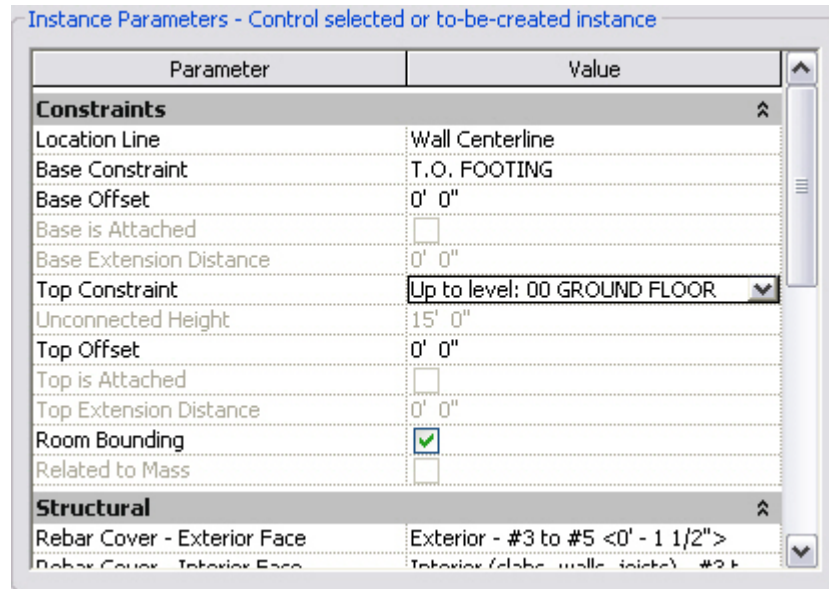


18. Click [ OK ].

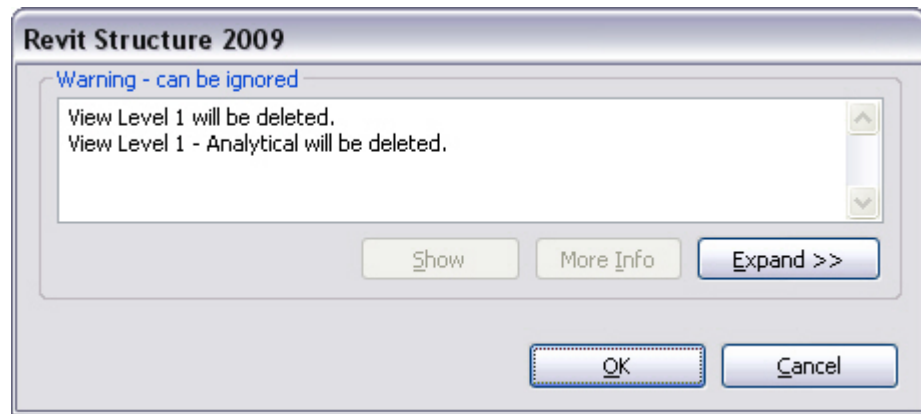19. Right-click on a column and select **Select All Instances**.



20. Click [⌨] (Element Properties).

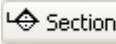21. Set the *Base Constraint* to **00 GROUND FLOOR** and the *Top Constraint* to **Roof**.

22. Click [ OK ].

23. Activate to the **South Elevation**.

24. Delete the existing **Level 1** and **Level 2**. You have replaced them with new levels.



25. Save the model.
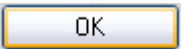
**Task 2 - Create Sections**

1. Select the **00 GROUND FLOOR** in the Project Browser.

2. Click [⬦ Section] in the *Basics* tab in the Design Bar.

3. Place a horizontal section through the middle of the building from left to right.

4. Select the section and break (⤴) it in the middle.

5. Select the blue grips (⬤) and drag the lines to an appropriate position.

6. On the right side of the section, select the Cycle icon (↻) to turn the right grid bubble on.

7. Right-click on the new section in the Project Browser and name it **Longitudinal Section**.
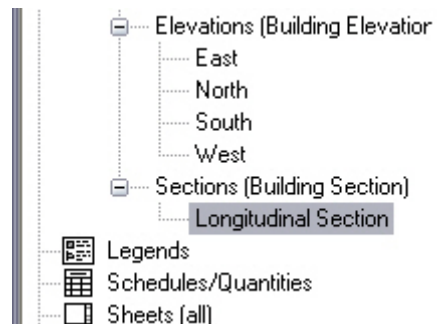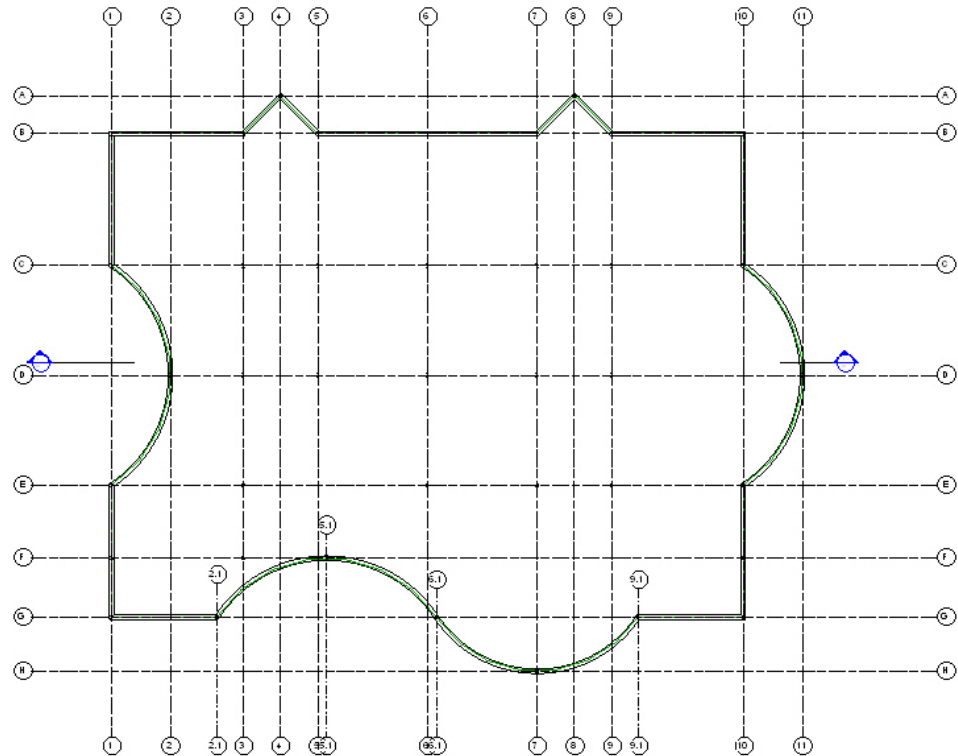
8. Add another section from top to bottom through the middle of the building.

9. Break the line (⌁).

10. Drag the grips (✛) to an appropriate position.

11. Cycle (↻) through the bottom tail until you see the target.

12. Rename the section as **Latitudinal Section**.

13. Open the **Longitudinal Section**.

14. Turn the detail level to ▨ (Fine).

15. Select the crop region, and stretch it up so all of the levels are visible.

16. Stretch it to the left and right, as needed.

17. Type **VG** to open the Visibility Graphics dialog box.

18. Select the *Revit Links* tab. Clear the **Syracuse Suites Architectural** item.

19. Click [ OK ].

20. Stretch the grid bubbles to the top of the view by selecting them and moving the blue grip.

21. Open the **Latitudinal Section**. You can double-click it on the section marker or in the Project Browser.

22. Repeat the previous steps to clean up the view.

23. Click ![Callout icon] Callout in the *View* tab in the Design Bar.

24. Draw a window around the lower left end of the foundation wall. This is the defining window for a callout. After the callout is placed, several blue grips appear. This enables you to stretch and manipulate the callout window.
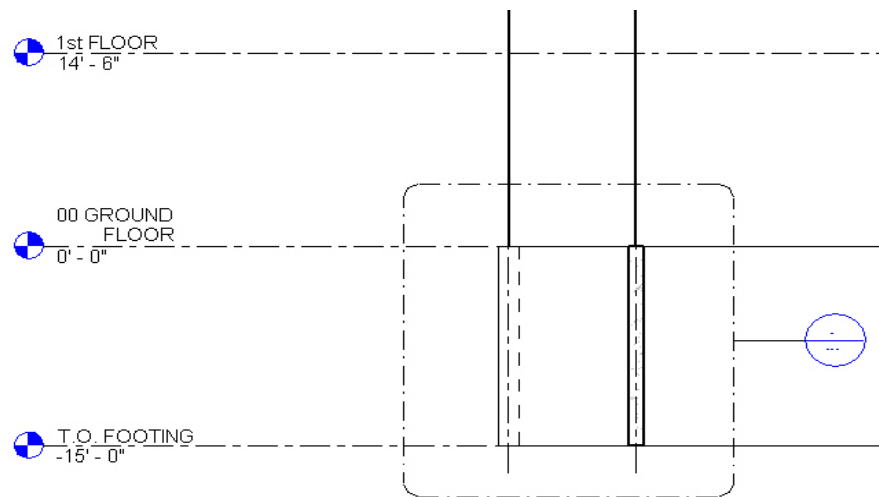


25. Rename the callout as **Typical foundation Detail**.

26. Save the model.

# Self Check:
# Setting up Levels and Working with Views

1. Levels can be created in a plan view. True or False?

2. If an elevation symbol is deleted from the plan, what happens to the elevation view it corresponds to?

3. How do you *break* a section line after you have placed it in the model?

4. How do you create a framing elevation?