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Autodesk® Revit® 2021 Structure Autodesk Certified Professional Exam Topics Review

Certification Preparation Guide
Imperial Units - 1st Edition

AUTODESK
Authorized Publisher

ASCENT - Center for Technical Knowledge®
Autodesk® Revit® 2021 Structure
Autodesk Certified Professional Exam Topics Review

Imperial Units - 1st Edition

Prepared and produced by:

ASCENT Center for Technical Knowledge
630 Peter Jefferson Parkway, Suite 175
Charlottesville, VA 22911

866-527-2368
www.ASCENTed.com

Lead Contributor: Cherisse Biddulph

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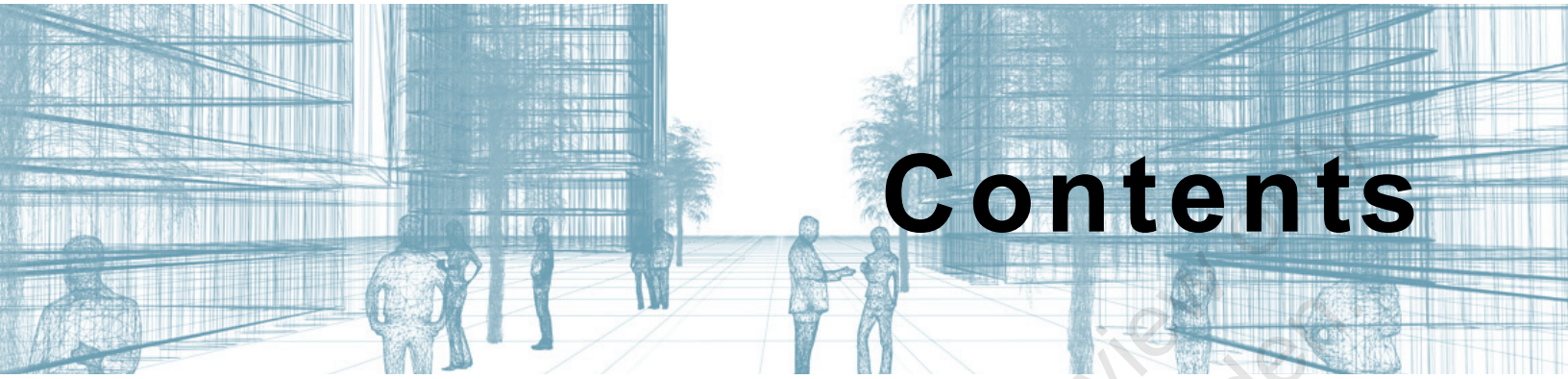

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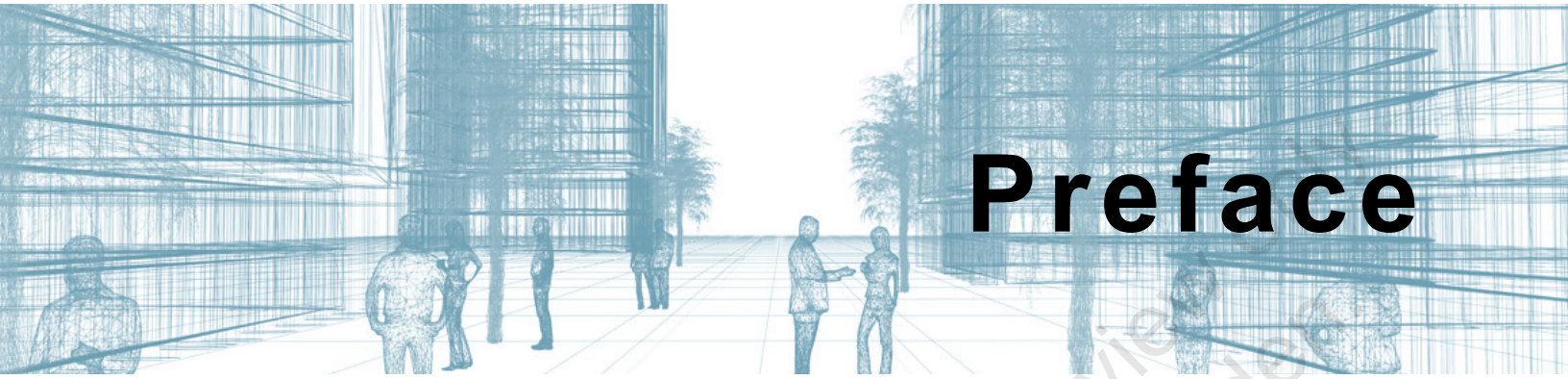

Preface

Autodesk® Revit® 2021 Structure: Autodesk Certified Professional Exam Topics Review is a comprehensive review guide to assist in preparing for the Autodesk Certified Professional: Revit for Structural Design exam. This certification preparation guide enables experienced users to review learning content from ASCENT that is related to the exam objectives. It is divided into sections that align with the topics in the exam. The beginning of each section includes a list of the objectives that are covered in that section and the corresponding chapter where the review content is presented.

This guide is intended for experienced users of the Autodesk Revit software. New users of the Autodesk Revit 2021 software should refer to the following ASCENT learning guides:

- *Autodesk Revit 2021: Fundamentals for Structure*
- *Autodesk Revit 2021 BIM Management: Template and Family Creation*
- *Autodesk Revit 2021: Collaboration Tools*
- *Autodesk Revit 2021 Architecture: Conceptual Design and Visualization*
- *Autodesk Revit 2021: Site Planning and Design*

Autodesk Certified Professional Exam Objectives

Exam Objective	Chapter(s)
1.1 Create and modify structural elements	
1.1.a Work with foundations	Ch. 1
1.1.b Work with structural floors	Ch. 2
1.1.c Work with structural walls and wall types	Ch. 1
1.1.d Work with structural columns	Ch. 3
1.1.e Work with structural framing and connections*	See p. 4-1
1.1.f Work with stairs	Ch. 5
1.1.g Understand the functions and limitations of model and detail groups	Ch. 6
1.1.h Work with reinforcement tools	Ch. 7

Exam Objective	Chapter(s)
1.2 Use and modify element materials	
1.2.a Associate a material with an object or a style	Ch. 8
1.2.b Create and edit a basic material and its properties	Ch. 8
1.2.c Load a material library	See p. 8-1
1.3 Use selection sets	
1.3.a Create, edit, and load selection sets	Ch. 6
2.1 Manage family categories and types	
2.1.a Configure family types	Ch. 1 Ch. 9
2.1.b Understand concepts of family categories and types	Ch. 9
2.1.c Differentiate between various types of families	Ch. 9
2.1.d Transfer system families between projects	Ch. 9
2.2 Use family parameters	
2.2.a Create or delete an instance or type parameter	Ch. 9
2.2.b Determine the appropriate parameter discipline, type, and grouping	Ch. 9
2.3 Create family content	
2.3.a Select the appropriate family template	Ch. 9
2.3.b Export a family to create a type catalog	Ch. 9
2.3.c Add reference planes, lines, and dimensions	Ch. 9
2.3.d Create geometry	Ch. 9
2.3.e Associate dimensional parameters	Ch. 9
3.1 Annotate views	
3.1.a Use dimensions	Ch. 10
3.1.b Create and modify annotation families for documentation	Ch. 10
3.1.c Create legend views	Ch. 10
3.1.d Annotate rebar	Ch. 10
3.2 Create and use detail components	
3.2.a Load and create a detail component family	Ch. 11
3.2.b Add a detail component	Ch. 11
3.2.c Define a repeating detail	Ch. 11

Exam Objective	Chapter(s)
3.3 Demonstrate an understanding of phases and design options	
3.3.a Use phase filters	Ch. 12
3.3.b Assign, display, and accept primary design options	Ch. 12
3.4 Use document revisions	
3.4.a Understand sheet issues/revisions	Ch. 13
3.4.b Create a revision cloud	Ch. 13
3.5 Configure export and print settings	
3.5.a Configure export settings	Ch. 13
3.5.b Configure custom print setup	Ch. 13
4.1 Apply advanced view techniques	
4.1.a Understand browser organization	Ch. 14
4.1.b Set view properties	Ch. 14 Ch. 19
4.1.c Apply visibility/graphic overrides	Ch. 9 Ch. 14
4.1.d Apply and edit view templates	Ch. 14
4.1.e Create and manage elevation and call-out views	Ch. 14
4.1.f Set up a sheet	Ch. 13
4.1.g Apply worksharing display modes to a view	Ch. 17
4.1.h Use duplicate views	Ch. 14
4.2 Manage, create, and modify schedules	
4.2.a Develop and customize schedules	Ch. 15
4.2.b Manipulate schedule data	Ch. 15
5.1 Link or import files	
5.1.a Understand the difference between imported and linked files	Ch. 16
5.1.b Manage linked files	Ch. 16
5.1.c Understand the concept of copy and monitor elements from a linked file	Ch. 16
5.2 Define worksharing concepts	
5.2.a Understand why worksharing features are used	Ch. 17

Exam Objective	Chapter(s)
5.3 Use levels and grids	
5.3.a Modify level and grid types	Ch. 18
5.3.b Edit level and grid properties	Ch. 18
5.4 Transfer project standards and establish shared coordinates	
5.4.a Transfer and review project standards	Ch. 9
5.4.b Understand the concept of shared coordinates	Ch. 19
5.5 Edit object styles	
5.5.a Control the appearance of elements at a project level	Ch. 14 Ch. 16 Ch. 20
5.6 Conduct maintenance on a Revit project	
5.6.a Understand and use purge	Ch. 3
5.6.b Understand and use the audit and compact tools	Ch. 17
5.6.c Assess review warnings in Revit	Ch. 16
5.6.d Check a model for interferences	Ch. 16
5.7 Understand shared, project, and global parameters	Ch. 10 Ch. 21

***Objectives marked with an asterisk are not explicitly covered in this learning guide. Refer to each section for more information.**

Prerequisites

- Access to the 2021.0 version of the software, to ensure compatibility with this guide. Future software updates that are released by Autodesk may include changes that are not reflected in this guide. The practices and files included with this guide are not compatible with prior versions (e.g., 2020).

Note on Software Setup

This guide assumes a standard installation of the software using the default preferences during installation. Lectures and practices use the standard software templates and default options for the Content Libraries.

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Lead Contributor: Cherisse Biddulph

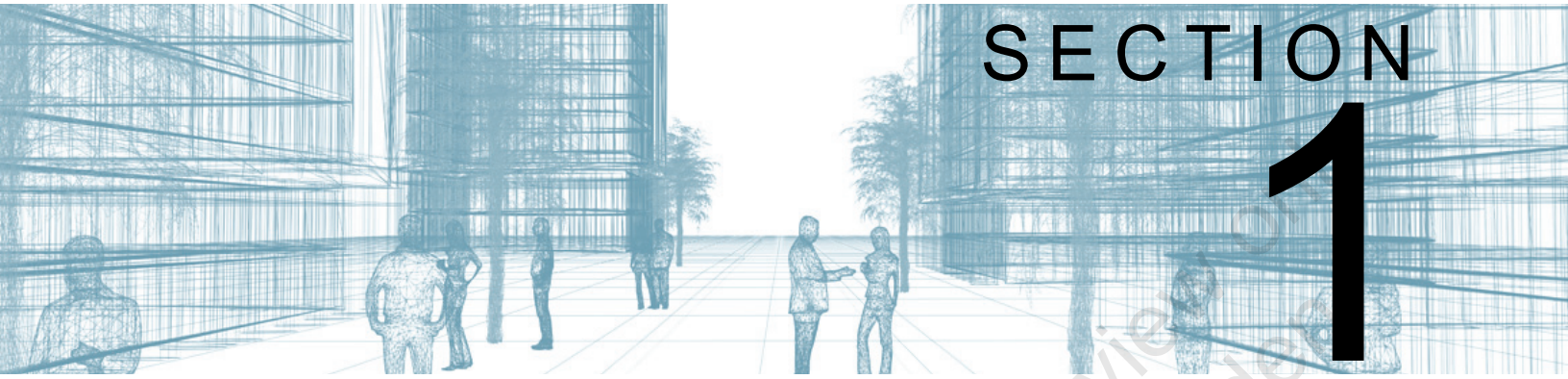
Cherisse is an Autodesk Certified Professional for Revit as well as an Autodesk Certified Instructor. She brings over 15 years of industry, teaching, and technical support experience to her role as a Learning Content Developer with ASCENT. With a passion for design and architecture, she received her Associate of Applied Science in Drafting and Design and has worked in the industry assisting firms with their CAD Management and software implementation needs as they modernize to a Building Information Modeling (BIM) design environment. Although her main passion is the Revit design product, she is also proficient in AutoCAD, Autodesk BIM 360, and Autodesk Navisworks. Today, Cherisse continues to expand her knowledge in the ever-evolving AEC industry and the software used to support it.

Cherisse Biddulph has been the Lead Contributor for *Autodesk Revit Structure: Autodesk Certified Professional Exam Topics Review* since 2020.

In This Guide

The following highlights the key features of this guide.

Feature	Description
Practice Files	The Practice Files page includes a link to the practice files and instructions on how to download and install them. The practice files are required to complete the practices in this guide.
Sections	This guide is divided into sections that align with the topics in the Autodesk Certified Professional exam. The beginning of each section includes a list of the exam objectives that are covered in that section and their corresponding chapters.
Chapters	A chapter consists of the following - Exam Objectives, Instructional Content, and Practices. • **Exam Objectives** lists the Autodesk certification exam objectives that are covered in the chapter. • **Instructional Content**, which begins right after Exam Objectives, refers to the descriptive and procedural information related to various topics. Each main topic introduces a product feature, discusses various aspects of that feature, and provides step-by-step procedures on how to use that feature. Where relevant, examples, figures, helpful hints, and notes are provided. • **Practice** for a topic follows the instructional content. Practices enable you to use the software to perform a hands-on review of a topic. It is required that you download the practice files (using the link found on the Practice Files page) prior to starting the first practice.

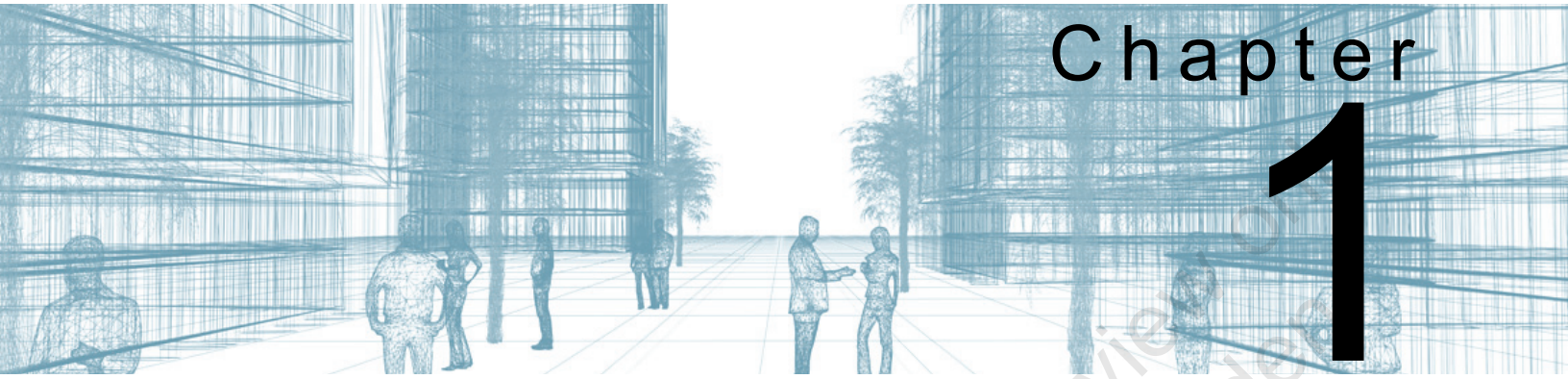


SECTION

1

Modeling and Materials

Exam Objective	Chapter(s)
1.1 Create and modify structural elements	
1.1.a Work with foundations	Ch. 1
1.1.b Work with structural floors	Ch. 2
1.1.c Work with structural walls and wall types	Ch. 1
1.1.d Work with structural columns	Ch. 3
1.1.e Work with structural framing and connections	See p. 4-1
1.1.f Work with stairs	Ch. 5
1.1.g Understand the functions and limitations of model and detail groups	Ch. 6
1.1.h Work with reinforcement tools	Ch. 7
1.2 Use and modify element materials	
1.2.a Associate a material with an object or a style	Ch. 8
1.2.b Create and edit a basic material and its properties	Ch. 8
1.2.c Load a material library	See p. 8-1
1.3 Use selection sets	
1.3.a Create, edit, and load selection sets	Ch. 6



Chapter 1

Foundations

Exam Objectives Covered in This Chapter

1.1.a Work with foundations
1.1.c Work with structural walls and wall types
2.1.a Configure family types*

***Note:** The objective *2.1.a Configure family types* is also covered in Chapter 9.

1.1 Modeling Walls

Walls in the Autodesk Revit software are more than just two lines on a plan. They are complete 3D elements that store detailed information, including height, thickness, and materials. This means they are useful in both 2D and 3D views. Structural walls (as shown in Figure 1–1) are bearing walls that can act as Exterior, Foundation, Retaining, and Shaft walls.

Walls are not automatically reinforced. You must apply reinforcement as separate elements.

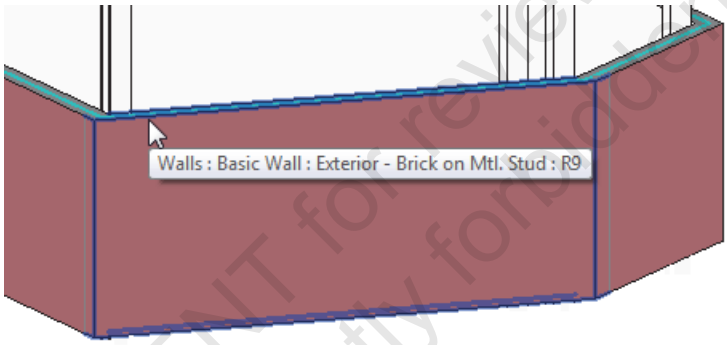


Figure 1–1

There are three broad categories of walls:

- *Basic walls:* Compound walls that contain on or more layers (e.g., blocks, air space, bricks, etc.).
- *Curtain walls:* Non-bearing walls made of glass with mullions.
- *Stacked walls:* Includes one wall type above another wall type, such as a brick wall over a concrete wall.

These three categories' *Cross-Section* can be modified to be **Vertical** or **Slanted**, as shown in Figure 1–2.

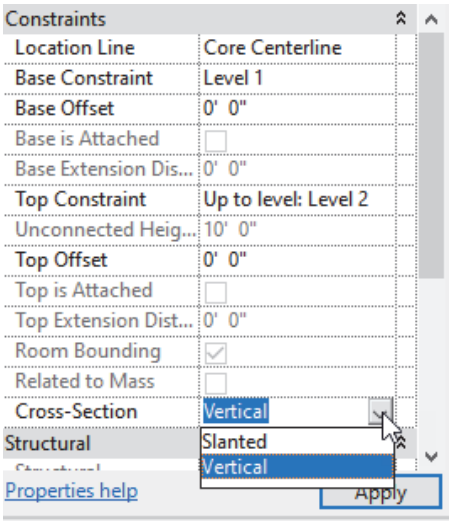


Figure 1–2

While some walls are made of only one material such as poured concrete other walls can be made of multiple layers such as block, air space, and brick all in one wall type. These compound walls can have different justifications, as shown in Figure 1–3.

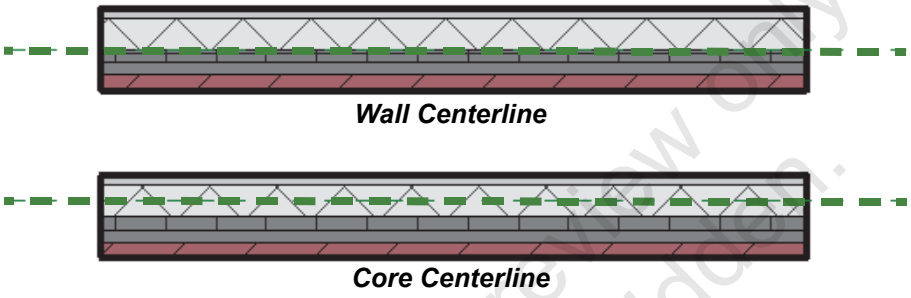


Figure 1–3

The core is typically the structural part of the wall.

How To: Model a Wall

1. In the *Structure* tab>Structure panel, click (Wall: Structural).
   - Architectural walls (which are created with the **Wall: Architectural** command) are typically non-bearing walls, such as curtain walls and partitions. They do not display when the view *Discipline* is set to **Structural**.
2. In the Type Selector, select a wall type, as shown in Figure 1–4.
   - You can use the Search box to quickly find specific types of walls.

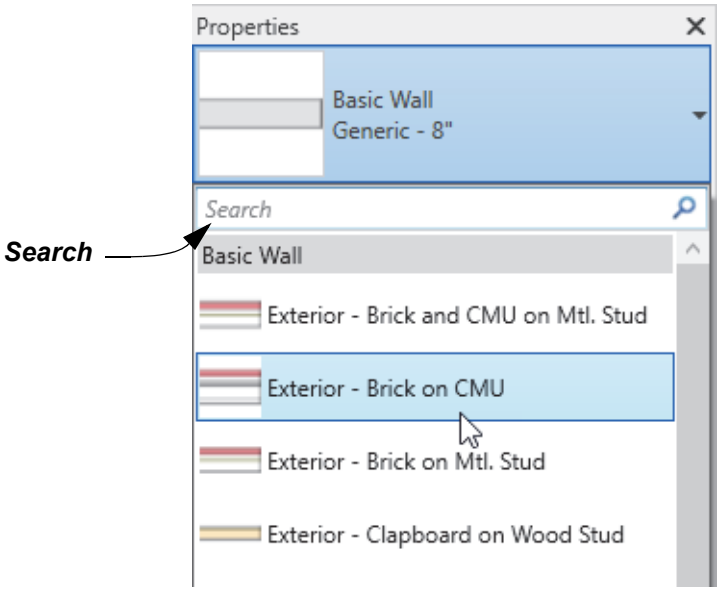


Figure 1–4

3. In the Options Bar (shown in Figure 1–5), specify the following information about the wall before you start drawing:

   - *Depth:* Set the depth of a wall to either Unconnected (with a specified distance) or to a level. This command can also be set to *Height*.
   - *Location Line:* Set the justification of the wall using the options shown in Figure 1–5.
   - *Chain:* Enables you to draw multiple connected walls.
   - *Offset:* Enables you to enter the distance at which a new wall is created from an existing element.
   - *Radius:* Adds a curve of a specified radius to connected walls as you draw.
   - *Join Status:* Select between **Allow**, which permits automatic wall joins, and **Disallow**, which prohibits the walls from cleaning up when they touch other walls.

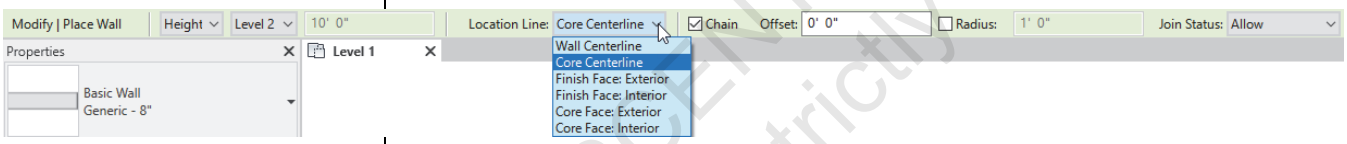


Figure 1–5

4. In the *Modify* | *Place Wall* tab>Draw panel (shown in Figure 1–6), select one of the options to create the wall.

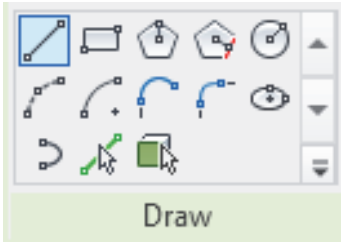


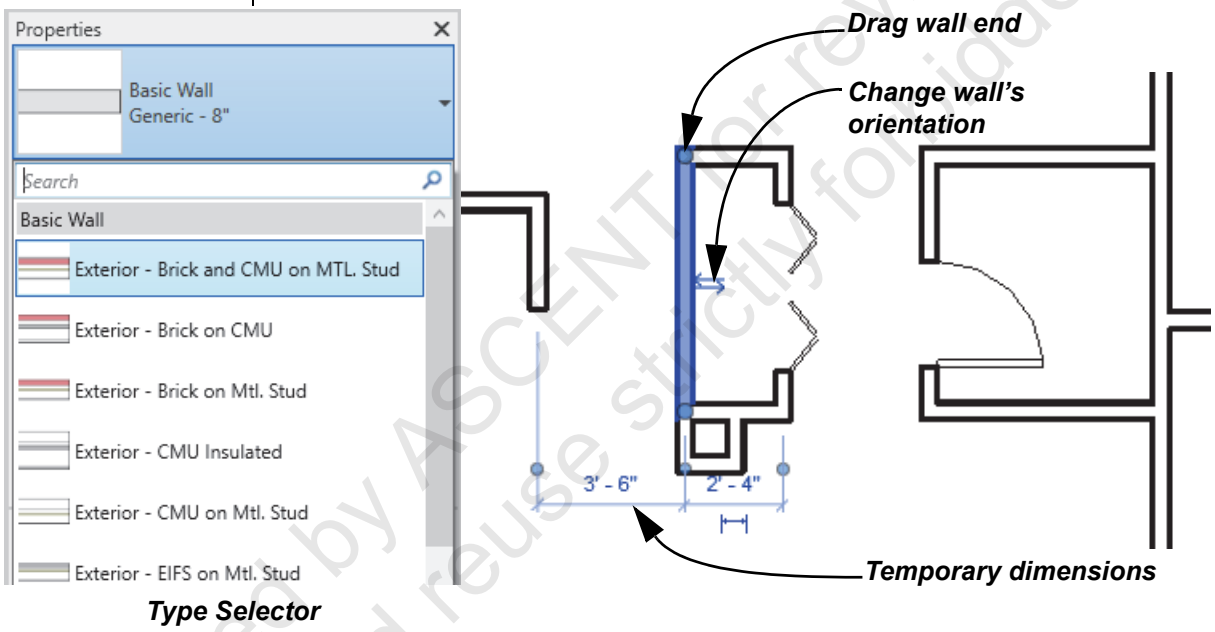
Figure 1–6

   - Use alignment lines, temporary dimensions, and snaps to place the walls.
   - When using the *Chain* option, press <Esc> to finish the string of walls and remain in the Wall command.
   - As you are sketching, you can press <Spacebar> to flip the orientation of compound walls.

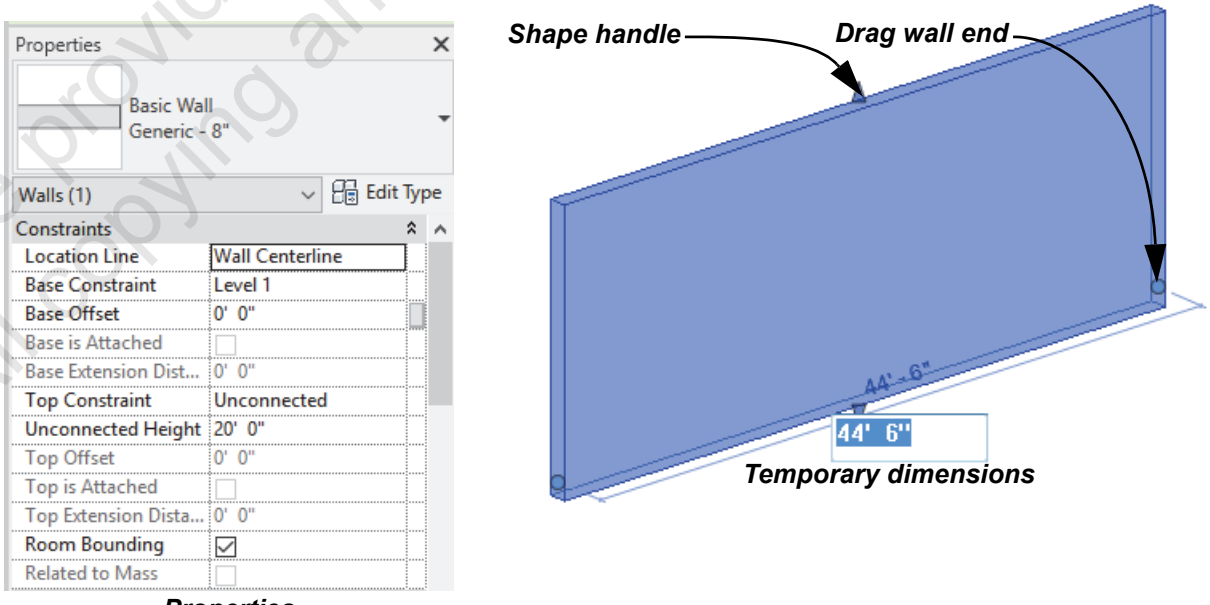
Modifying Walls

There are several methods of modifying walls, as shown in Figure 1–7. These methods include the following:

- Changing the type of wall using the Type Selector.
- Using controls and shape handles to modify the length and wall orientation.
- Using temporary and permanent dimensions to change the location or length of a wall in 2D and 3D.
- Modifying the wall Properties.



Type Selector



Properties

Figure 1–7

- To display the hatching in the walls in plan views, in the View Control Bar, set the *Detail Level* to **Medium** or **Fine**, as shown in Figure 1–8.

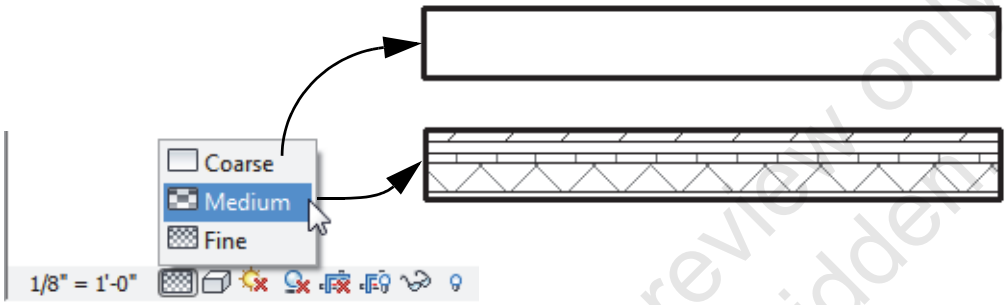


Figure 1–8

Wall Joins

The software automatically joins walls with common materials when they come together at an intersection, as shown on the left in Figure 1–9. However, there are times when you do not want the walls to clean up, such as when one fire-rated wall butts into another, or when a wall touches a column surround, as shown on the right in Figure 1–9.

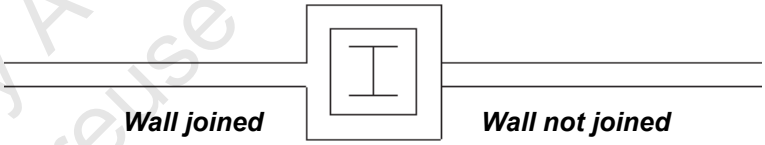


Figure 1–9

- While you are creating walls, change the *Join Status* to **Disallow** in the Options Bar.
- If a wall is already placed, right-click on the control at the end of the wall and select **Disallow Join**, as shown on the left in Figure 1–10. Once the end is not joined, you can drag it to the appropriate location, as shown on the right in Figure 1–10.

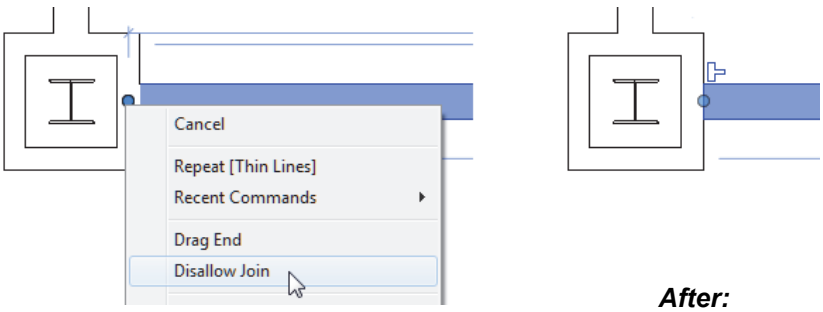


Figure 1–10

To rejoin the walls, click (Allow Join) or right-click on the end control and select **Allow Join**. Manually drag the wall back to where you want it to touch the target wall.

Hint: Using Thin Lines

The software automatically applies line weights to views, as shown for a section on the left in Figure 1–11. If a line weight seems heavy or obscures your work on the elements, toggle off the line weights. In the Quick Access Toolbar or in the *View* tab>Graphics panel, click (Thin Lines) or type **TL**. The lines display with the same weight, as shown on the right in Figure 1–11.

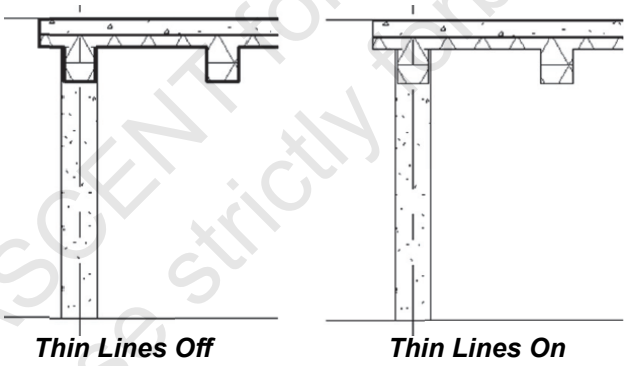


Figure 1–11

- The **Thin Line** setting is remembered until you change it, even if you shut down and restart the software.

Wall Openings

You can add openings in walls that are not windows or doors by using the **Wall Opening** tool. This creates rectangular openings for both straight and curved walls, as shown in Figure 1–12.

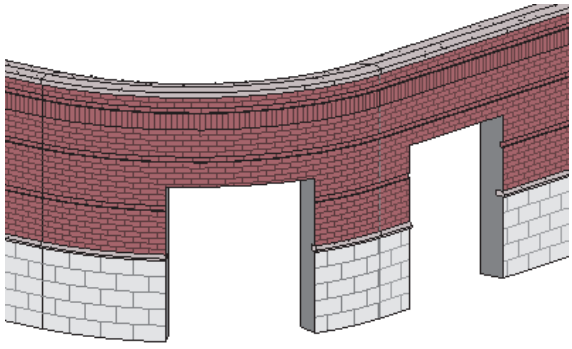


Figure 1–12

How To: Add Wall Openings

1. Open an elevation, section, or 3D view.
2. In the *Architecture* tab>Openings panel, click (Wall Opening).
3. Select the wall.
4. Pick two points on the diagonal to determine the opening size.

- You can use temporary dimensions to size the opening while in the command and both temporary dimensions and shape handles to modify the opening when it is selected, as shown in Figure 1–13.

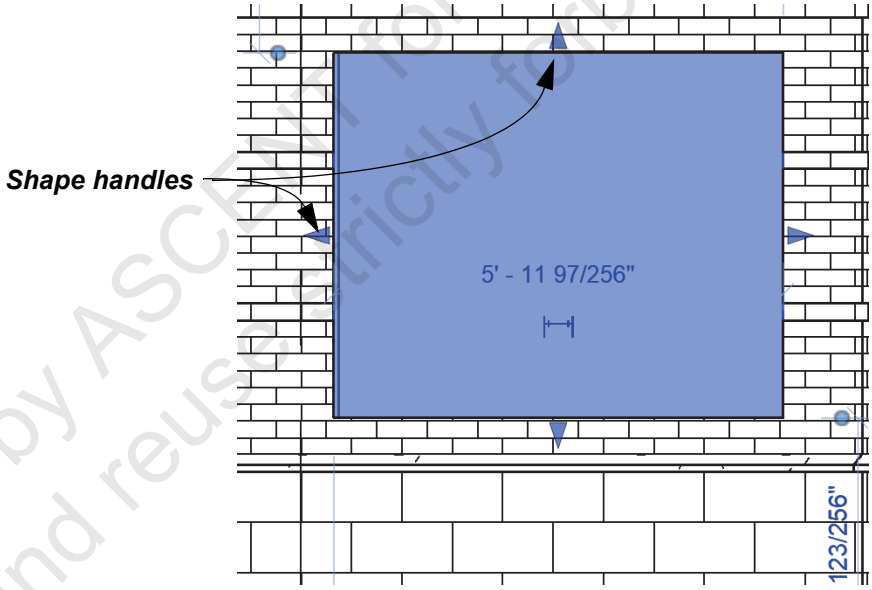


Figure 1–13

1.2 Creating Wall, Roof, Floor, and Ceiling Types

System families are modified in a project or template file by duplicating an existing element type. Some of these system families (such as walls, roofs, floors, and some ceilings) are compound or layer-based. For example, to modify a compound wall, you edit the type and select the **Structure** parameter. This opens the Edit Assembly dialog box (as shown in Figure 1–14) which enables you to specify each layer of the assembly.

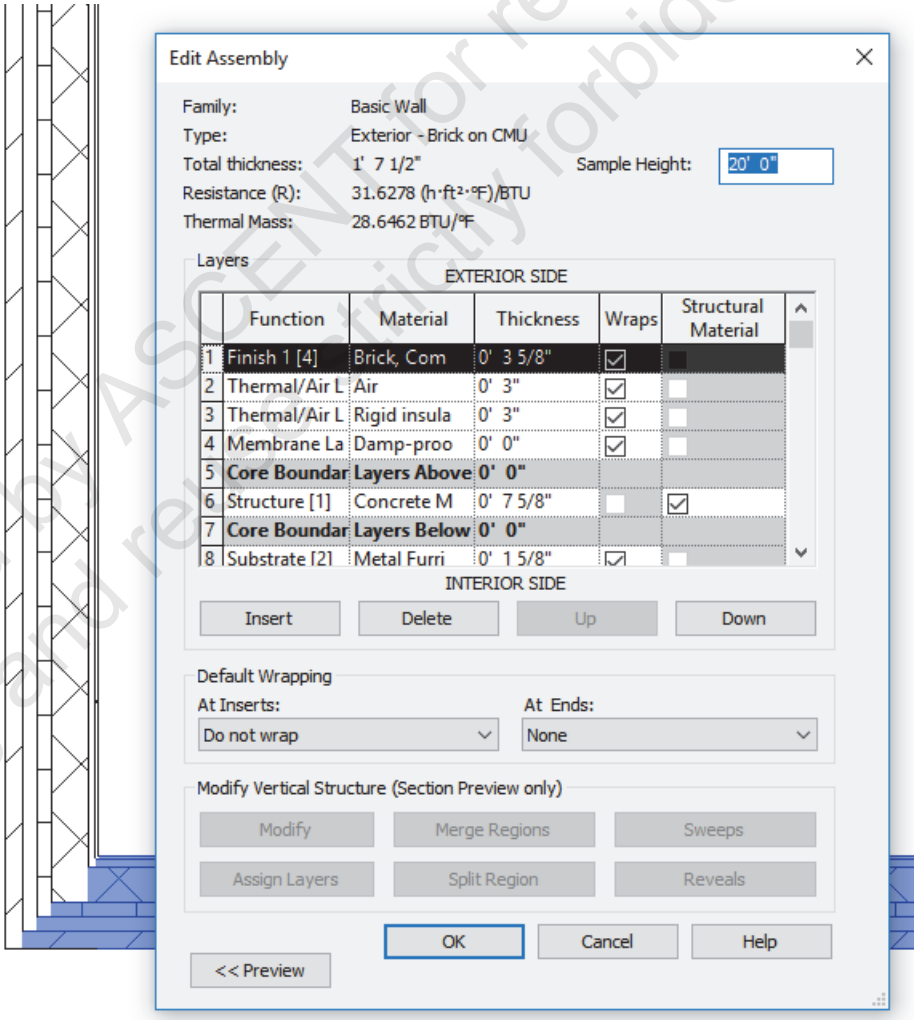


Figure 1–14

- Walls are used as the primary example, but floors, roofs, and compound ceilings follow the same pattern.
- Structural Floors often use profiles for metal decking. Creating this type of floor is covered in the profile families topic.

How To: Create a Compound Wall, Floor, Roof, or Ceiling

1. Start the wall, floor, roof or ceiling command.
2. In Properties, select a type similar to the one you want to create and click (Edit Type).
3. In the Type Properties dialog box, click **Duplicate...**.
4. In the Name dialog box, enter a name for the new type and click **OK**.
5. Next to the **Structure** parameter, click **Edit...**.
6. In the Edit Assembly dialog box, modify the layers of the assembly and click **OK**.
7. Modify any Type Parameters in the Type Properties dialog box.
8. Click **OK** to close the dialog box.

Hint: Basic Ceilings

The basic ceiling system family does not include a structure parameter and is intended to be used for open framed/exposed ceiling spaces where a ceiling truly would not exist. Instead, modify the Type by specifying a *Material* for the entire thickness of the ceiling.

Editing Wall, Roof, and Floor Assemblies

In the Edit Assembly dialog box, you can define the layers that make up the compound structure, as shown in Figure 1–15.

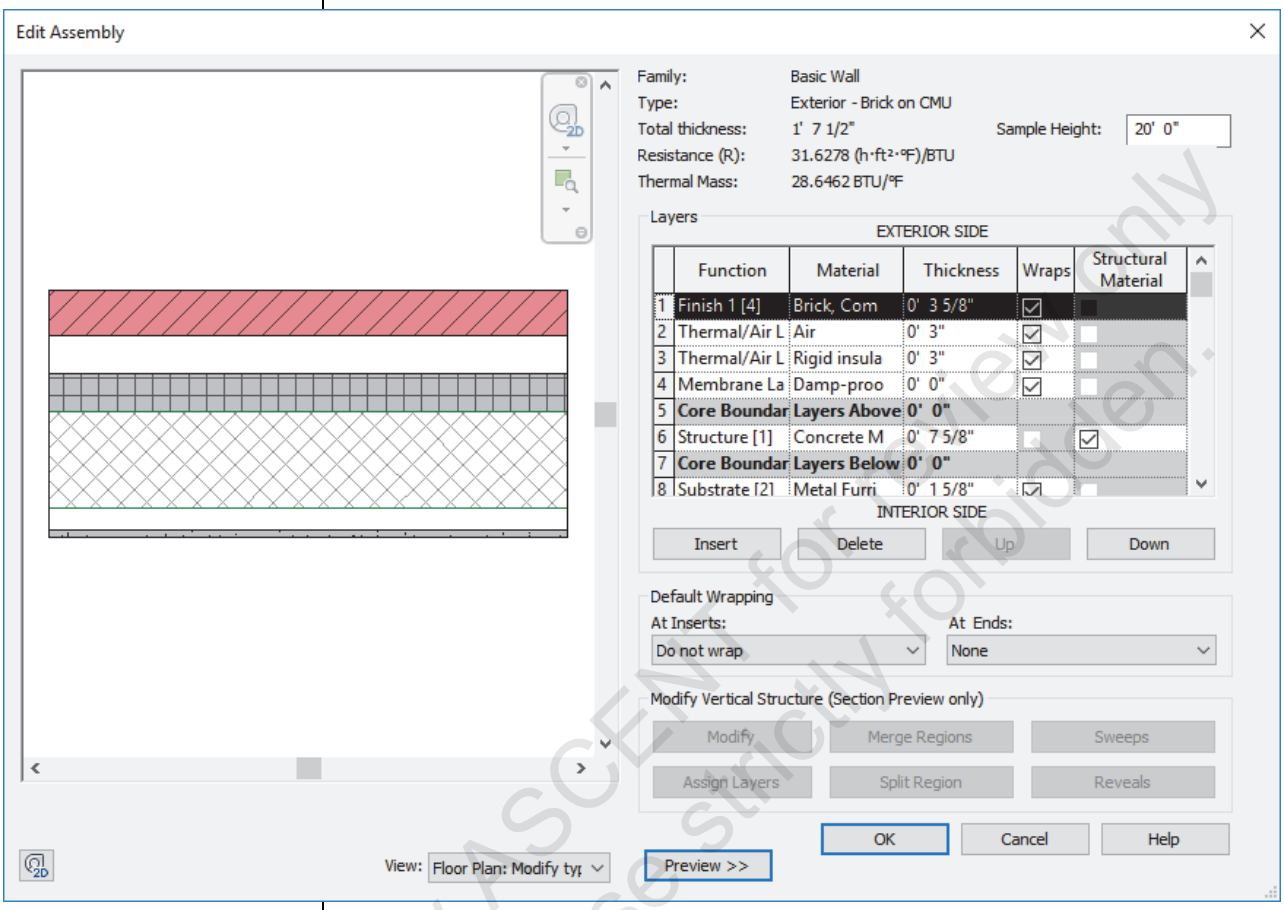


Figure 1–15

- To better visualize the wall, click **<< Preview** to open a view of the layers in the structure. You can preview the structure in a plan or section view, and zoom or pan in the preview screen.

Assembly Information

The top of the dialog box lists the *Family* (such as **Basic Wall** or **Floor**), the *Type* name that you assigned to the new type, and the *Total thickness* (which is the sum of the layers defined in the wall), as shown in Figure 1–16. It also includes *Resistance (R)* and *Thermal Mass* which are automatically calculated from the materials assigned to the layers. You can also set a *Sample Height* for your wall design.

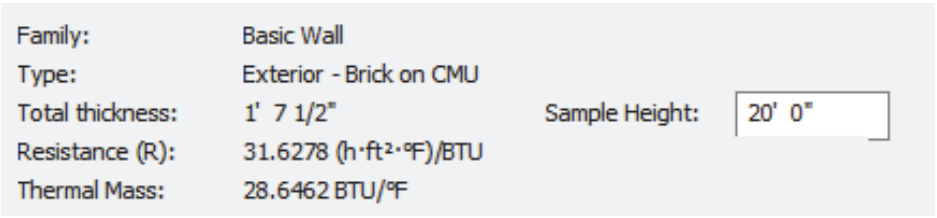


Figure 1–16

Layers

When you specify the layers for the compound element, you assign them a *Function*, *Material*, and *Thickness*, as shown in Figure 1–17.

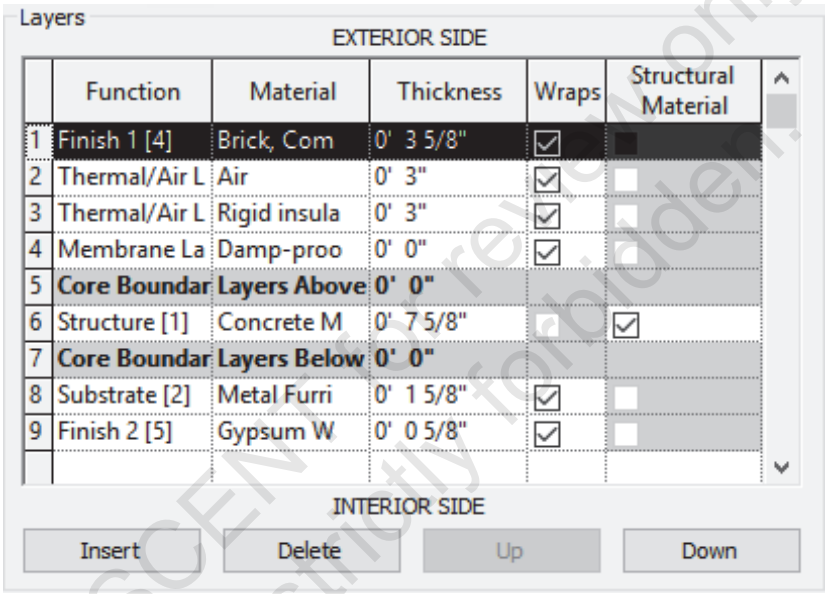
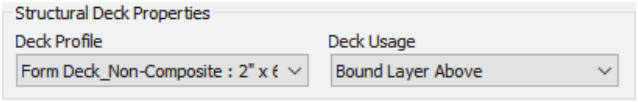


Figure 1–17

- Use the buttons to insert additional layers and to rearrange them in the layer list. You can also delete layers from the list.
- The *Core Boundary* function separates the core or structural portion of the wall, floor, roof, or ceiling from the layers above and below the wrapping; a heavier line displays when a plan or section view is cut.
- Editing a wall assembly works from the exterior side at the top of the list to the interior side at the bottom. For floors and roofs, you work around the layers above and below the wrap of the *Core Boundary*.

Options

Function	Select from a set list of functions in the drop-down list with a priority of highest (1) to lowest (5). High priority layers connect with another elements layer of the same priority before lower priority layers. For example, a wall with a layer of Structure [1] will connect first with another wall that has a layer of Structure [1].
Structure [1]	The structural support for the wall, floor, or roof.
Substrate [2]	A material that acts as a foundation for another material, such as plywoodsheathing or gypsum board.
Thermal/ Air Layer [3]	An open layer for rigid insulation or air space.
Finish 1 [4]	The exterior finish layer, such as brick for an exterior wall type, or one side of finish on an interior wall type. For Floors, Roofs, and Ceilings, represents the top finish layer of the assembly
Finish 2 [5]	The interior finish layer, such as drywall on the inside of an exterior wall type, or the opposite side of finish on an interior wall type. For Floors, Roofs, and Ceilings, represents the bottom finish layer of the assembly.
Membrane Layer	A vapor barrier. Typically, this layer represents vapor or moisture barrier/retarder within a wall, floor, roof, or ceiling assembly. Due to the barrier actually being so thin, it is set to a 0'-0" thickness and, therefore, it does not have a priority code.
Structural Deck (1)	(Floors only) A structural support based on a Deck Profile. You can also specify the Deck Usage with a Bound Layer Above or a Standalone Deck. 
Material	Select from a list of available materials. Layers clean up if they share the same material and function. If they do not, a line displays at the join.
Thickness	Set the thickness of the particular layer.
Wraps	Set up individual layers to wrap when the Default Wrapping area has been specified - select the Wraps option at the end of each layer.
Structural Material	When selected, the physical asset of the layers material is used in the structural analytical model.

Wall Only Options

Sample Height	Displays the height of a wall in section when you are creating it. It does not impact the height of the wall in the project but is used when editing the vertical material changes and additions of sweeps or reveals.
Default Wrapping	Controls how the layers within the assembly wrap at the end of a wall (At Ends) or an opening (At Inserts) within the wall.

- Wall wrapping can be set in the assembly or in the Type Properties, as shown in Figure 1–18.

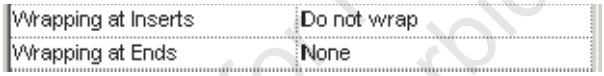


Figure 1–18

- Roofs, floors, and structural slabs have an additional parameter that relates to sloping for drains. When *Variable* is not selected, the slab is set to a constant thickness and the entire element slopes, as shown on the top in Figure 1–19. When *Variable* is selected, only the variable layer gets thicker or thinner, as shown on the bottom in Figure 1–19.

Variable not checked

Variable checked

Figure 1–19

Practice 1a

Create a Structural Floor Type

Practice Objectives

- Load a custom profile into a project.
- Create a new structural floor type using the profile.

In this practice, you will load a metal deck profile into a project, use it to create a new metal deck floor type, as shown in Figure 1–20, and test the new floor type.

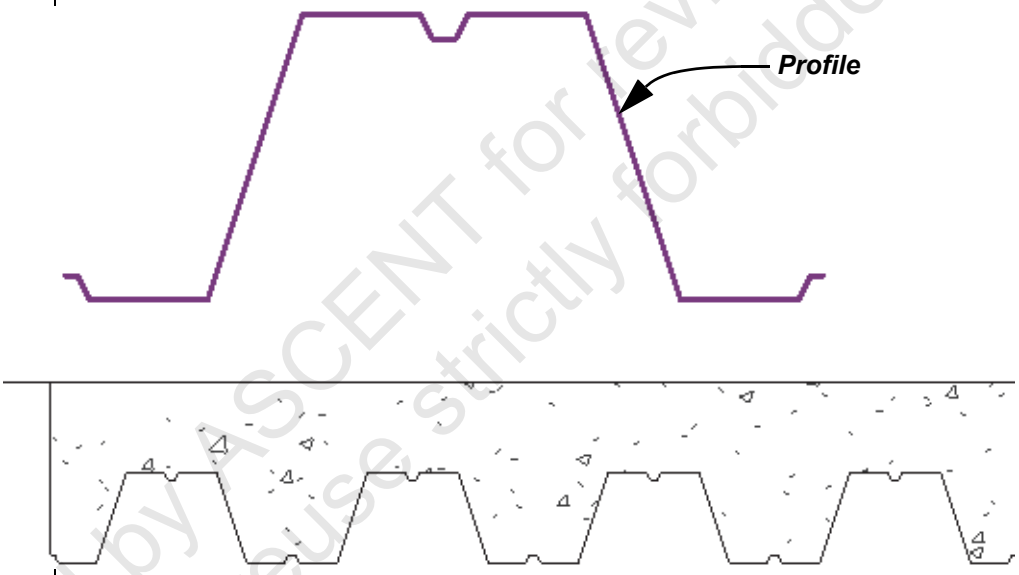


Figure 1–20

Task 1 - Load the a profile and create a structural floor.

1. Start a new project based on the default Structural template. You should be in the **Structural Plans: Level 2** view of the new project.
2. Save the project as **Custom Floor Types.rvt** in the practice files folder.
3. In the *Insert* tab>Load from Library panel, click (Load Family).
4. Navigate to the practice files *Families* folder, select **Custom-Metal-Deck-Profile.rfa**, and click **Open**.
5. In the *Structure* tab>Structure panel, click (Floor: Structural).

6. in the Type Selector, verify that **Floor: 3"LW Concrete on 2" Metal Deck** is selected.

7. In the *Modify* | *Create Floor Boundary* tab>Draw panel, use the **Line** or **Rectangle** tool to draw a slab of any shape or size, as shown in Figure 1–21.

Figure 1–21

   - If the span direction is not horizontal, in the *Modify* | *Edit Boundary* tab> Draw panel, click (Span Direction) and select a horizontal sketch line.

8. Click (Finish Edit Mode).

9. In the Quick Access Toolbar or *View* tab>Create panel, click (Section) and place a section vertically through the slab from north to south.

10. Open the new section view and change the *Scale* to **3/4"=1'-0"** and the *Detail Level* to **Fine**. You might need to adjust the crop region and/or zoom in on the slab section. It should look similar to the one shown in Figure 1–22.

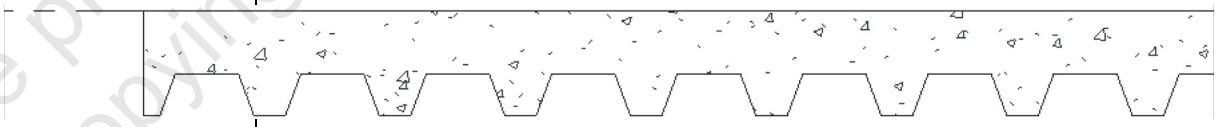


Figure 1–22

11. Save the project.

Task 2 - Create a new floor type.

1. Select the slab.

2. In Properties, click (Edit Type).

3. Duplicate the existing type. Name the duplicated type **6" Concrete on 3" Comp Metal Deck**.

4. In the Type Properties dialog box, next to the **Structure** parameter, click **Edit...**.

5. Modify the **Structure [1], Concrete, Lightweight - 4 ksi** layer to a *Thickness* of **6"**, as shown in Figure 1–23.

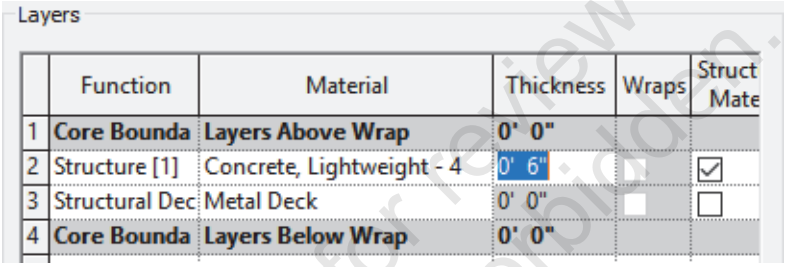


Figure 1–23

6. In the *Layers* area, select the **Structural Deck** layer.

7. In the *Structural Deck Properties* area, in the Deck Profile drop-down list, select **Custom-Metal- Deck-Profile: 3"**, as shown in Figure 1–24.

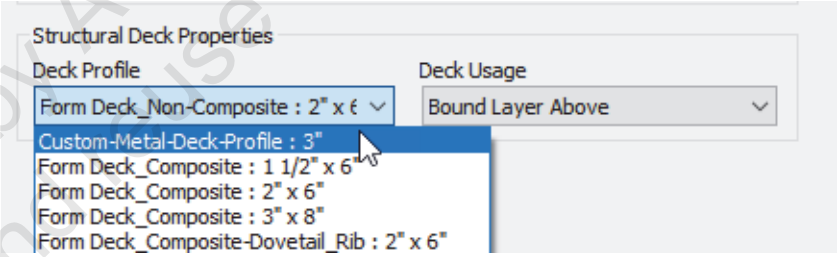


Figure 1–24

8. Click **OK** to close all of the dialog boxes. The section should display the metal deck profile that was previously created, as shown in Figure 1–25.

Figure 1–25

9. Save and close the project.

1.3 Vertically Compound Walls

Vertically Compound walls are made of regions of different materials, as well as optional permanent sweeps or reveals, as shown in Figure 1–26. Several options help you create these walls: **Modify**, **Split Region**, **Merge Regions**, **Assign Layers**, **Wall Sweeps**, and **Reveals**.

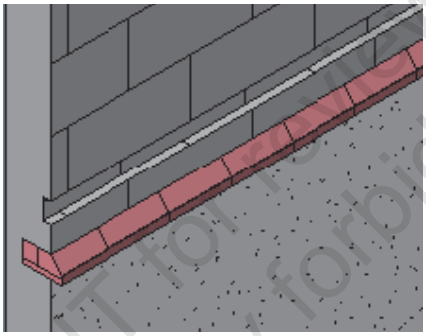


Figure 1–26

In the Edit Assembly dialog box, you must have the preview's *View:* set to **Section: Modify type attributes** to work with the *Modify Vertical Structure* tools, as shown in Figure 1–27.

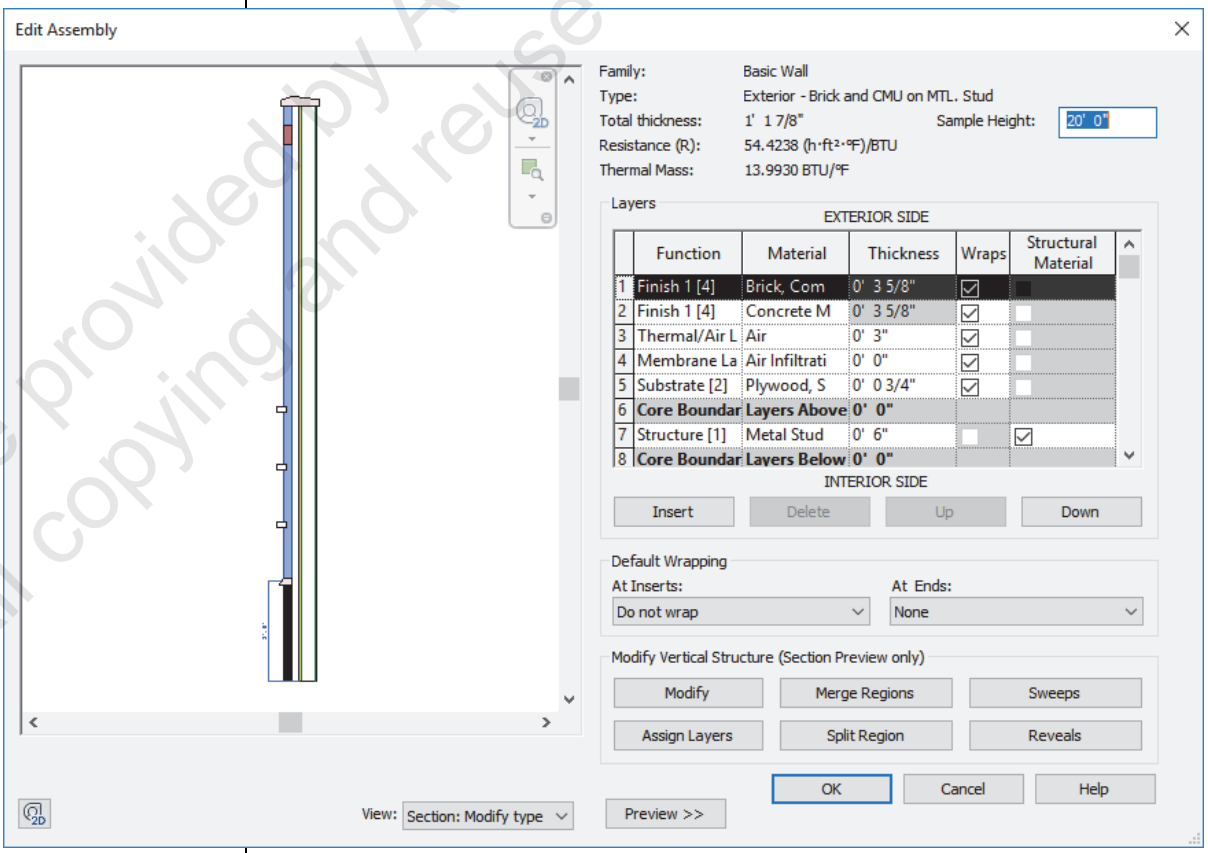


Figure 1–27

How To: Modify the Vertical Structure of a Wall Type

1. Edit the wall type you want to modify and edit the structure.
2. Create any additional layers that might be required.
3. In the Edit Assembly dialog box, open the preview and set the *View:* to **Section: Modify Type Attributes**. This activates the *Modify Vertical Structure* tools, as shown in Figure 1–28.

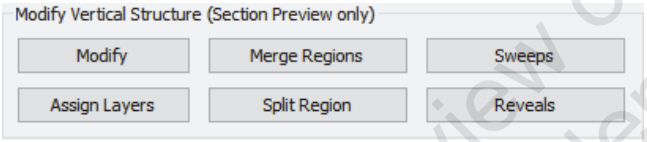


Figure 1–28

4. Zoom in to see the various layers.
5. In the Layers list, select the layer you want to work with.
6. Use the various tools that are outlined below.
7. Click **OK** until all of the dialog boxes are closed to save the wall type.

- When making changes to the vertical structure of a wall type it helps to have the *Sample Height* set to the shortest expected height for the wall type so the changes display more clearly.

How To: Split Regions and Assign Layers

1. In the Edit Assembly dialog box, click **Split Region**.
2. In the section preview, move the cursor to the edge of the wall, and a dimension will display. Move the cursor up the wall's edge to the place where you want the region to be cut. Select the wall's individual layer at the edge of that point, as shown in Figure 1–29.

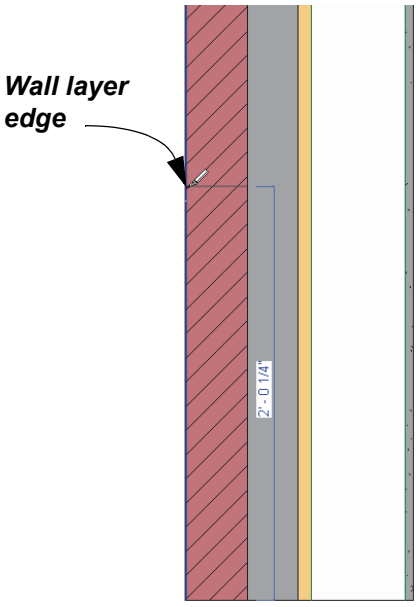


Figure 1–29

- When splitting regions, it is helpful to move the cursor along the outer edge of the region being split. Look for the horizontal line across the region before picking the point to split, as shown in Figure 1–30.

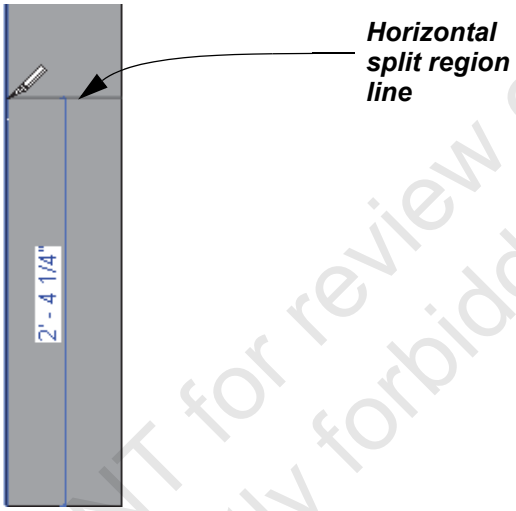


Figure 1–30

3. In the *Layers* area, highlight the layer that you want to use and click **Assign Layers**.
4. In the section view, select the wall part that you want to change and click (Modify).

- You can create as many split regions as required in one layer.
- To change the dimension, click (Modify) and select the border between the two regions that have been split. Then, select the temporary dimension you want to adjust and type a new distance using the temporary dimension, as shown in Figure 1–31.

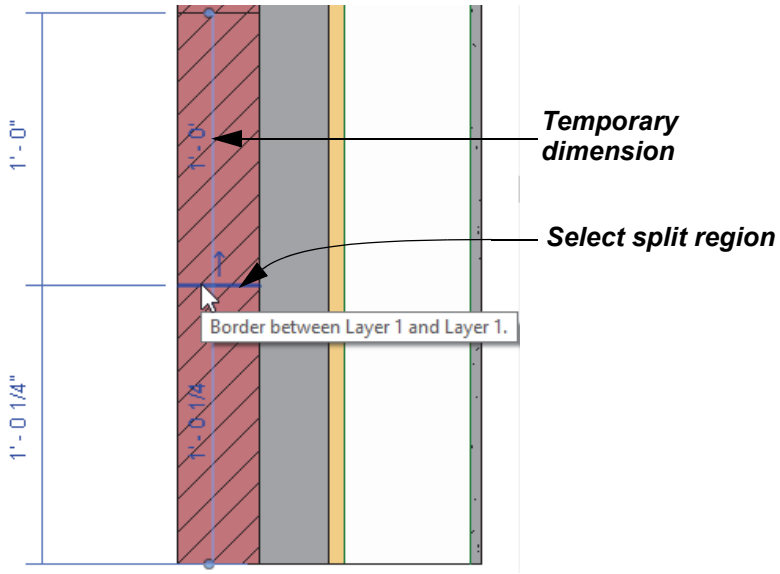


Figure 1–31

- You can modify the width of the layer in the section view by clicking **Modify**, then selecting the outer boundary (left edge of the region) to display temporary dimensions (as shown in Figure 1–32) to change the width. Note that this will change the width for both regions stacked on top of one another.

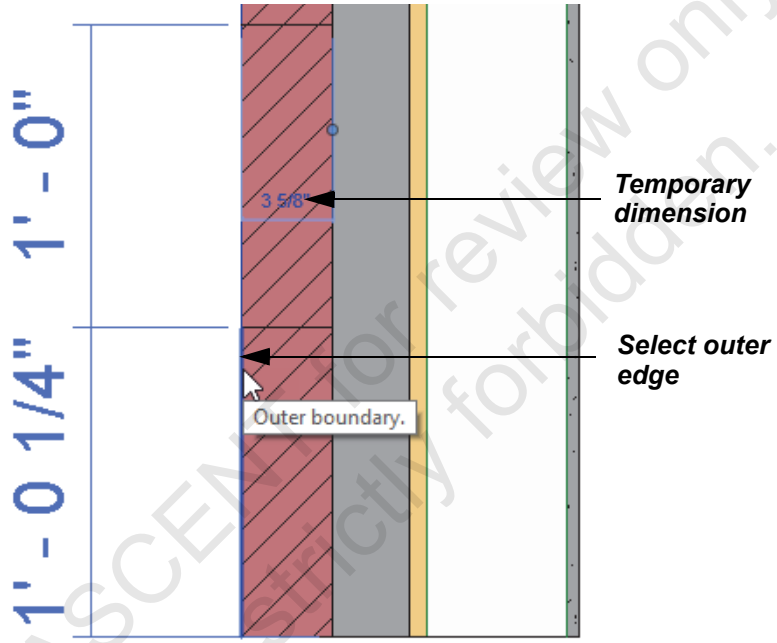


Figure 1–32

- You can add additional layers and assign functions as required. In the example shown in Figure 1–33, two layers have the function **Finish 1 [4]**, and each layer has a different material. When a region is split, the thickness of the original layer is set to **Variable** and cannot be modified in the *Layers* area of the Edit Assembly dialog box.

*Do not select more than you need. There is no **Undo** option in this dialog box.*

Layers

EXTERIOR SIDE

	Function	Material	Thickness	Wraps	Structural Material
1	Finish 1 [4]	Masonry - Bric	Variable	☑	☐
2	Finish 1 [4]	Concrete	0' 3 5/8"	☑	☐
3	Thermal/Air Layer	Insulation / Th	0' 3"	☑	☐

Figure 1–33

Merging Regions

To link regions together, click **Merge Regions** and select the line between the layers you want to merge, as shown in Figure 1–34. As you move the cursor across the region boundary that is to be merged, watch the arrow cursor. It tells you which way the merge direction will take place. The tooltip also tells you names of the layers that are being merged. You can only merge layers that are next to each other.

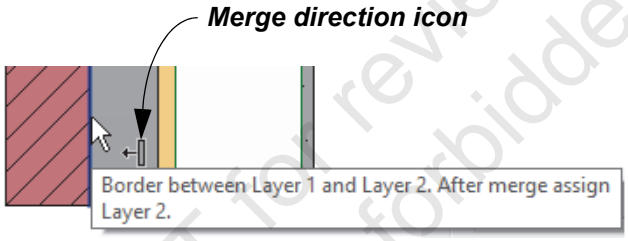


Figure 1–34

- You can merge layers vertically or horizontally. You need to split the regions horizontally before merging some of the vertical lines.

Wall Sweeps and Reveals

When you split regions, the parts you create cannot have different widths. To create a protrusion or a reveal, add a wall sweep or reveal using a profile, as shown in Figure 1–35. You can also specify the material (sweeps only), orientation, offset, distance from top or base, if the wall profile will be on the exterior or interior side, and the option to flip the wall profile.

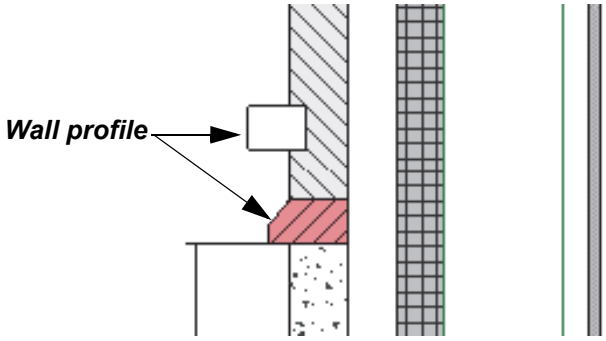


Figure 1–35

How To: Add a Sweep

1. In the Edit Assembly dialog box, click **Sweeps** to open the Wall Sweeps dialog box.
2. In the Wall Sweeps dialog box, click **Add**. A default row is added.

3. In the *Profile* column, select from the drop-down list of the existing profiles in the project. Click **Load Profile** to add a profile.
4. Continue setting up the profile by selecting a *Material* and setting the *Distance* from the top or bottom, interior or exterior *Side*, and the *Offset* from that side, as shown in Figure 1–36. If needed, place a check mark in the *Flip* column to flip the profile.

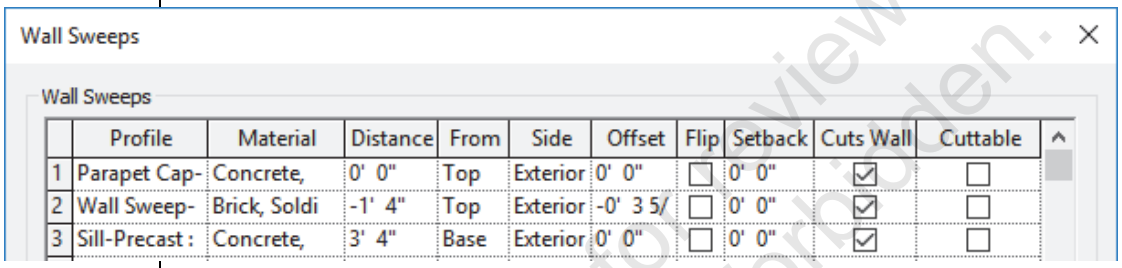


Figure 1–36

5. Click **Apply** to see the sweep in the preview before you click **OK** to finish.

- Reveals work the same way, except that you do not assign a material to a reveal. The whole shape of the reveal profile is visible in the section view, but you only see the cut in the project.

Practice 1b

Create a Vertically Compound Wall

Practice Objective

- Create a vertically compound wall.

In this practice, you will modify the vertical structure of a wall type using **Split Region** and **Assign Layers**.You will then add wall sweeps and reveals, as shown in Figure 1–37.

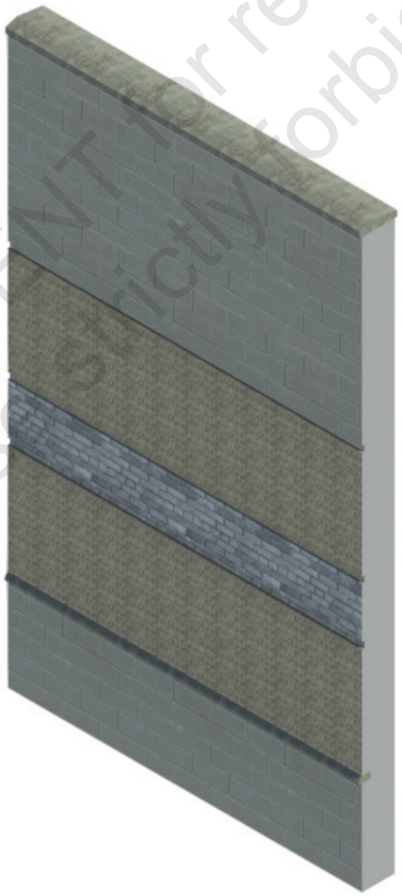


Figure 1–37

Task 1 - Add materials to the project.

1. Open **Custom Wall Types-Vertical.rvt** from the practice files folder.
2. In the *Manage* tab>Settings panel, click (Materials).

3. At the bottom of the Material Browser dialog box, expand the Material Library section as shown in Figure 1–38.

Figure 1–38

4. If you do not see the AEC Materials library at the bottom of the dialog box, click **Shows/Hides library tree**, as shown in Figure 1–39.

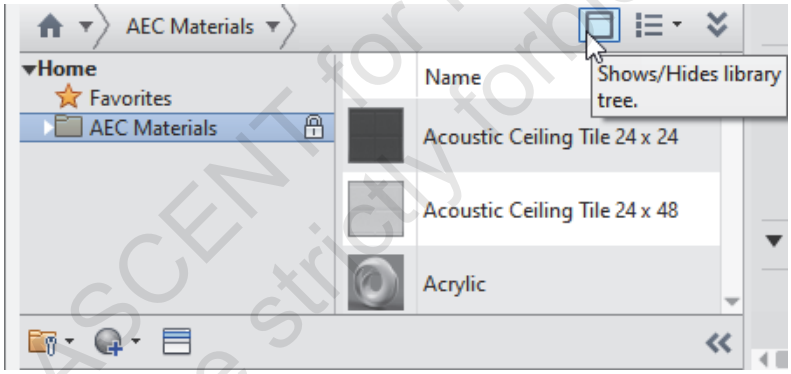


Figure 1–39

5. In the AEC Material library, select the *Masonry* folder.

6. In the *Name* list scroll down and select **Brick, Common, Grey** and click (Adds material to document), as shown in Figure 1–40.

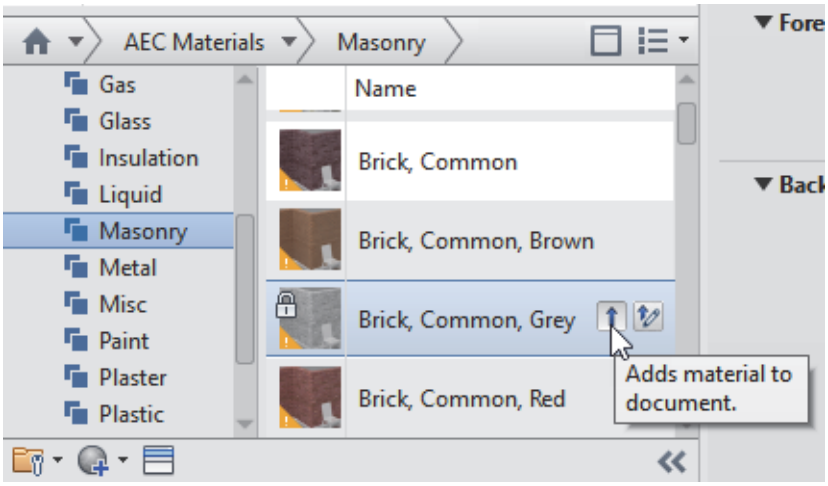


Figure 1–40

7. Repeat the process and add the **CMU, Split Face** material to the project and click **OK**.
8. Save the project.

Task 2 - Split regions in the wall type section.

1. Select the existing wall and in the Type Selector, verify that it is set to **Exterior - Custom** and click (Edit Type).
2. Edit the *Structure* parameter.
3. Set the *Sample Height* to **30'-0"**.
4. Click **<< Preview** and set the *View:* to **Section: Modify type attributes**.
5. In the *Layers* area, insert two additional layers with the *Function* **Finish1 [4]** on the exterior side of the structure. Set the materials as shown in Figure 1–41. Do not specify a thickness. Once you apply it to part of the split region, it takes on the appropriate thickness.

Layers

EXTERIOR SIDE

	Function	Material	Thickness	Wraps
1	Finish 1 [4]	CMU, Split Face	0' 0"	☑
2	Finish 1 [4]	Brick, Common, Grey	0' 0"	☑
3	Finish 1 [4]	Concrete Masonry Units	0' 3 5/8"	☑
4	Thermal/Air Layer	Air	0' 3"	☑
5	Membrane Layer	Air Infiltration Barrier	0' 0"	☑
6	Substrate [2]	Plywood, Sheathing	0' 0 3/4"	☑
7	**Core Boundary**	**Layers Above Wrap**	**0' 0"**	
8	Structure [1]	Metal Stud Layer	0' 6"	☐
9	**Core Boundary**	**Layers Below Wrap**	**0' 0"**	
10	Membrane Layer	Vapor Retarder	0' 0"	☑
11	Finish 2 [5]	Gypsum Wall Board	0' 0 1/2"	☑

Figure 1–41

6. In the *Modify Vertical Structure* area, click **Split Region**.

7. In the Section view preview, move the cursor along the left edge of the exterior finish region (the leftmost region) to a point **3'-6"** above the base. Zoom in to ensure that you split the finish layer and not the central structural layer. Add the three additional splits to the same layers, as shown in Figure 1–42.

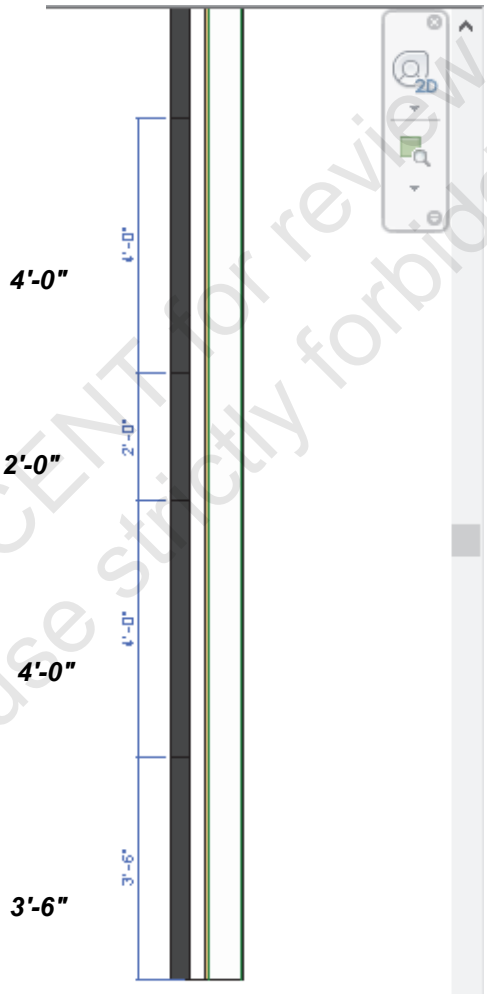


Figure 1–42

Task 3 - Assign layers in a wall type.

1. Zoom in so you can see the areas that have been split, as shown in Figure 1–43.
2. In the *Layers* area, select the **Brick, Common, Gray** layer on the Exterior Side.
3. In the *Modify Vertical Structure* area, click **Assign Layers**.

4. In the preview, select the exterior edge of the **2'-0"** part of the exterior wall where you want the finish applied. The section should highlight as shown in Figure 1–43.

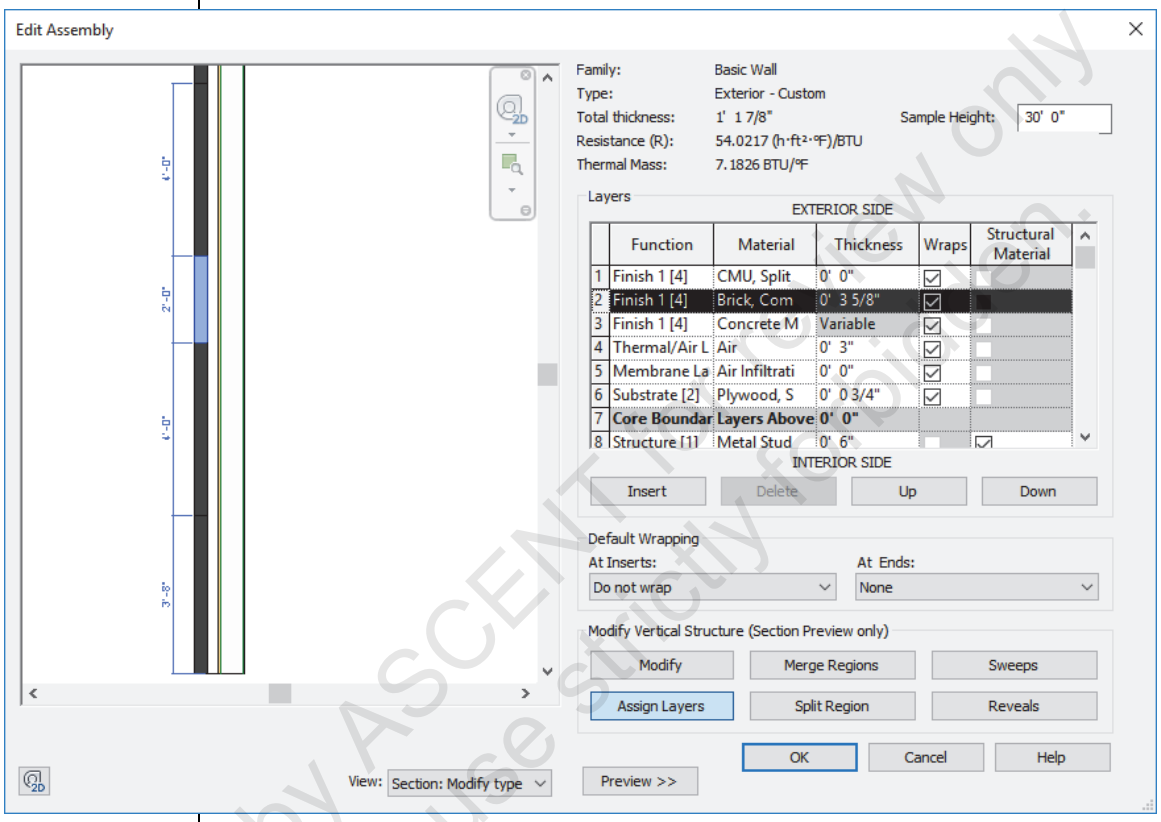


Figure 1–43

5. Repeat with the **CMU, Split face** material in each of the 4'-0" sections. The top and bottom of the wall remain using the **Concrete Masonry Units** material.

6. Click (Modify) to finish the process. The list of layers displays as shown in Figure 1–44.

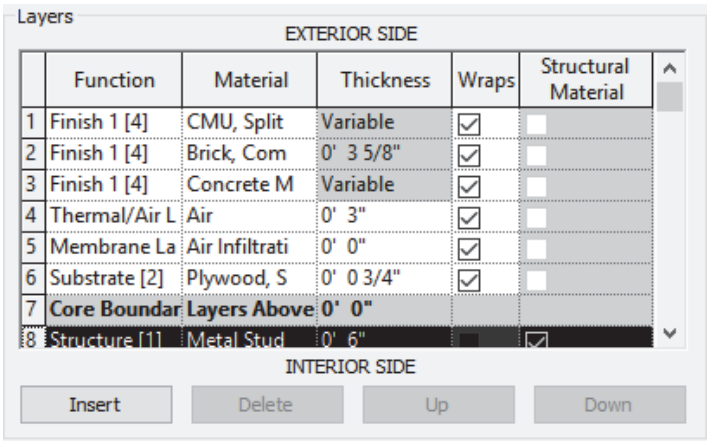


Figure 1–44

7. Click **OK** twice to close the dialog boxes.
8. Set the *Visual Style* of the 3D view to **Realistic**, as shown in Figure 1–45, to see the layout of the materials.

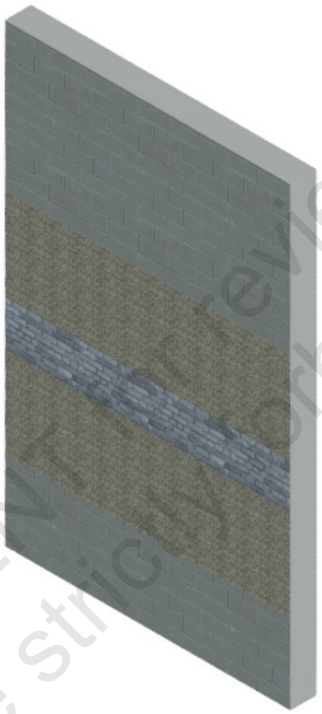


Figure 1–45

9. Save the project.

Task 4 - Add sweeps and reveals to the wall type.

1. Edit the structure of the same wall type.
2. In the Edit Assembly dialog box, *Modify Vertical Structure* area, click **Sweeps**.
3. In the Wall Sweeps dialog box, click **Add** and set up two wall sweeps using the following information, as shown in Figure 1–46, and leave other options at their default settings.

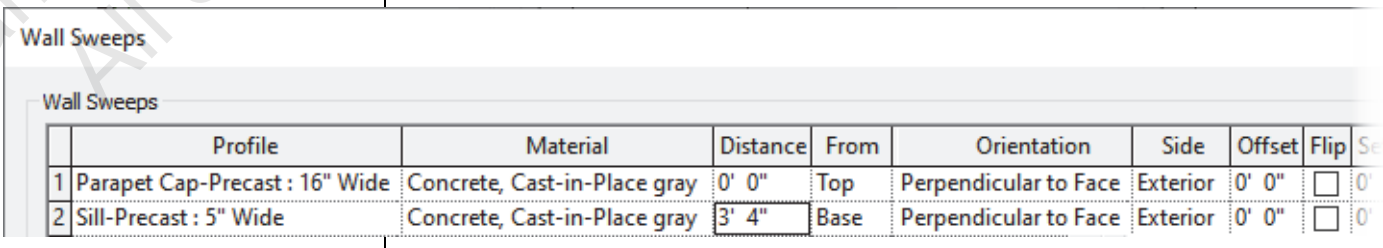


Figure 1–46

4. Click **OK** to exit the Wall Sweeps dialog box.

5. In the preview of the Edit Assembly dialog box, you should see the two sweeps when you zoom in, as shown for the sill in Figure 1–47 and the cap in Figure 1–48.

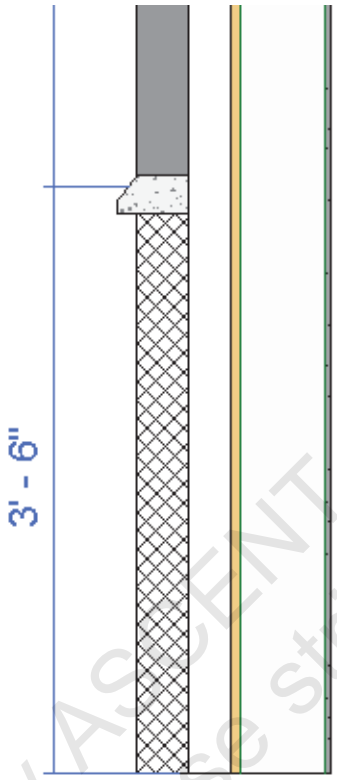


Figure 1–47

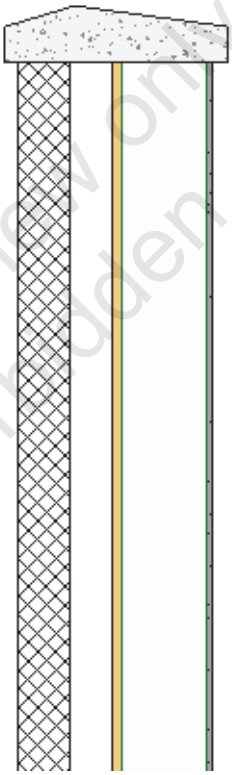
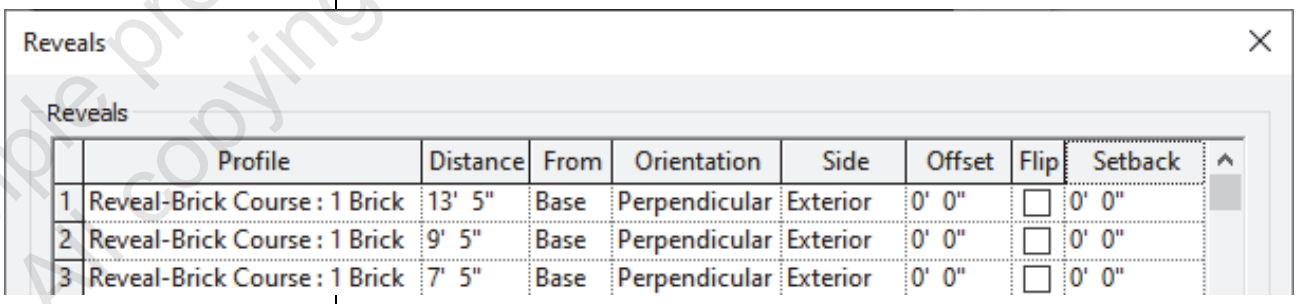


Figure 1–48

6. In the Edit Assembly dialog box, *Modify Vertical Structure* area, click **Reveals**.

7. In the Reveals dialog box click **Add** and set up three reveals as shown in Figure 1–49. Click **OK**.



	Profile	Distance	From	Orientation	Side	Offset	Flip	Setback
1	Reveal-Brick Course : 1 Brick	13' 5"	Base	Perpendicular	Exterior	0' 0"	☐	0' 0"
2	Reveal-Brick Course : 1 Brick	9' 5"	Base	Perpendicular	Exterior	0' 0"	☐	0' 0"
3	Reveal-Brick Course : 1 Brick	7' 5"	Base	Perpendicular	Exterior	0' 0"	☐	0' 0"

Figure 1–49

8. Click **OK** twice to close the dialog boxes. The wall displays complete with sweeps and reveals.

9. Save and close the project.

1.4 Stacked and Embedded Walls

A vertically stacked wall is a specific system family that takes two or more existing basic walls and stacks them on top of each other at specific heights, as shown in Figure 1–50. One wall must be variable in height. The basic wall types have to be in place before you create the stacked wall. These walls are created by copying and editing an existing Vertically Stacked Wall type.

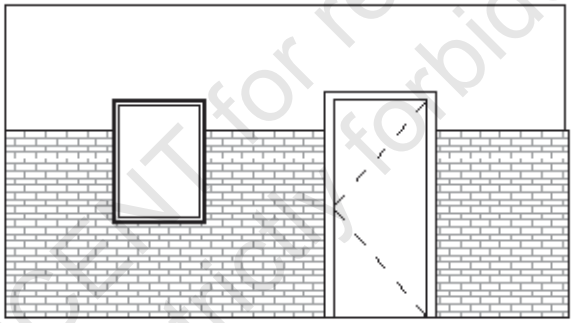


Figure 1–50

How To: Create a Vertically Stacked Wall

1. Start the **Wall** command.
2. In Properties Type Selector, select an existing stacked wall type and click (Edit Type).
3. Duplicate the wall type and give it a new name.
4. In the Type Properties dialog box, next to the **Structure** parameter, click **Edit...**.
5. In the Edit Assembly dialog box, set the *Offset* for how the walls should align when they are stacked, and a *Sample Height* for the preview, as shown in Figure 1–51.

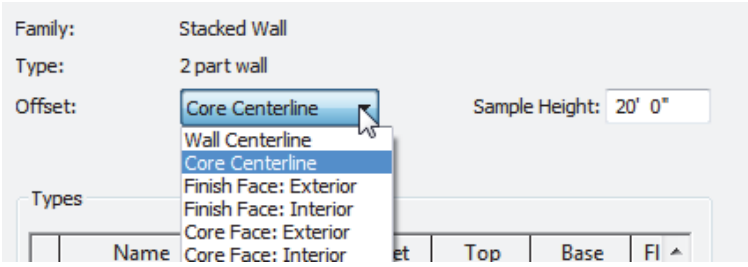


Figure 1–51

6. In the *Name* column, select the basic wall types you want to add to the stacked wall, as shown in Figure 1–52.

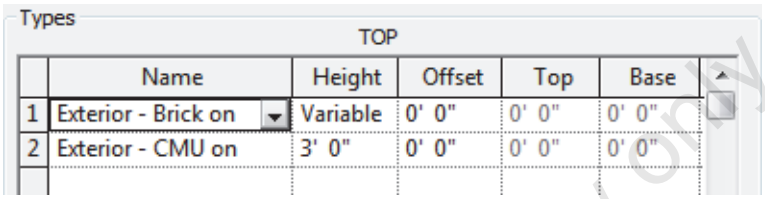


Figure 1–52

7. For each wall type, set the appropriate height and location (Up or Down) in the list. One height must be variable. Set the *Offset* of the wall as required.
8. Click **<< Preview** to see the wall, as shown in Figure 1–53.

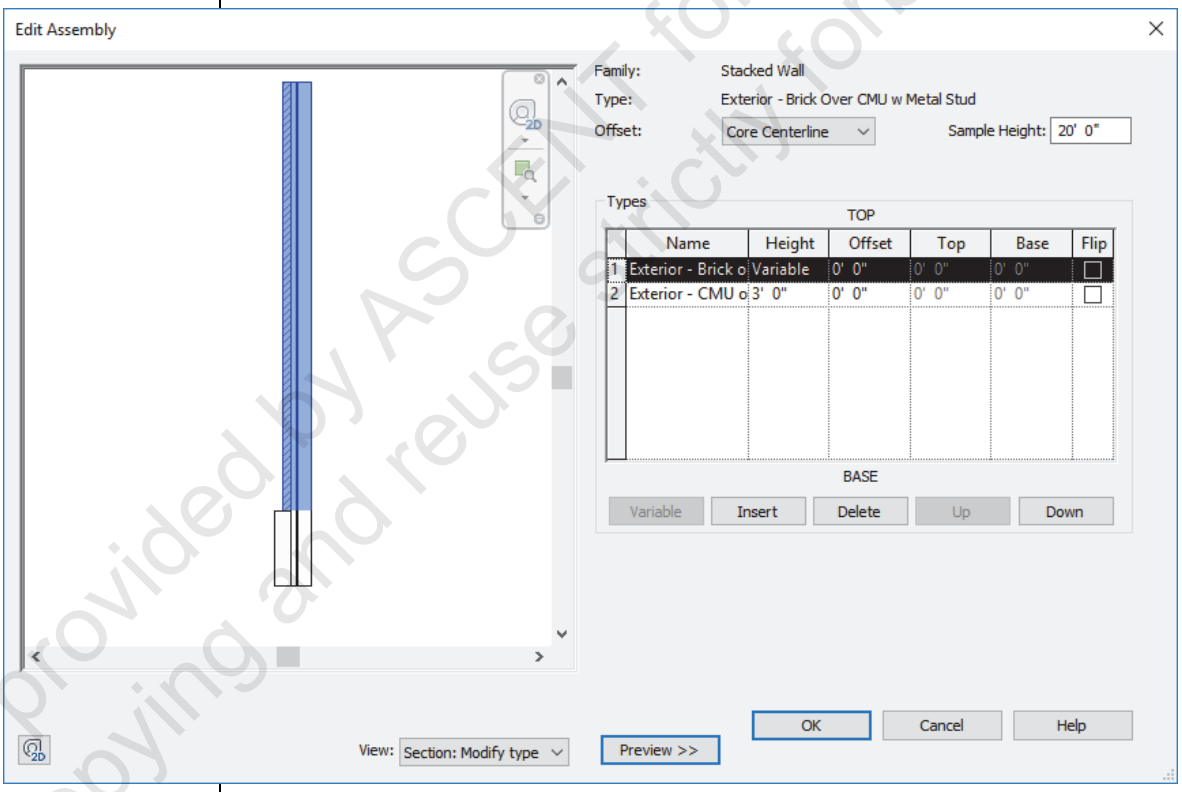


Figure 1–53

9. Click **OK** until all of the dialog boxes are closed.

Hint: Embedding a Wall Inside Another Wall

Another way of creating a compound wall is to embed one wall inside another wall, as shown in Figure 1–54. When you have drawn a host wall, draw another wall on top of, or parallel to it near the host. A warning box opens and recommends that you use **Cut Geometry** to embed the wall in the host wall.

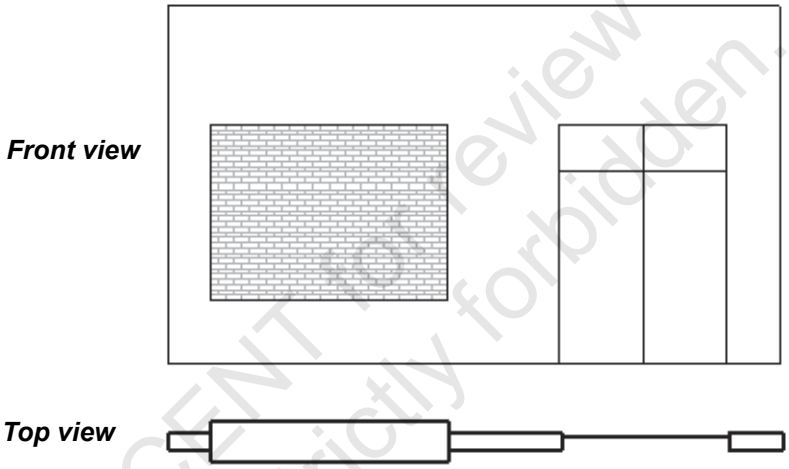


Figure 1–54

1. Add the embedded wall to the host wall.
2. Close the warning box.
3. In the *Modify* tab>Geometry panel, click (Cut).
4. Select the host wall.
5. Select the wall that cuts the host wall.

- Embedded walls work similar to windows. You can modify the embedded wall with controls.
- Some curtain wall types are created to be automatically embedded in another wall. The type **Curtain Wall: Storefront** is an example. The Type Parameter *Automatically Embed* is available for all curtain wall types.
- You can separate embedded walls. In the *Modify* tab> Geometry panel, expand (Cut) and click (Uncut Geometry).

Practice 1c

Create Stacked and Embedded Walls

Practice Objectives

- Create a vertically stacked wall type.
- Embed a wall into a stacked wall.

In this practice, you will create a vertically stacked wall and use it in a project. You will also embed a curtain wall and another wall type into a host wall, as shown in Figure 1–55.

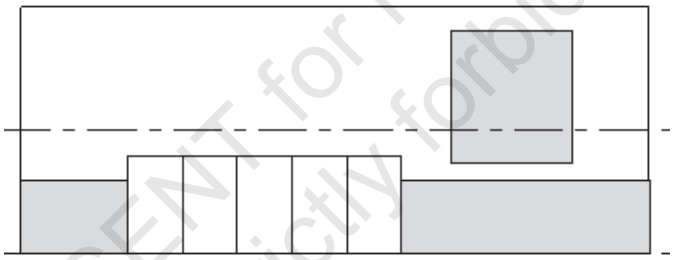


Figure 1–55

Task 1 - Create a stacked wall.

1. Start a new project based on the default architectural or structural template and save it as **Warehouse.rvt** in the practice files folder.
2. Start the **Wall** command and select the **Stacked Wall: Exterior – Brick Over CMU w Metal Stud** type.
3. Edit the type and duplicate it to create a new wall type named **Exterior – EIFS over Brick/CMU**.
4. Edit the structure of the new wall.
5. For the top wall, select **Exterior – EIFS on Mtl. Stud**. Leave the *Height* as **Variable** and set the *Offset* to **4"**.
6. For the bottom wall, select **Exterior – Brick on CMU** and set the *Height* to **6'-0"**.
7. Click **OK** to close all of the open dialog boxes.
8. Draw a rectangular building **50'-0" x 30'-0"** using the new wall style.
9. Set the Detail Level to **Fine**.

10. Display the walls in 3D to verify that the Brick/EIFS display on the exterior.
11. Save the project.

Task 2 - Create an embedded wall.

1. Open the **Floor Plans: Level 1** view.
2. On the south face of the building, add a wall using **Curtain Wall: Storefront** at an *Unconnected Height* of **8'-0"**. Place it directly on the center line of the existing wall along only a portion of the wall. It automatically cuts the existing wall.
3. Open the **Floor Plans: Level 2** view.
4. Add another wall on the same face using **Basic Wall: Exterior – Brick on Mtl. Stud**. This time a warning box opens. Read and close the warning box.
5. In the *Modify|Place Wall* tab>Geometry panel, click  (Cut).
6. Select the host wall.
7. Select the wall that cuts the host wall.
8. Open the **South** elevation view.
9. Set the Visual Style to **Realistic**.
   - Flip the orientation of the brick insert, if needed.
10. Change the size of the embedded wall using the controls, but do not move it down into the lower brick wall.
11. Save and close the project.

1.5 Adding Wall Footings

Wall footings for bearing and retaining are hosted by the walls. Once a footing is in place, you can add reinforcement, as shown in Figure 1–56. With the advantages of having a true foundation in place, you can accurately tag and schedule the footings.

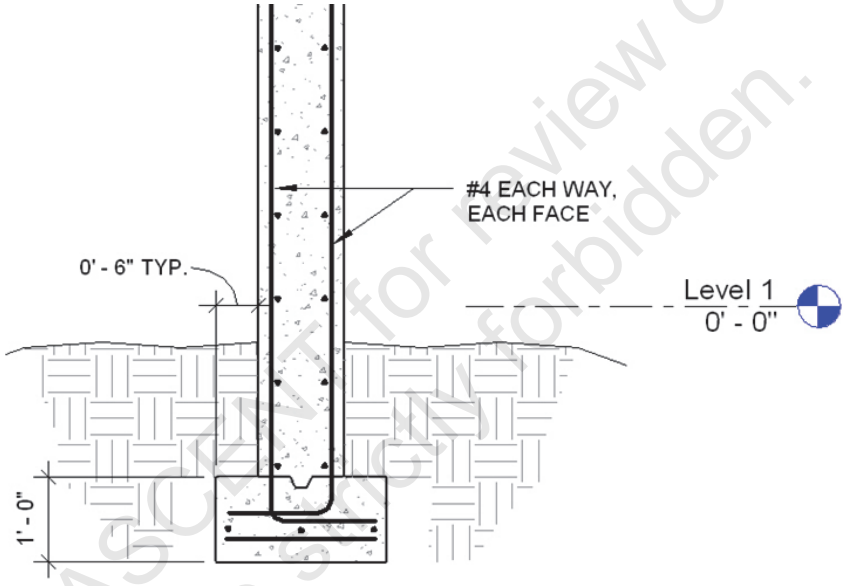
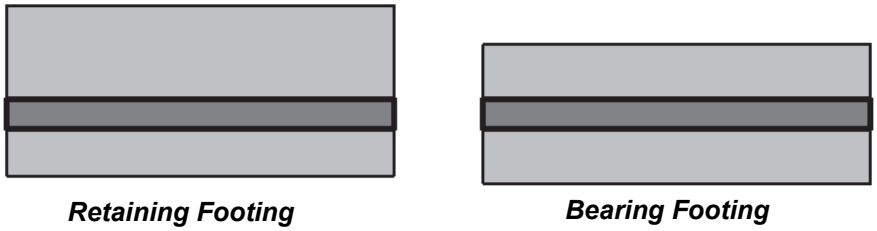


Figure 1–56

- You can apply two types of continuous footing systems, as shown in Figure 1–57. You must have walls in your model to add a footing system:
  - **Retaining footings:** A footing with one side offset to accommodate additional lateral loads and reinforcement
  - **Bearing footings:** A footing with an equal distance on either side of the bearing wall.



Retaining Footing ***Bearing Footing***

Figure 1–57

How To: Place a Bearing or Retaining Footing

Wall foundations can also be placed in 3D, section, and elevation views.

1. Create walls or use existing ones. A wall must be in place for this command to work.
2. Open a foundation plan and set it up so that the walls are displayed and you can select them.

3. In the *Structure* tab>Foundation panel, click (Wall) to start the **Structural Foundations: Wall** command, or type **FT**.
4. In the Type Selector, select a type, as shown in Figure 1–58.

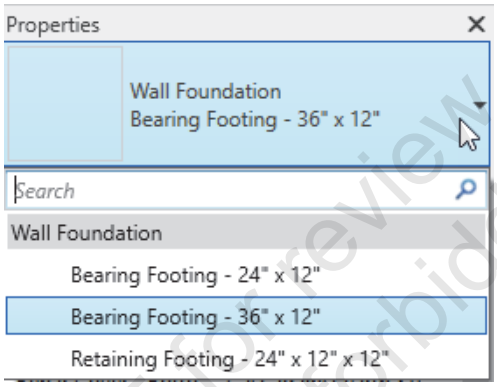


Figure 1–58

5. Select a wall, the footing is placed beneath the wall as shown in Figure 1–59.

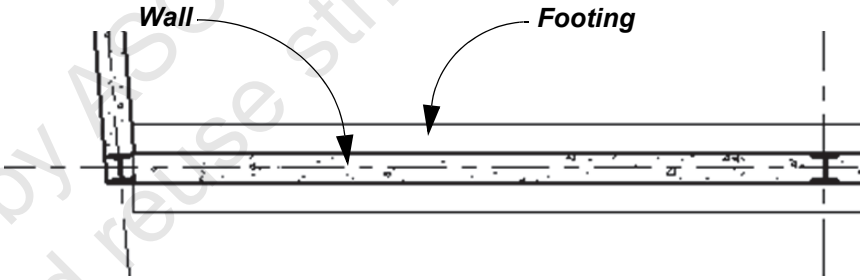


Figure 1–59

- To select multiple walls, hover over one wall and then press <Tab> to select all connected walls. Alternatively, in the *Modify | Place Wall Foundation* tab>Multiple panel, click (Select Multiple). Select the walls using any selection method and click (Finish) to place the footings.
- You can flip retaining footings as shown in Figure 1–60.

Figure 1–60

How To: Create a Footing Type

1. Select an existing foundation wall element or start the **Structural Foundation: Wall** command.
2. In the Type Selector, select a type similar to the type that you want to create and in Properties, click (Edit Type).
3. In the Type Properties dialog box, click **Duplicate**.
4. In the Name dialog box, type a new name for the element and click **OK**.
5. Make any changes to the type properties as needed, as shown in Figure 1–61.

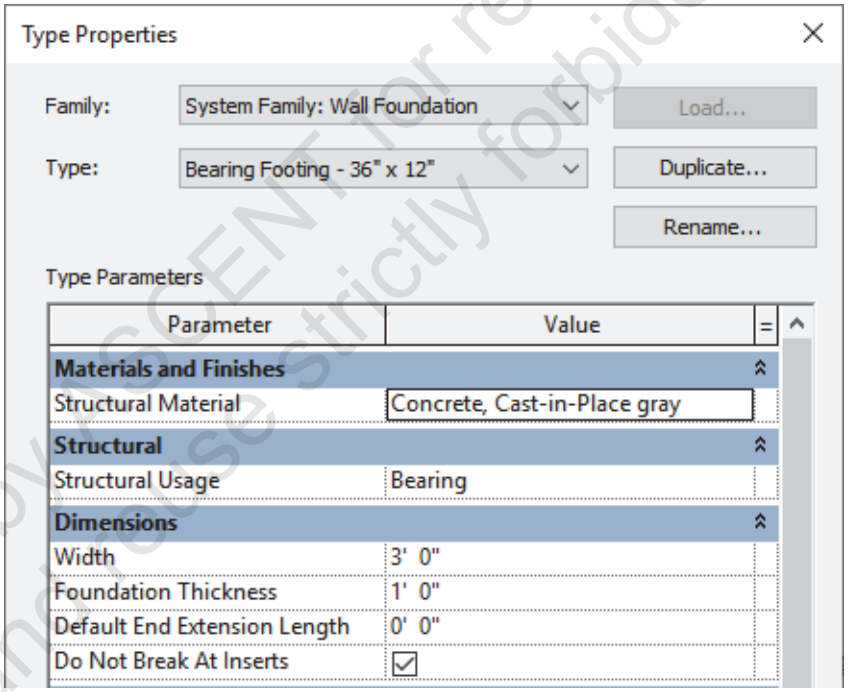
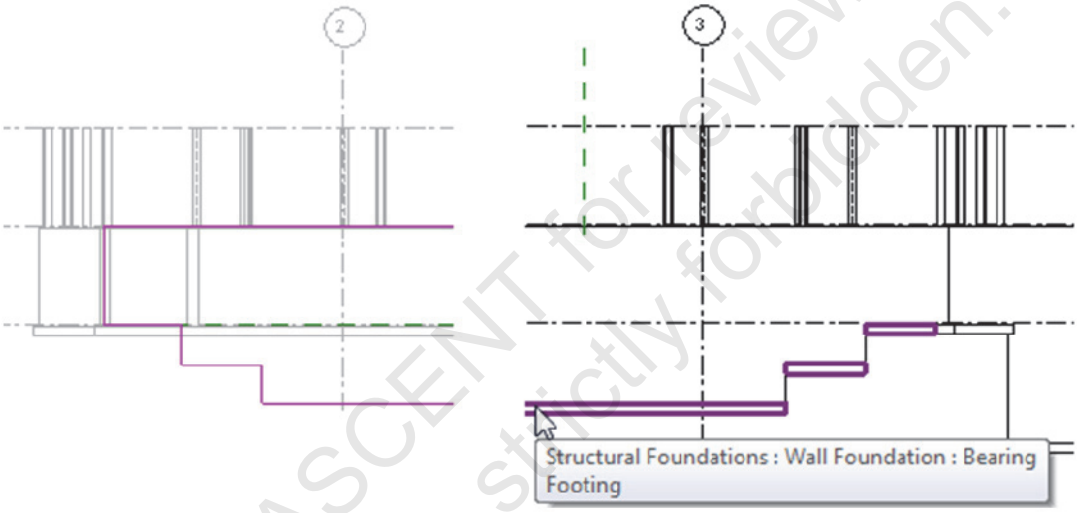


Figure 1–61

6. Click **OK** to close the dialog box.

Wall Profiles and Footings

Footings are appended to the bottom of a wall, which means that any change to the base of the host wall influences the footing. This occurs for lateral movement and horizontal movement. For the example shown in Figure 1–62, when the wall profile changes based on a sloped site (as shown on the left), the footing breaks and follows the modified profile (as shown on the right). This is accomplished by editing the profile of the foundation wall.



Wall profile in process ***Completed wall with footing***

Figure 1–62

How To: Edit the Profile of a Wall

1. Open an elevation or section view in which you can see the face of the wall that you want to edit.
2. Select the wall (by highlighting the wall boundary).
3. In the *Modify* | *Walls* tab>Mode panel, click (Edit Profile). The wall is outlined in magenta indicating the profile of the wall.

4. In the *Modify | Walls>Edit Profile* tab>Draw panel, use the tools to modify the profile sketch of the wall, as shown on the top in Figure 1–63.

5. Once the profile is complete, click (Finish Edit Mode). The footing now follows the new profile, as shown on the bottom in Figure 1–63.

The sketch must form a continuous loop. Verify that the lines are clean without any gaps or overlaps. Use any of the tools in the Modify panel to clean up the sketch.

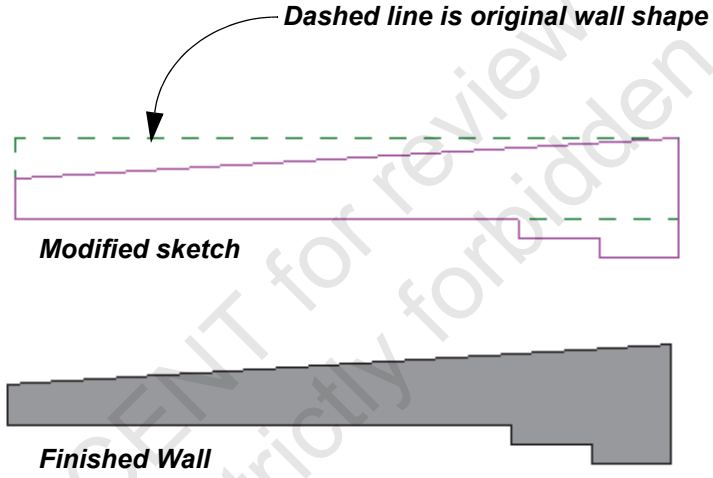


Figure 1–63

- After you adjust the sketch you can add isolated footings to create the appropriate shape.

Hint: Materials

When you are creating some types, such a wall footings, one option is to set the *Structural Material*. In the Type Properties dialog box, in the *Materials and Finishes* area, click in the *Value* column and then click ... (Browse), shown in Figure 1–64.

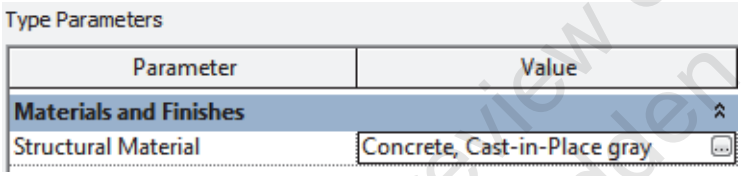


Figure 1–64

In the Material Browser (shown in Figure 1–65), specify the material you want to use and then click **OK.**

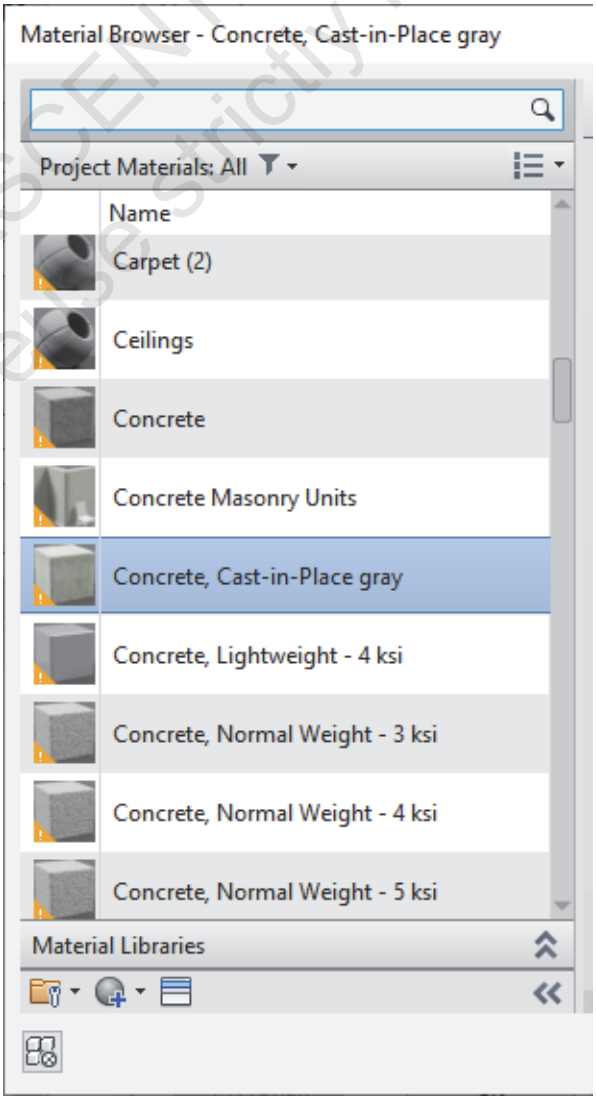


Figure 1–65

Practice 1d

Model Walls and Wall Footings

Practice Objectives

- Place structural walls.
- Create and apply wall footings.

In this practice, you will model the perimeter foundation walls as shown in Figure 1–66.

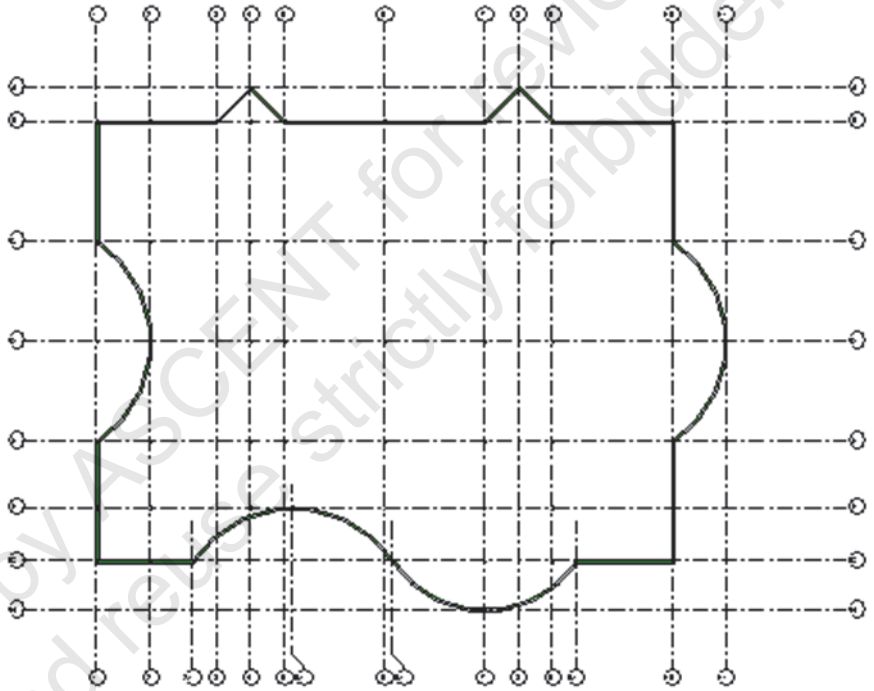


Figure 1–66

Task 1 - Add walls.

1. Open **Walls-Syracuse-Suites.rvt** from the practice files folder.
2. Open the **Structural Plan: 00 GROUND FLOOR** view. (The green lines are the outline of the building.)
3. In the *Structure* tab>Structure panel, click (Wall: Structural).
4. In the Type Selector, select **Basic Wall: Exterior - 8" Concrete**.

5. In the Options Bar, set the *Depth* to **T.O. FOOTING** and ensure that the *Location Line* is **Wall Centerline** and **Chain** is selected.

6. In the *Modify* | *Place Structural Wall* tab>Draw panel, click (Line).

7. Select the start point by snapping to the intersection at **Grid G1** as shown in Figure 1–67.

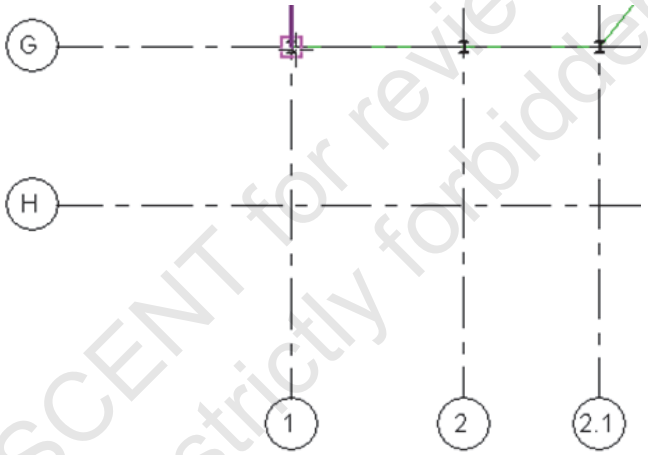


Figure 1–67

8. Draw the wall up to the intersection of **Grid E1**.

9. In the Draw panel, click (Start-End-Radius Arc). Select the second point at **Grid C1** and then the third point anywhere along the green arc to specify the radius of the arc, as shown in Figure 1–68.

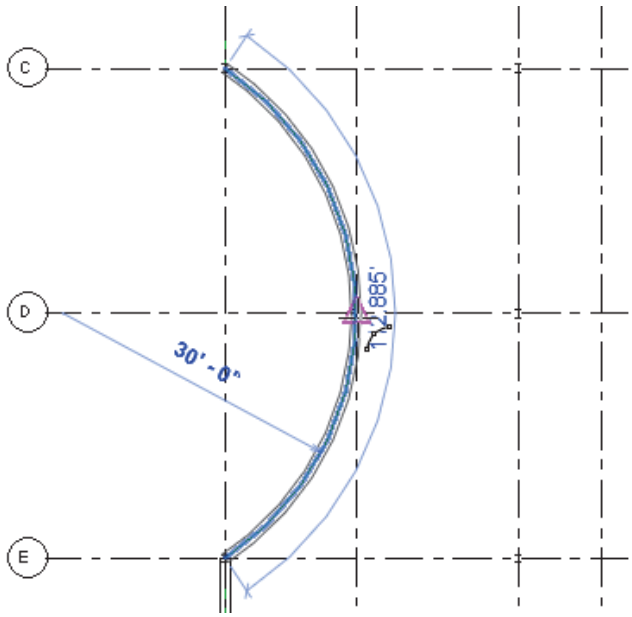


Figure 1–68

10. Click (Line) again and select the intersection of **Grid B1**.
11. Following the green outline, continue drawing walls all of the way around the perimeter as shown in Figure 1–69.

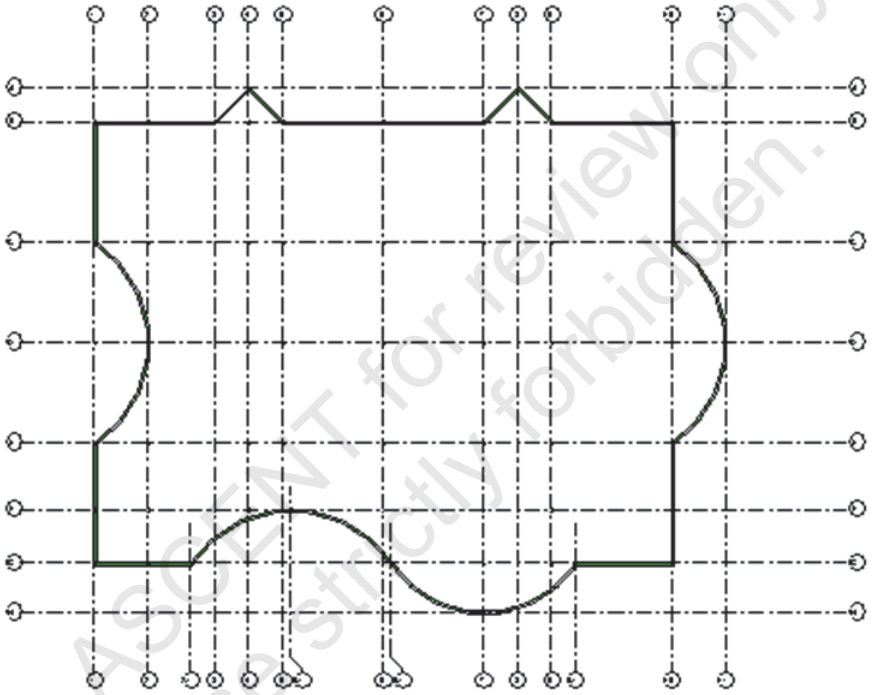


Figure 1–69

12. Save the project.

Task 2 - Create and apply wall footings.

1. Open the **Structural Plans: 000 FOUNDATION PLAN** view.
2. In the *Structure* tab>Foundation panel, click (Structural Foundation: Wall) or type **FT**.
3. Make sure you are on **Wall Foundation: Bearing Footing - 36" x 12"**. In the Type Selector, click (Edit Type).
4. In the Type Properties dialog box, click **Duplicate...**.
5. In the Name dialog box, type **Bearing Footing – 24" x 12"** and then click **OK**.

6. In the Type Properties dialog box, under *Dimensions*, set the *Width* to **2'-0"**, as shown in Figure 1–70.

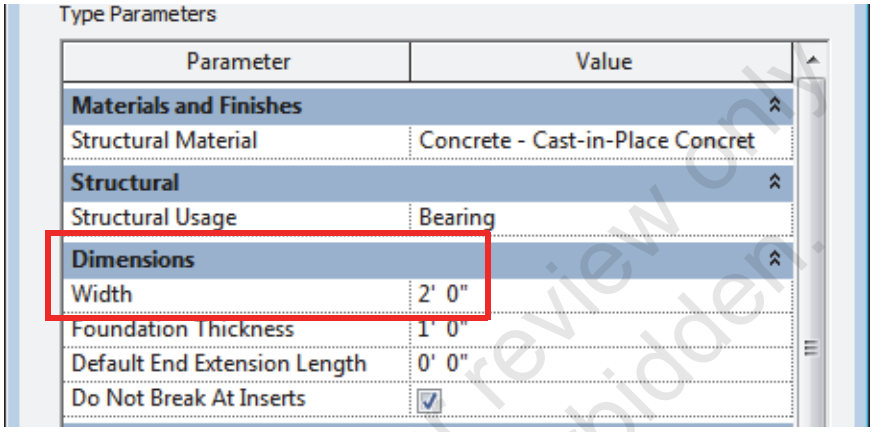


Figure 1–70

7. Click **OK**.

8. You are still in the **Wall Foundation** command. In the Type Selector, ensure that the new **Wall Foundation: Bearing Footing - 24" x 12"** is selected, as shown in Figure 1–71.

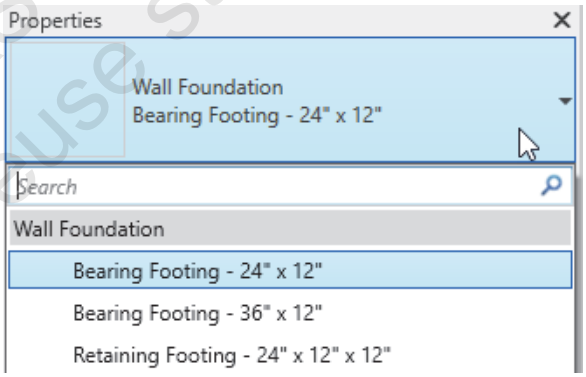


Figure 1–71

9. Hover the cursor over one of the existing walls and press <Tab> to highlight the entire wall system. Click to select the walls. The footing is placed under the entire structure.

10. If you do not see the new wall foundation elements, you might be in an area of the view where they are not visible. Open the **Structural Plans: 000 FOUNDATION PLAN** view.

11. End the command.

12. In the Quick Access Toolbar, click (Default 3D View) to go to a 3D view and verify that the footing is placed correctly as shown in part in Figure 1–72. Change the **Visual Style** as needed.

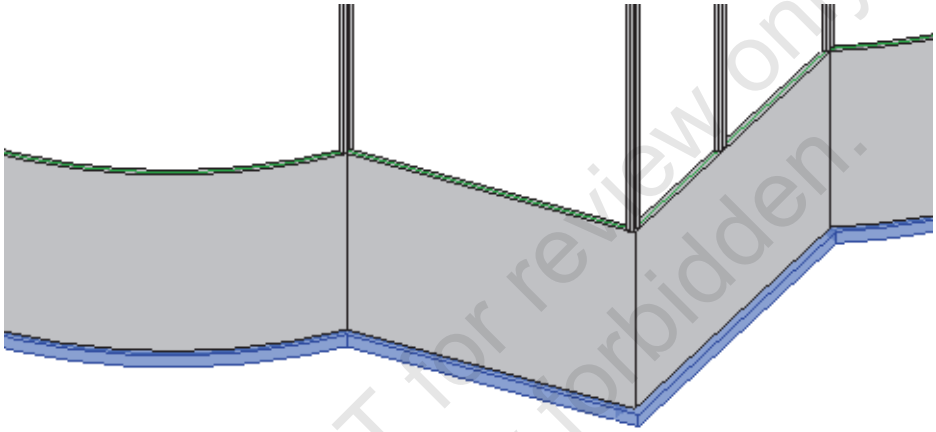


Figure 1–72

13. Save and close the project.

1.6 Creating Piers and Pilasters

The Autodesk Revit software does not have specific categories for piers and pilasters. If you need to create these elements, the best method is to use concrete columns as shown in Figure 1–73. You can then analyze them as part of the foundation system and independently schedule them from the main column schedule. A concrete column also automatically embeds itself into a concrete wall.

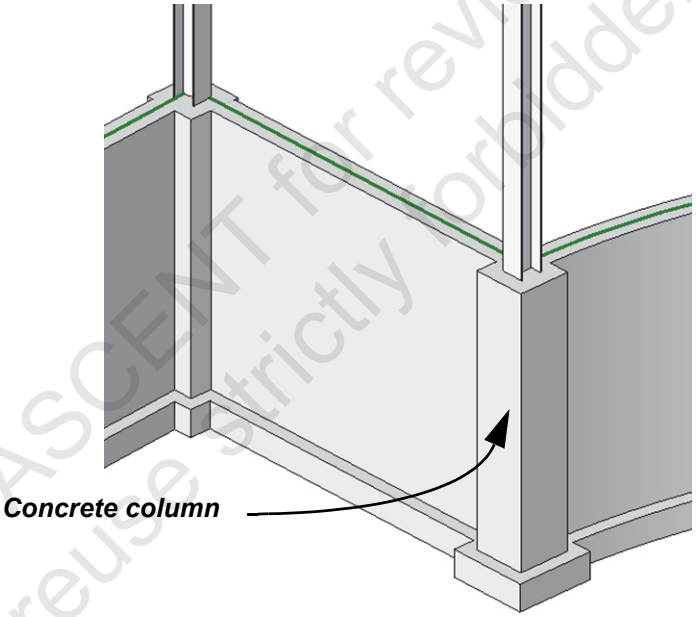


Figure 1–73

- Poured concrete columns can be created in many sizes. For typical rectangular, square, and round columns, it is easy to create custom sizes.

How To: Create a Custom Column Size

1. Open a plan view.
2. In the *Structure* tab>Structure panel, click (Column).
3. In the Type Selector, select an existing column family type similar to the one you want to create, such as **Concrete-Rectangular-Column**.
4. In Properties, click (Edit Type).
5. In the Type Properties dialog box, click **Duplicate**.

6. In the Name dialog box, type a name as shown in Figure 1–74. Click **OK**.

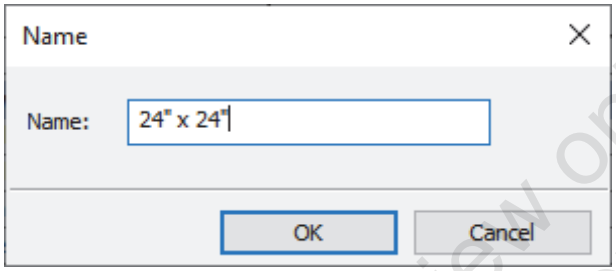


Figure 1–74

7. Modify the dimensions as required. Enter the required values for *b* (base) and *h* (height), as shown in Figure 1–75.

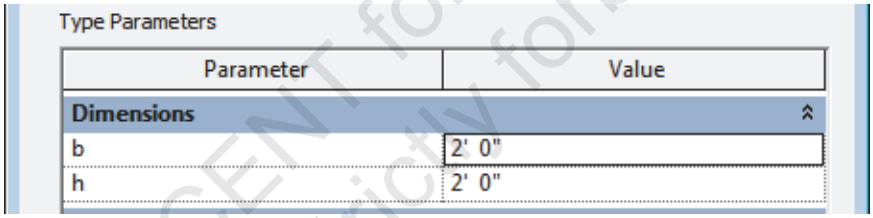


Figure 1–75

8. Click **OK**.
9. The new pier column can placed at the base of the existing steel columns, as shown in Figure 1–76.

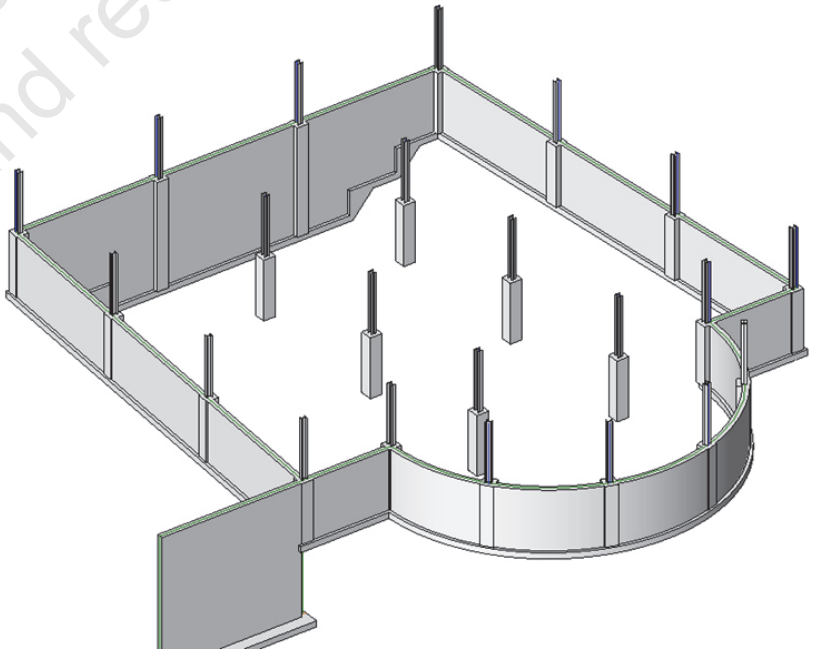


Figure 1–76

Hint: Temporary Hide/Isolate

You might want to temporarily hide elements from a view, modify the project, and then restore the elements. Instead of completely toggling the elements off, you can use (Temporary Hide/Isolate) in the View Control Bar. The Temporary Hide/Isolate status is not saved with the project.

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 1–77.

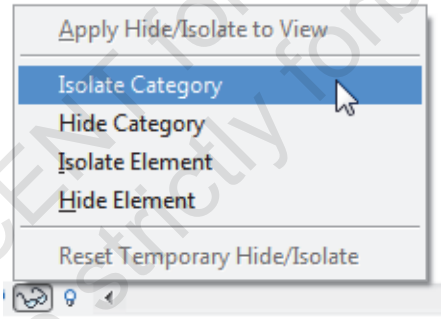


Figure 1–77

The elements or category are hidden or isolated. A cyan border displays around the view with a note in the upper left corner, as shown in Figure 1–78. It indicates that the view contains temporarily hidden or isolated elements.

Figure 1–78

- 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**.
- Any elements that are temporarily hidden still print.

Practice 1e

Create Piers and Pilasters

Practice Objectives

- Create a new column type.
- Add columns.

In this practice, you will create a new column type and place piers and pilasters (types of columns). The resulting model is shown in Figure 1–79.

The steel columns have been hidden in this view for clarity.

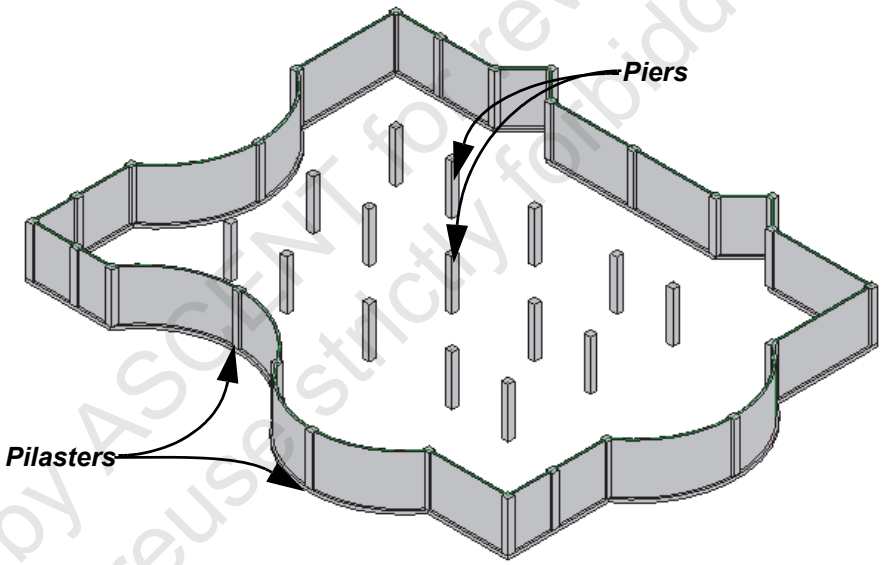


Figure 1–79

Task 1 - Create a new column type.

1. Open **Foundations-Syracuse-Suites.rvt** from the practice files folder.
2. Open the **Structural Plans: 000 FOUNDATION PLAN** view.
3. In the *Structure* tab>Structure panel, click (Column), or type **CL**.
4. In the Type Selector, select one of the **Concrete-Rectangular-Column** types.
5. In Properties, click (Edit Type).
6. In the Type Properties dialog box, click **Duplicate**.

7. Rename the column to **24 x 24.** The family name, **Concrete-Rectangular-Column** is automatically applied to the name. Click **OK**.

8. In the Type Properties dialog box, change the dimensions for both *b* (base) and *h* (height) to **2'-0"**, as shown in Figure 1–80.

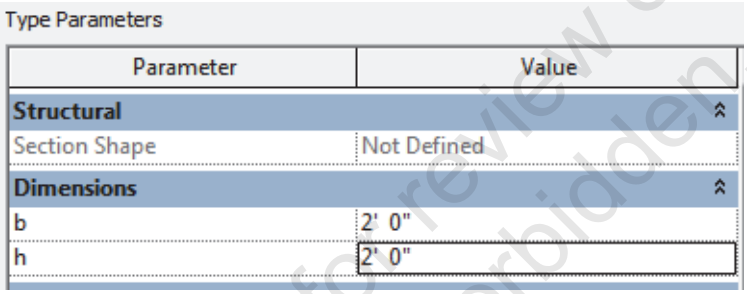


Figure 1–80

9. Click **OK**.

10. Click (Modify).

Task 2 - Place piers and pilasters.

1. Select one of the steel columns. In the View Control Bar, expand (Temporary Hide/Isolate) and click **Isolate Category**, as shown in Figure 1–81. Only the columns display.

*This is one method that can help you place the columns. You can also use **At Grids** and delete the columns that you do not need.*

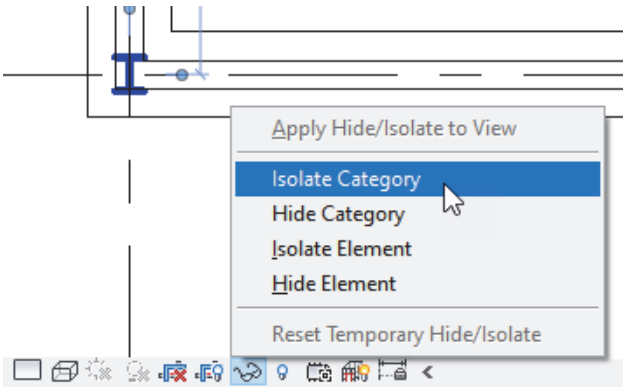


Figure 1–81

2. In the *Structure* tab>Structure panel, click (Column), or type **CL**.

3. Ensure that **Concrete-Rectangular-Column: 24 x 24** is selected in the Type Selector.

4. In the Options Bar, set *Depth* to ***T.O. Footing***.
5. Place a concrete column at each existing steel column. Some of the columns will look odd (as shown in Figure 1–82) because they are connected to the concrete foundation walls that have been hidden in the view.

Figure 1–82

6. When you finish placing the concrete columns, in the View Control Bar, expand (Temporary Hide/Isolate) and select **Reset Temporary Hide/Isolate**.
7. In the Quick Access Toolbar, click (Default 3D View). and view the new column placement.
8. Save and close the project.

1.7 Adding Isolated Footings

Footings for columns (shown in Figure 1–83) are placed using the **Structural Foundation: Isolated** command. When you select a column, the footing automatically attaches to the bottom of the column. This is true even when the bottom of the column is on a lower level than the view you are working in.

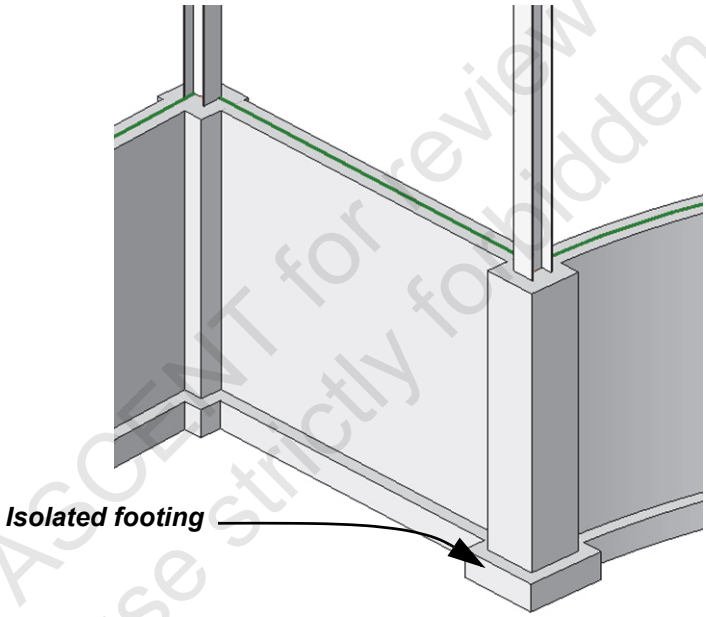


Figure 1–83

How To: Place an Isolated Footing

1. Open a plan view, such as a **T.O. Footing** structural floor plan.
2. In the *Structure* tab>Foundation panel, click (Isolated) to start the **Structural Foundation: Isolated** command.
3. In the Type Selector, select a footing type.
4. In the view, click to place the individual footing as shown in Figure 1–84.
   - If needed, press <Spacebar> to rotate the isolated footings after they are placed.

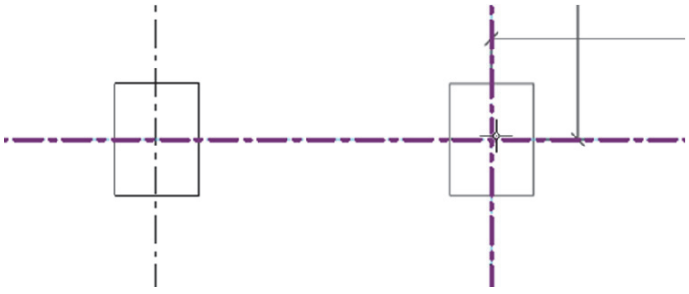


Figure 1–84

- To add more than one footing at a time, in the *Modify* | *Place Isolated Foundation* tab>Multiple panel, select (At Grids) or (At Columns) and select the grids or columns.
  - If needed, press <Spacebar> to rotate the isolated footings after they are placed.
- If the material of the wall footing and the material of the isolated footing are the same they automatically join, as shown in Figure 1–85.

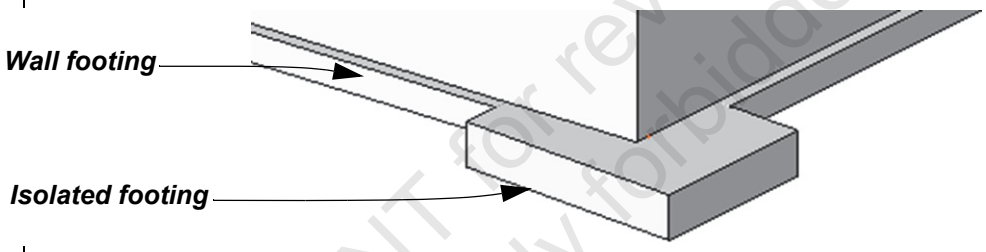


Figure 1–85

Hint: Foundation Element Properties

Some of the element properties are automatically generated from the location and size of the element in the model and are grayed out, for example *Host*, *Elevation at Top*, and *Elevation at Bottom* as shown in Figure 1–86. These can be used in tags and schedules.

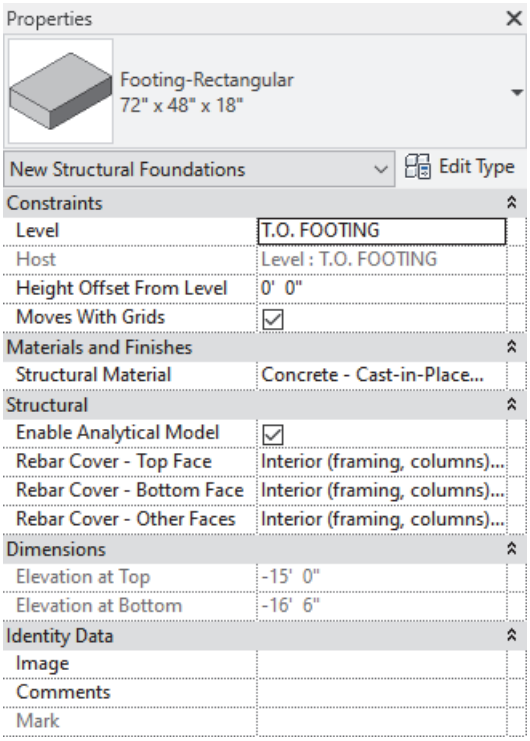


Figure 1–86

Working with Custom Families

Sometimes you need to work with a custom family that has parameters that you can manipulate to fit a specific situation. For example, to add the step footings shown in Figure 1–87, you need to insert an angled isolated footing and modify it to fit the exact size and location.

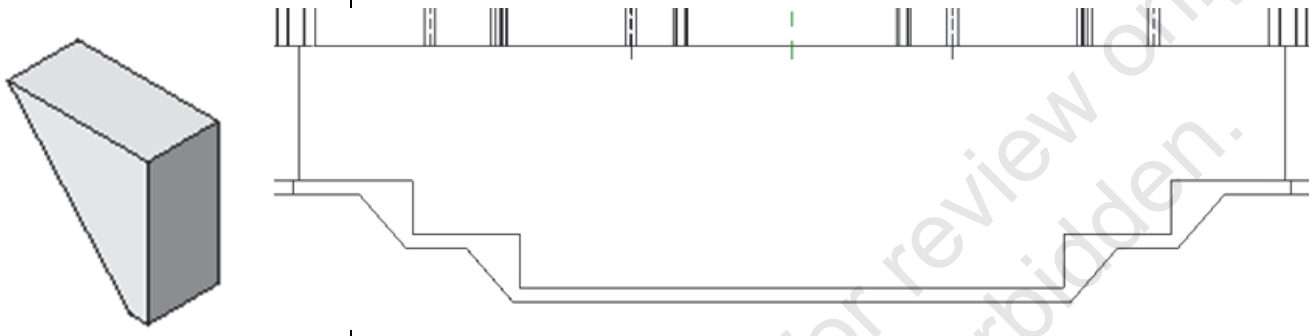


Figure 1–87

How To: Load, Insert, and Modify a Custom Footing

1. Open a plan view.
2. In the *Structure* tab>Foundation panel, click (Isolated) and in the *Modify* | *Place Isolated Foundation* tab>Mode panel, click (Load Family).
3. In the Load Family dialog box, find the structural foundation family that you want to use and click **Open**.
4. Place the footing in the plan view. It might not be in the right place, but you can modify it in a section or elevation view.
5. Open an elevation or section view.
6. Move the footing to the correct location. As long as it is in line with another footing, it automatically cleans up as shown in Figure 1–88.

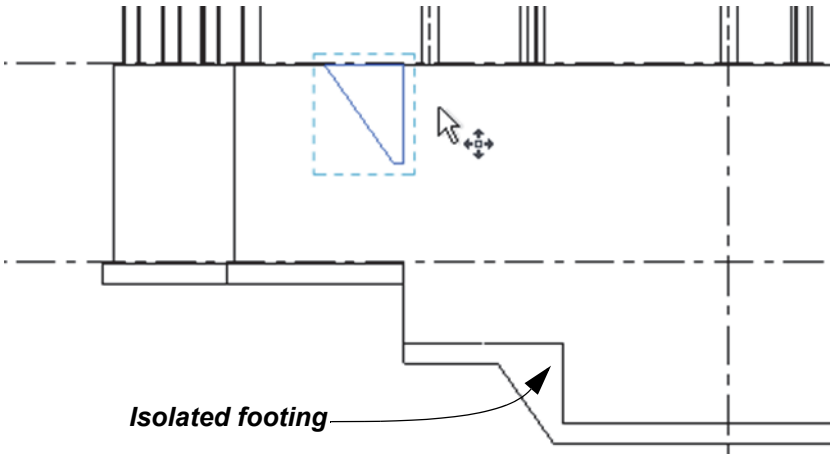


Figure 1–88

- Use  (Align) to align the isolated footing with the footing already in the model. When it is aligned, select the lock, as shown in Figure 1–89. This ensures that if the elevation of the footing wall changes, the step footing will also adjust appropriately.

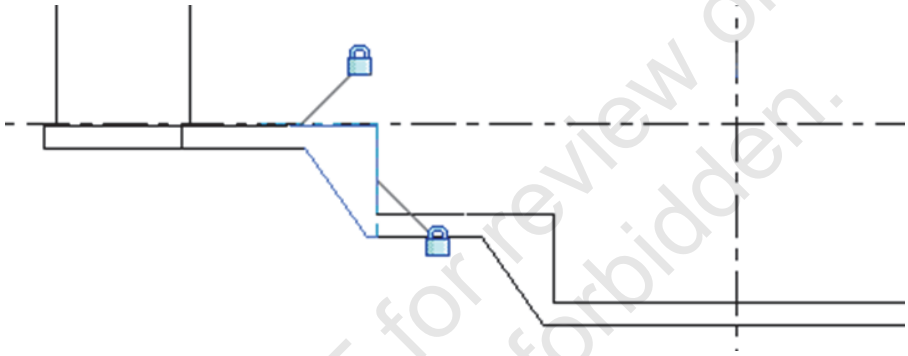
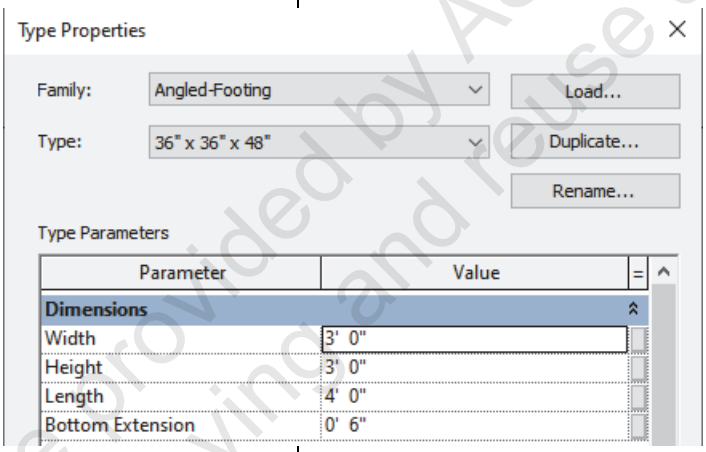


Figure 1–89

- Some custom families have sizing options in either Properties (per instance) or in the Type Properties (as shown in Figure 1–90) so that you can create additional types in various sizes as needed in the project.



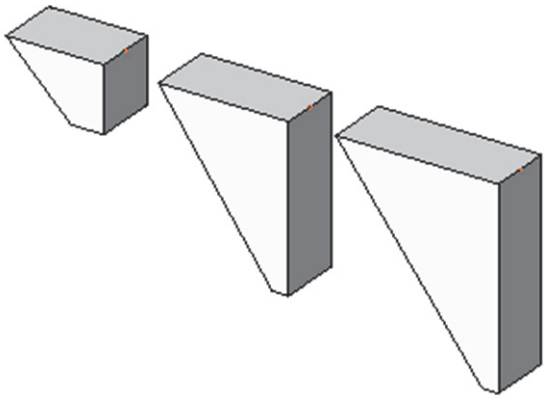


Figure 1–90

Practice 1f

Add Isolated Footings

Practice Objectives

- Place isolated footings.
- Modify a wall profile and add stepped footings.

In this practice, you will create a new footing type and place isolated footings, as shown in Figure 1–91. You will also create a series of stepped footings by modifying a wall profile and adding custom footings.

The steel columns have been hidden in this view for clarity.

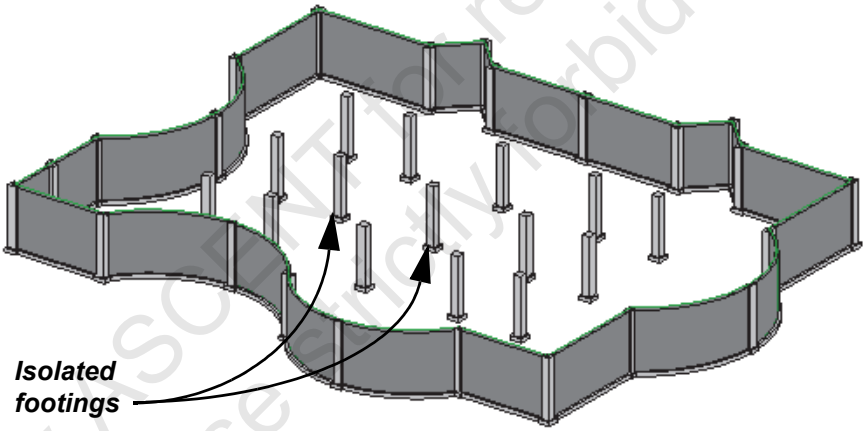


Figure 1–91

Task 1 - Place isolated footings.

1. Open **Footings-Syracuse-Suites.rvt** from the practice files folder.
2. Open the **Structural Plans: T.O. FOOTING** view.
3. In the *Structure* tab>Foundation panel, click (Isolated).
4. In Properties, click (Edit Type).
5. Duplicate the type and name it **36"x36"x12"**.

6. In the Type Properties dialog box, set the following, as shown in Figure 1–92:
   - *Width*: **3'-0"**
   - *Length*: **3'-0"**
   - *Thickness*: **1'-0"**

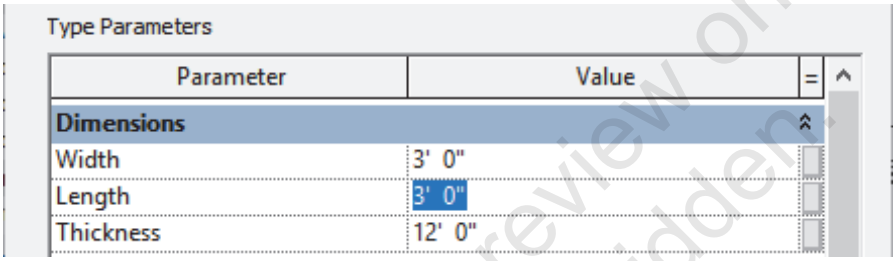


Figure 1–92

7. Click **OK**.
8. Zoom into the column at grid B1 and place the isolated footing. The isolated footing and wall footing automatically join together as shown in Figure 1–93.

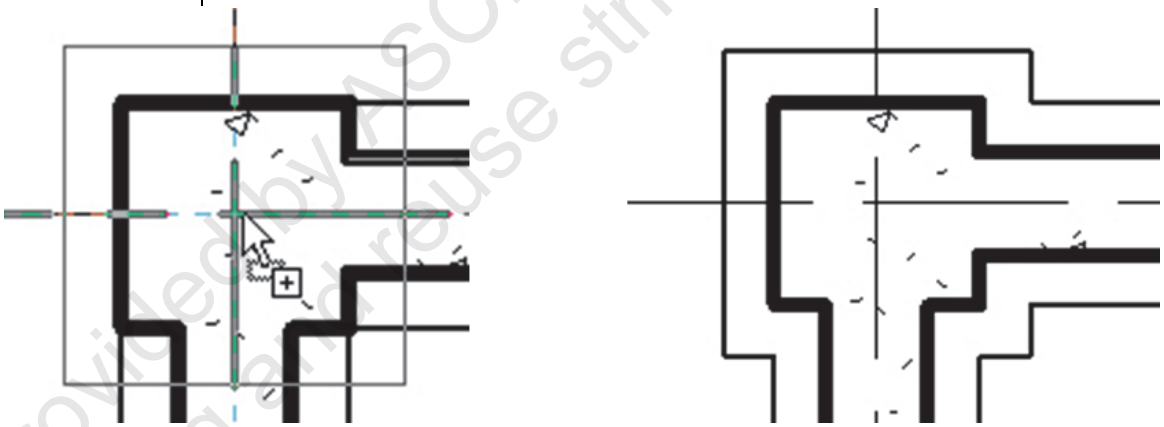


Figure 1–93

9. In the *Modify* | *Place Isolated Foundation* tab>Multiple panel, click (At Columns). Use a pick window to select all of the columns and click (Finish).
10. Reopen the Default 3D view.

The steel columns were hidden in this figure for clarity.

11. There should be an isolated footing under each pier and pilaster, as shown in Figure 1–94.

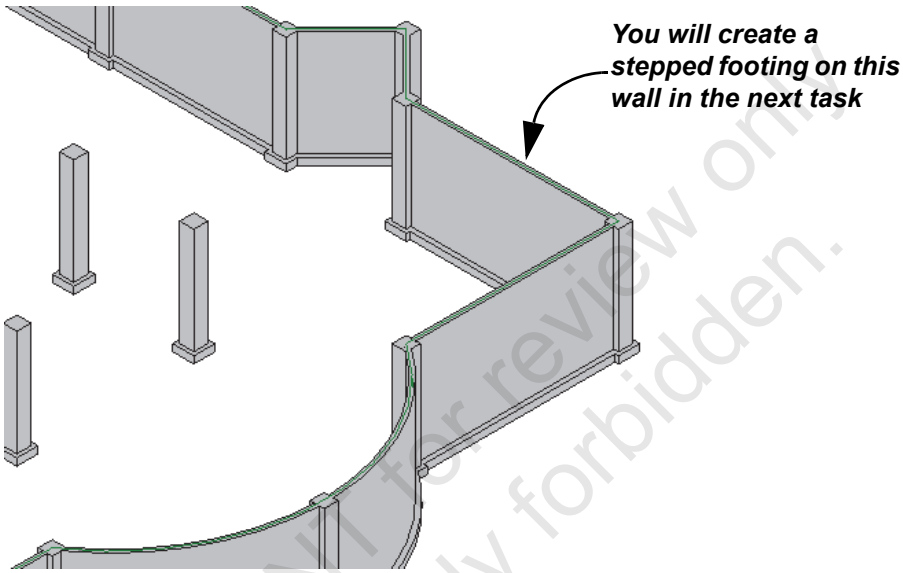


Figure 1–94

12. Save the project.

Task 2 - Modify the profile of a wall and add stepped footings.

1. Open the **Elevations (Building Elevation): North** view.
2. Zoom in on the left end of the foundation wall and select the wall located between grids 10 and 9, as shown in Figure 1–95.

   Hint: You can turn on (Crop View) and (Show Crop Region) to show less in this view and make it easier to see the grids.

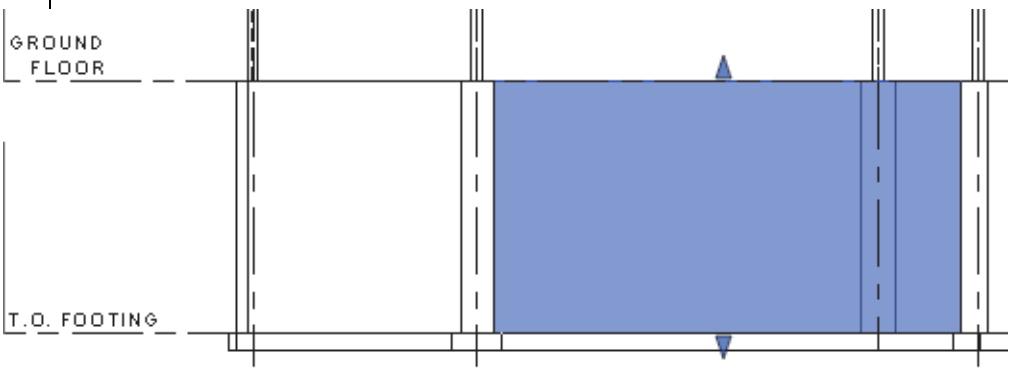


Figure 1–95

3. In the **Modify | Walls** tab>Mode panel, click (Edit Profile).

4. Use the Draw and Modify tools to add the stepped profile shown in Figure 1–96. The dimensions are for information only.

   - Make sure to remove the bottom of the walls constraint by clicking on the lock or moving the line and clicking **Remove Constraints** in the Error-cannot be ignored dialog box.

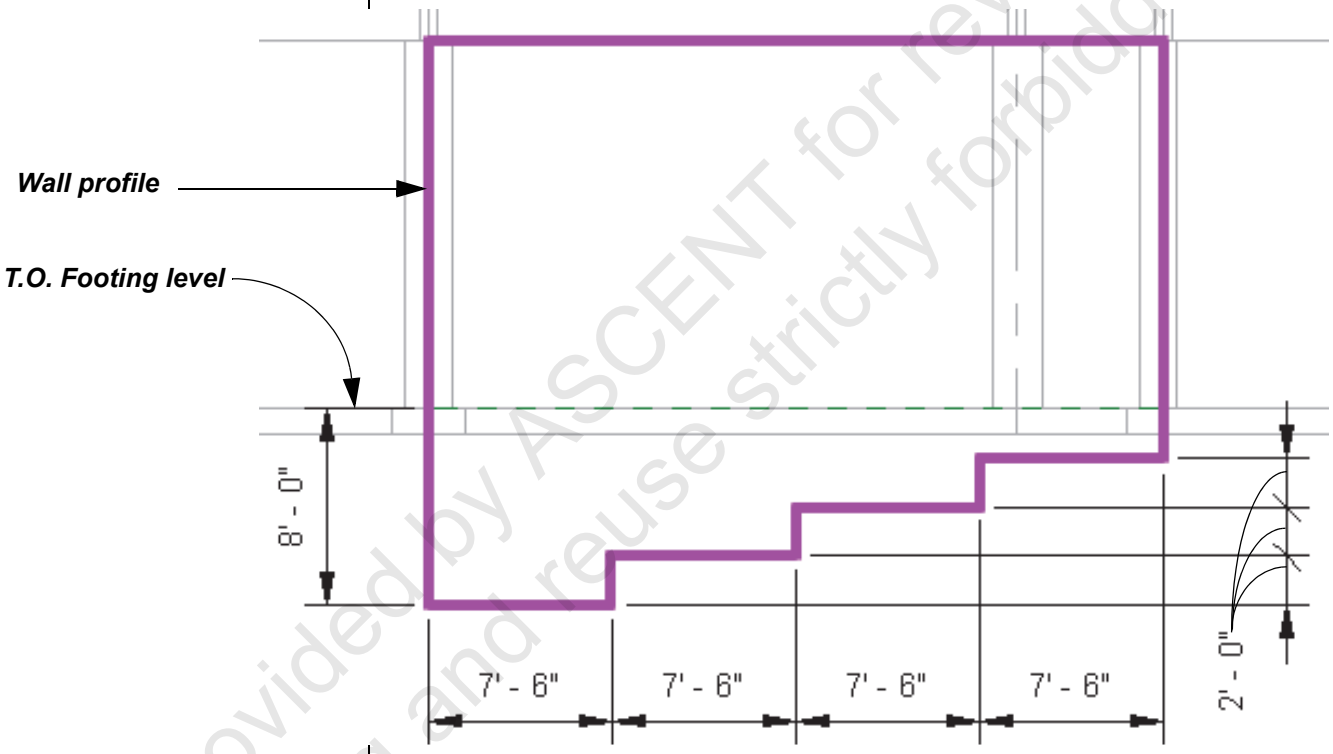


Figure 1–96

5. Click (Finish Edit Mode).

6. The wall profile is modified along with the footings, as shown in Figure 1–97.

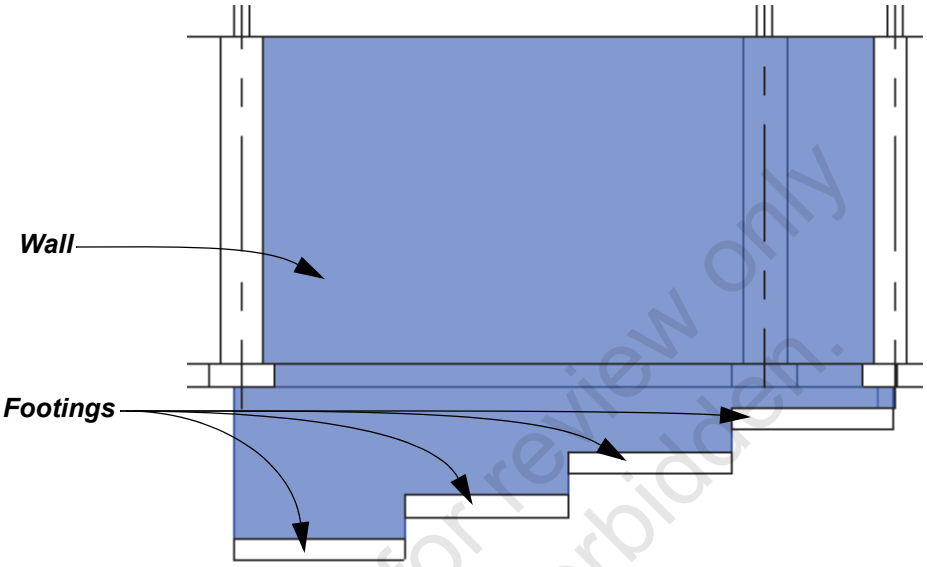


Figure 1–97

7. Open the Structural Plans: **T.O. Footing** view and zoom in on corner of grid B10. You should be able to see lines that show the steps of the footing below.

8. In the *Structure* tab>Foundation panel, click (Isolated).

9. In the *Modify | Place Isolated Foundation* tab>Mode panel, click (Load Family).

10. In the Load Family dialog box, navigate to the practice files *Families* folder and select **Angled-Footing.rfa**. Click **Open**.

11. In the Type Selector, select **Angled-Footing: 24" x 24" x 36"**.

12. Place three footings along the wall, similar to those shown in Figure 1–98.

The exact location does not matter at this time.

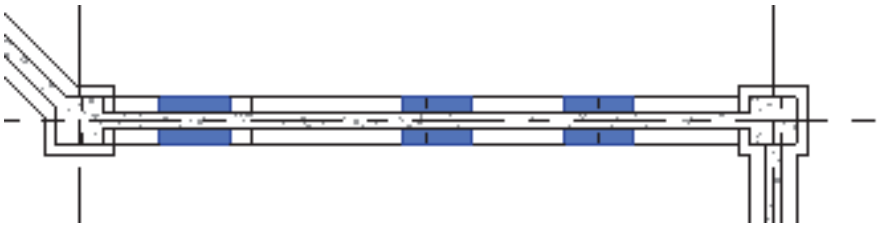


Figure 1–98

13. Return to the **North** elevation view. The three footings are still on the level where they were placed, as shown in Figure 1–99.

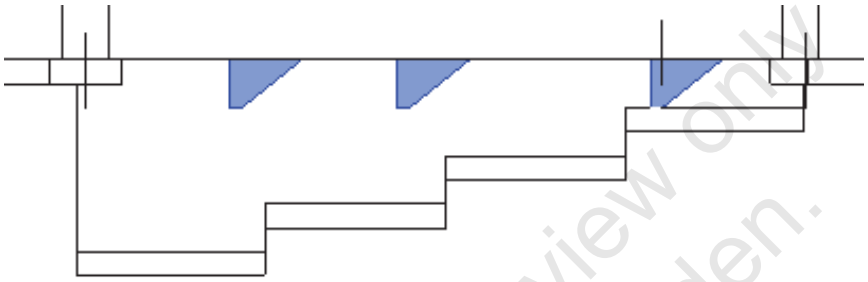


Figure 1–99

14. In the *Modify* tab>Modify panel, click (Align) or type **AL**.

15. Align each Angled Footing to the wall footings, as shown in Figure 1–100.

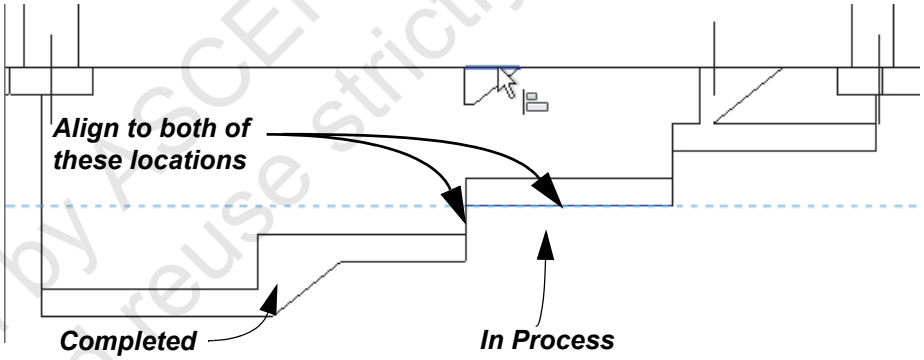


Figure 1–100

16. View the new footings in 3D, as shown in Figure 1–101.

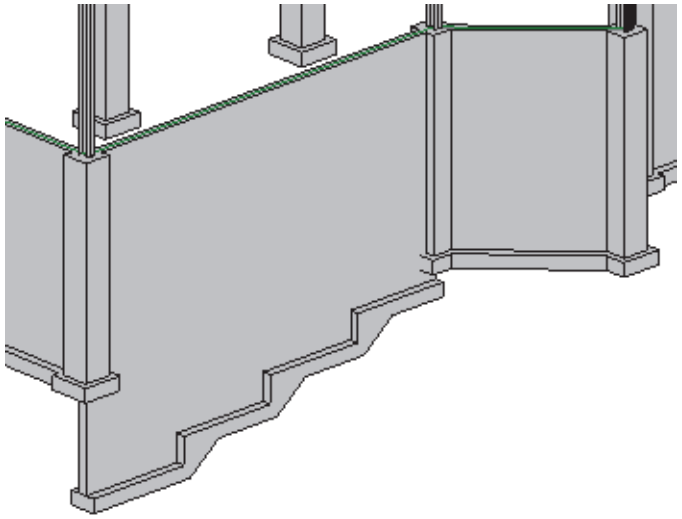


Figure 1–101

17. (Optional) Modify the nearby wall, columns, and footings to match up with the new stepped footings.
18. Save and close the project.