Autodesk® Revit® 2015

Structure Fundamentals

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Chapter 7

Adding Foundations

In this chapter you learn how to create wall footings (bearing and retaining), add isolated footings, and create and add piers and pilasters,

This chapter contains the following topics:

- **Creating Wall Footings**
- **Adding Isolated Footings**
- **Creating Piers and Pilasters**

7.1 Creating Wall Footings

Learning Objectives

- Create bearing or wall footings hosted by walls.
- Create new foundation wall types.

Wall footings for bearing and retaining are placed under walls and in Autodesk® Revit® software are actually hosted by the walls. Once a footing is in place, you can change the size of the section and add reinforcement, as shown in Figure 7–1, to make it a foundation bearing system. With the advantages of having a true foundation in place, you can accurately tag and schedule the footings. When a footing size or footing type changes, the software reads and updates the information where ever it is needed.

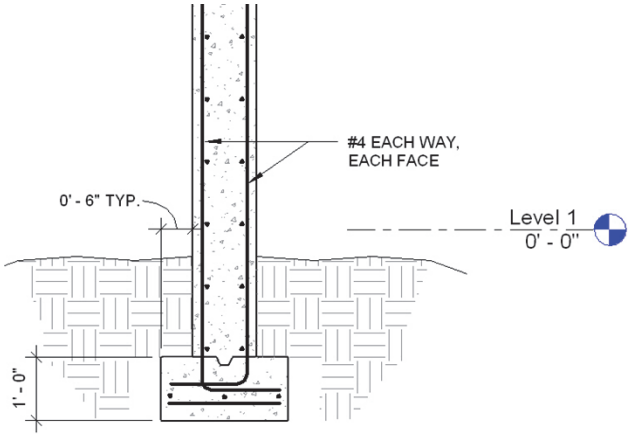
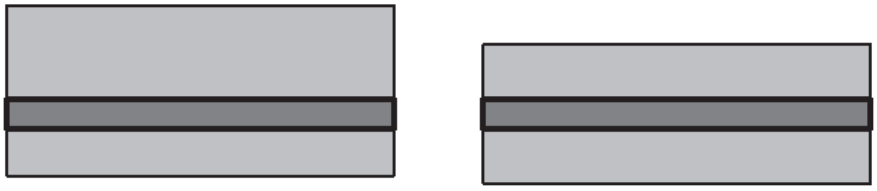


Figure 7–1

- You can apply two types of continuous footing systems, as shown in Figure 7–2; *Bearing footings* with an equal distance on either side of the bearing wall and *Retaining footings* with one side offset to accommodate additional lateral loads and reinforcement.



Retaining Footing ***Bearing Footing***

Figure 7–2

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

How To: Place a Bearing or Retaining Footing

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 7–3.

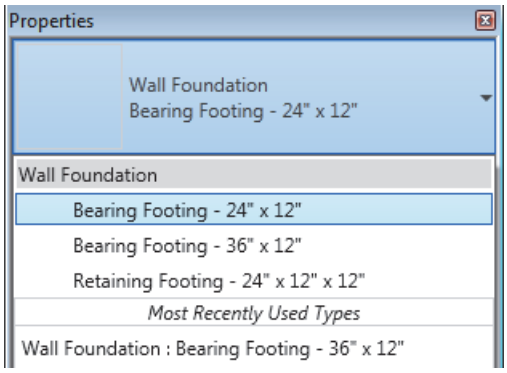


Figure 7–3

5. Select a wall, the footing is placed beneath the wall as shown in Figure 7–4.

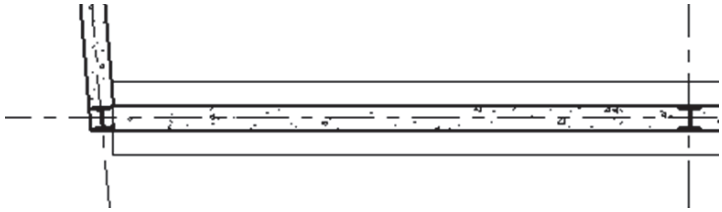


Figure 7–4

- To select multiple walls, 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 7–5

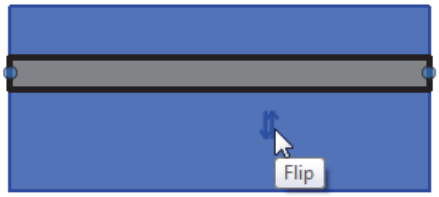


Figure 7–5

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How To: Create a Bearing 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.
5. Make any changes to the type properties, as needed as shown in Figure 7–6.

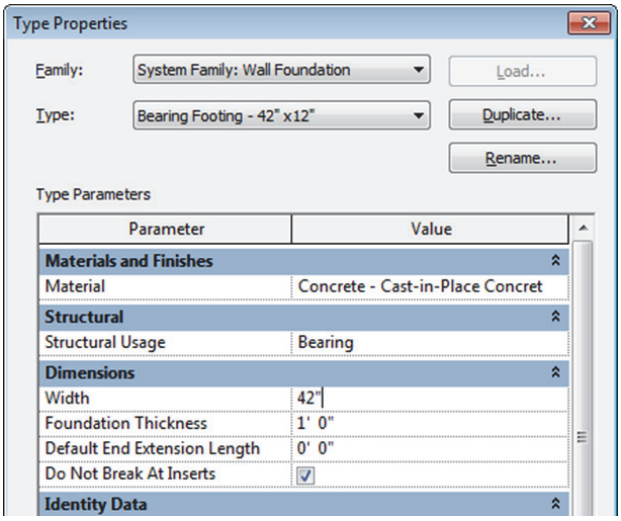

Figure 7–6

6. Click Apply if you want to create another type or click OK to close the dialog box.

- You can also create a new type through the Project Browser. Find an existing type in the *Families* area, right-click on the type and select **Duplicate**, as shown in Figure 7–7. The new footing is added to the list. Rename it and then double-click to open the Type Properties dialog box.

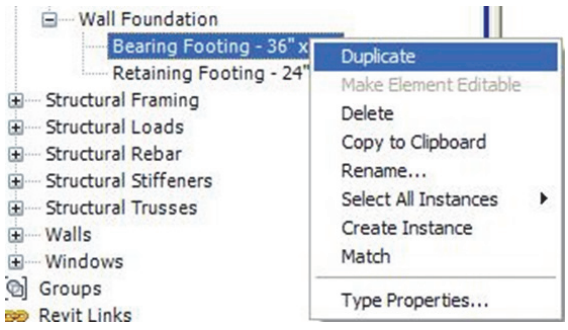

Figure 7–7

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 example, if the wall profile changes based on a sloped site (as shown on the left in Figure 7–8), the footing breaks and follows the modified profile, as shown on the right in Figure 7–8. This is accomplished by editing the profile of the foundation wall.

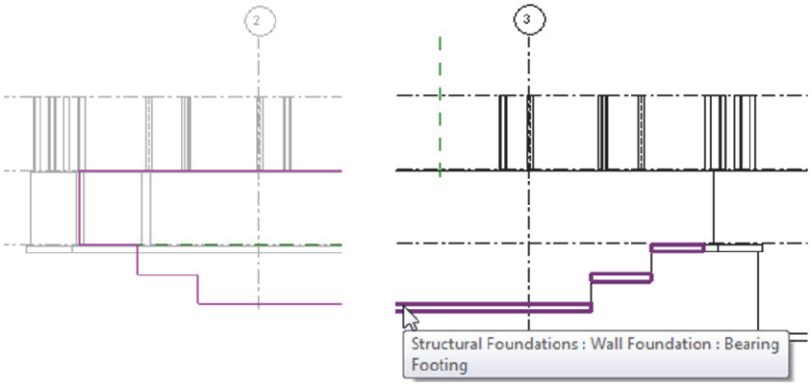

Figure 7–8

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 left in Figure 7–9.

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.

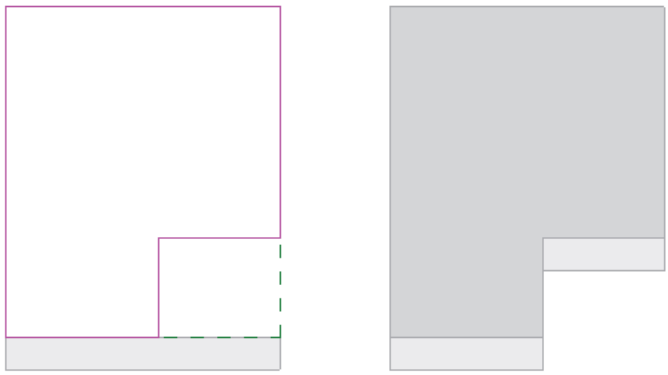

Figure 7–9

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5. Once the profile is complete, click (Finish Edit Mode) in the Mode panel. The footing now follows the new profile as shown on the right in Figure 7–9.
6. Press <Esc> or click (Modify) to clear the selection.

Hint: Materials

When you are creating types, one typical option is to set the *Material*. In the Type Properties dialog box, in the *Materials and Finishes* area, click (Browse) in the right corner of the *Value* column as shown in Figure 7–10. You might have to click in the field first.

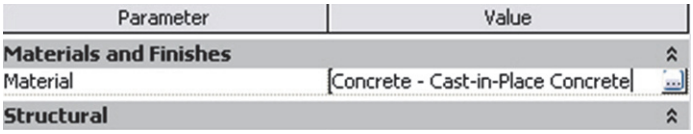

Figure 7–10

The Material Browser opens as shown in Figure 7–11, enabling you to specify the material to use. Click OK when you are done.

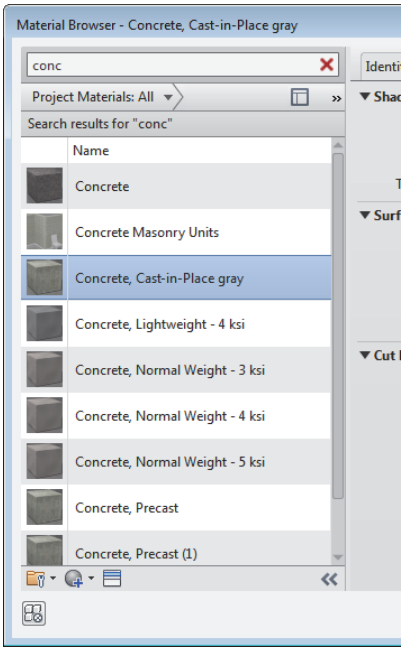

Figure 7–11

7.2 Adding Isolated Footings

Learning Objectives

- Place isolated footings under columns.
- Load and insert custom footings.

Footings for columns are considered Isolated footings, such as those shown on the right in Figure 7–12. You can also add custom isolated footings, such as the stepped footings shown on the left in Figure 7–12. Various types of foundation elements automatically join together as long as the materials are the same.

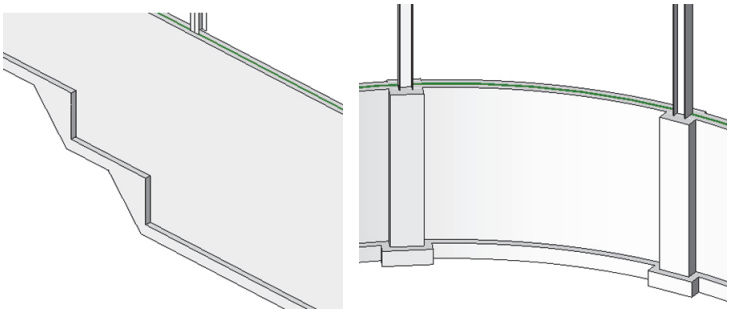

Figure 7–12

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 7–13.

If you click on a column to place an individual footing, 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 plan view you are working in.

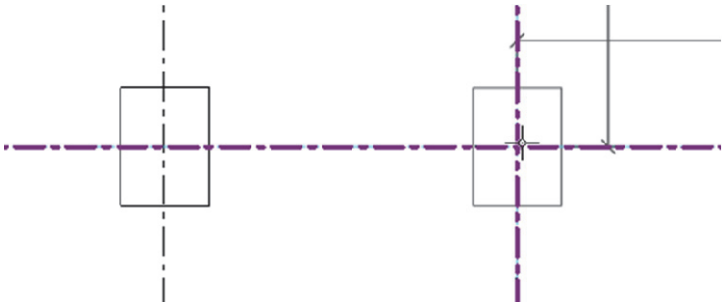

Figure 7–13

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5. 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.
6. Press <Esc> or (Modify) to end the command.

- If the material of the wall footing and the material of the isolated footing are the same they automatically join, as shown in Figure 7–14.

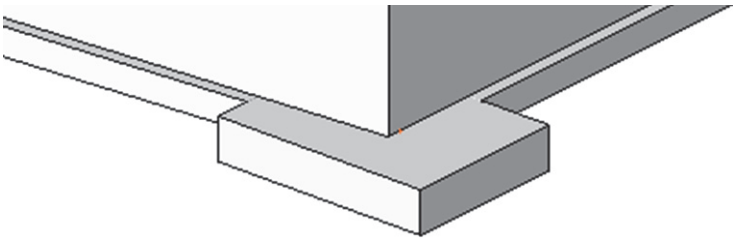

Figure 7–14

- An isolated footing attaches itself to the bottom of the component.
- Instead of adding extra levels for foundations, you can place foundation elements at the lowest floor level and then change the *Base Offset* parameter for the columns and walls to lower the footing below the floor. The foundation elements move with the base of the walls and columns.

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Hint: Foundation Element Properties

Many element properties are automatically gathered from the location and size of the element in the model. These can be used in tags and schedules. For example, Host, Elevation at Top, and Elevation at Bottom are grayed out (as shown in Figure 7–15), because they are automatically generated and cannot be modified directly.

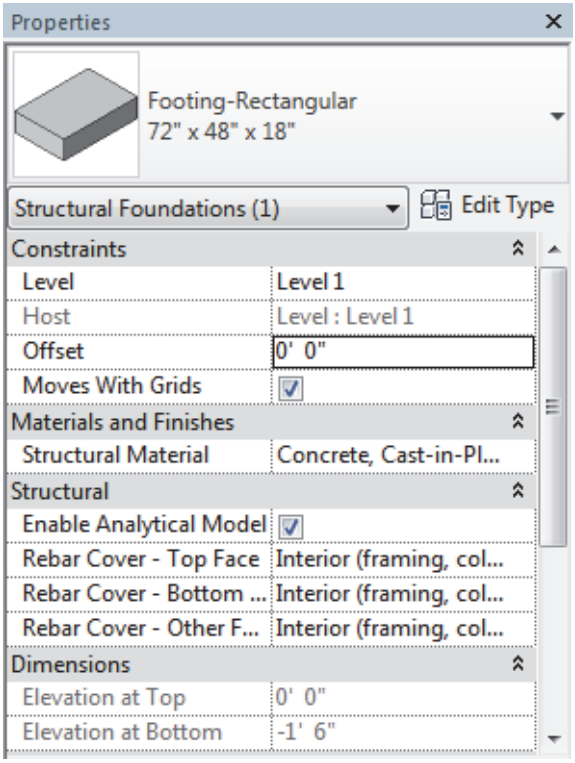

Figure 7–15

Enhanced in 2015

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 7–16 you need to insert an angled isolated footing and modify it to fit the exact size and location.

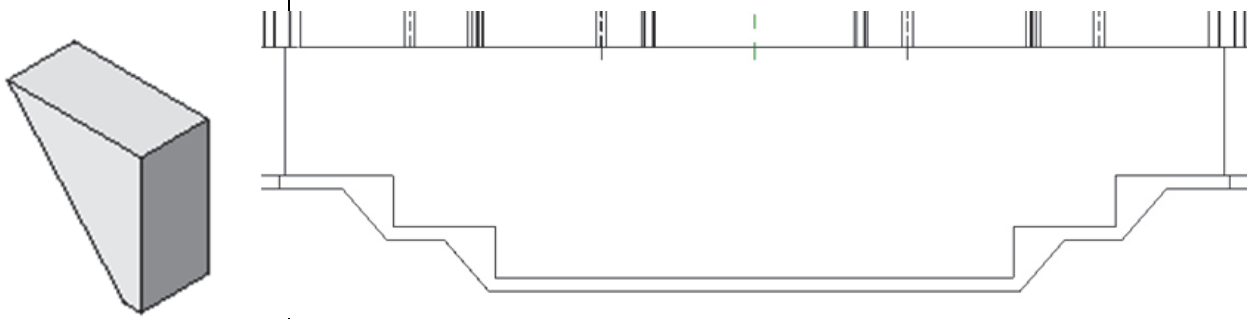

Figure 7–16

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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 footing family that you want to use and click Open.
4. Place the footing in the plan. It might not be in exactly the right place but you can modify it in other views.
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 7–17.

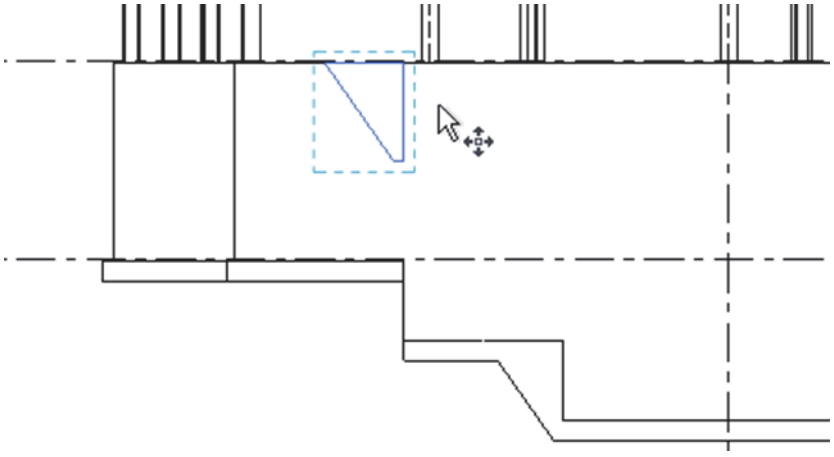

Figure 7–17

- Use (Align) to align footing with the footing already placed. When it is aligned, select the lock as shown in Figure 7–18 to ensure that if the elevation of the wall footing changes, the step footing also adjusts appropriately.

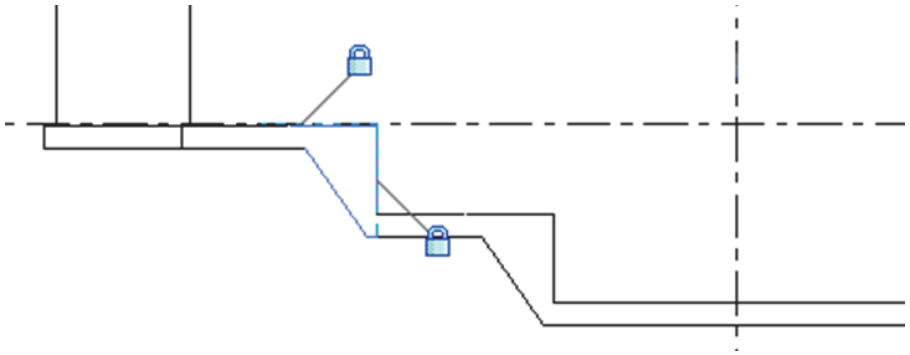

Figure 7–18

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- Some custom families have sizing options in either Properties (per instance) or in the Type Properties as shown in Figure 7–19 so that you can create additional types in various sizes as needed in the project.

Type Parameters

Parameter	
Dimensions	
Width	2' 0"
Height	5' 0"
Length	4' 0"
Bottom Extension	0' 6"
Identity Data	
Assembly Code	A1010100

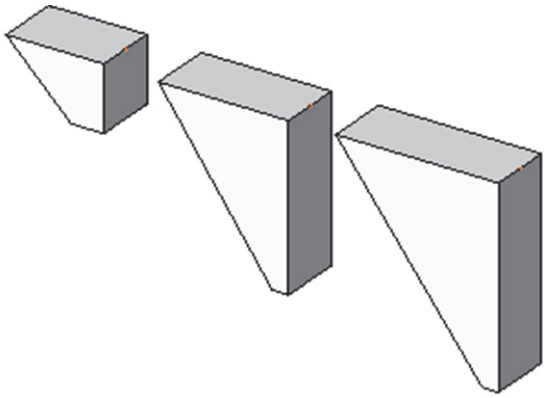

Figure 7–19

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7.3 Creating Piers and Pilasters

Learning Objective

- Create custom column sizes for 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 7–20. 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.

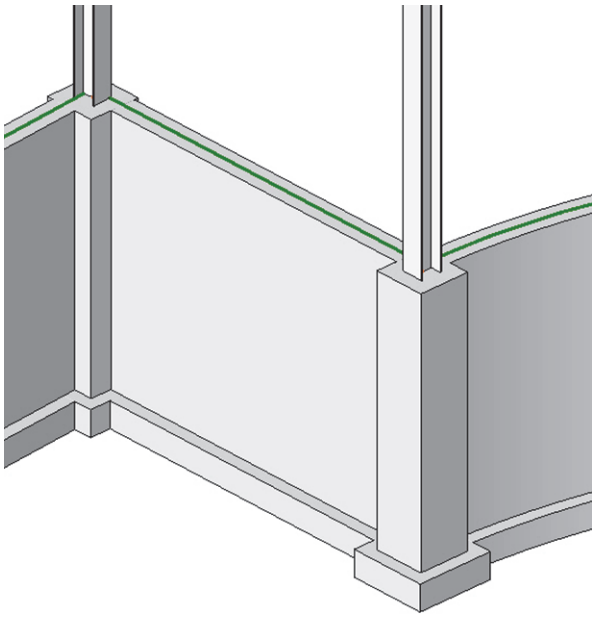

Figure 7–20

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....

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6. In the Name dialog box, type a name as shown in Figure 7–21.

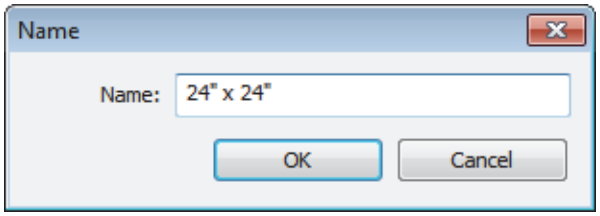

Figure 7–21

7. Modify the dimensions as needed. Enter the required values for *b* (base) and *h* (height), as shown in Figure 7–22.

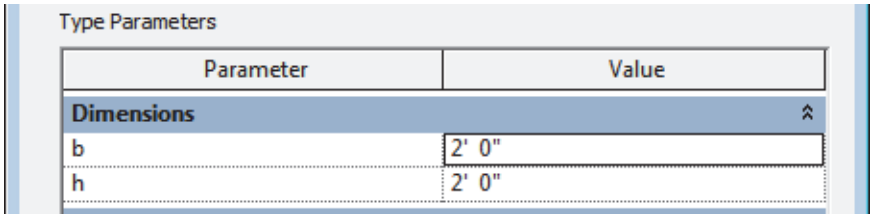

Figure 7–22

8. Click OK.
9. The new pier column can placed at the base of the existing steel columns, as shown in Figure 7–23.

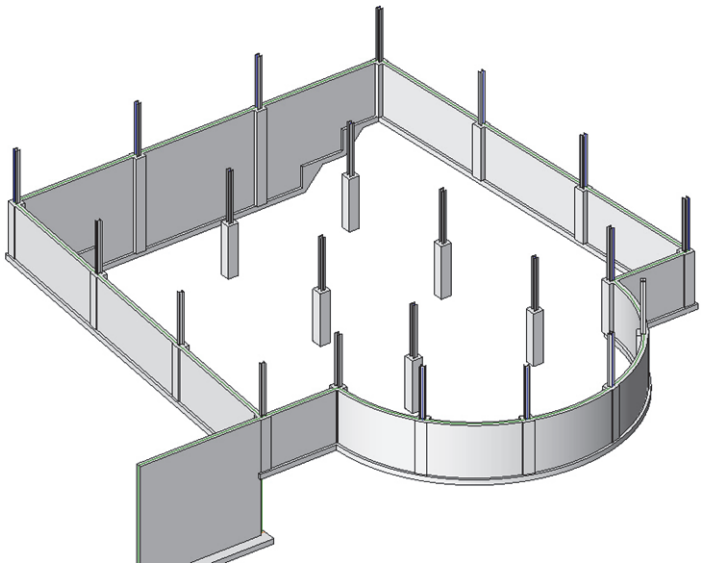

Figure 7–23

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Practice 7a

Add Footings Piers and Pilasters

Estimated time for completion: 40 minutes

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

Learning Objectives

- Create a foundation plan view.
- Create and apply wall footings.
- Create a new column type so that you can add concrete piers and pilasters.
- Place isolated footings at the base of each pier and pilaster.

In this practice you will create and add wall footings, piers and pilasters (types of columns), and isolated footings, as shown in Figure 7–24.

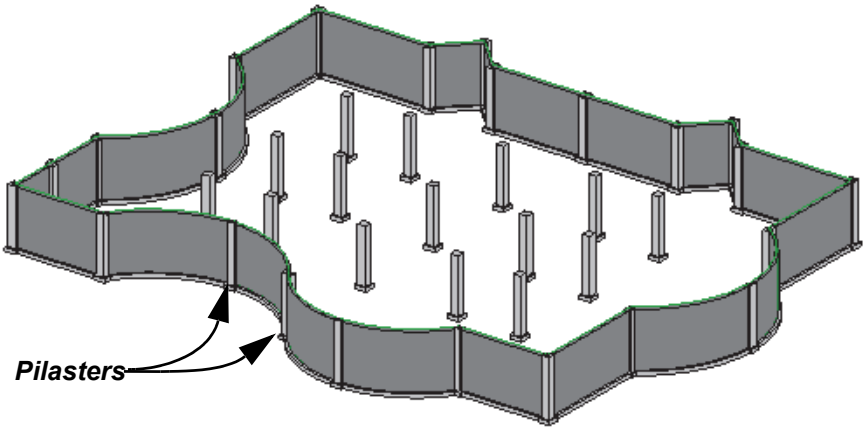

Figure 7–24

Task 1 - Create a foundation plan view.

1. Open the file **Syracuse-Suites-Foundations.rvt** in your class files folder.
2. In the Project Browser, right click on the Structural Plans: 00 GROUND FLOOR view and select **Duplicate View> Duplicate with Detailing**.
3. Right-click on the new view and *Rename* it **FOUNDATION PLAN**.
4. In Properties, under *Extents*, next to **View Range**, click Edit....

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5. In the View Range dialog box, set the *Primary Range: Bottom* and the *View Depth* to **Level Below (T.O.Footing),** as shown in Figure 7–25. This enables you to see both the steel columns at the 00 GROUND FLOOR level, and the footings being added.

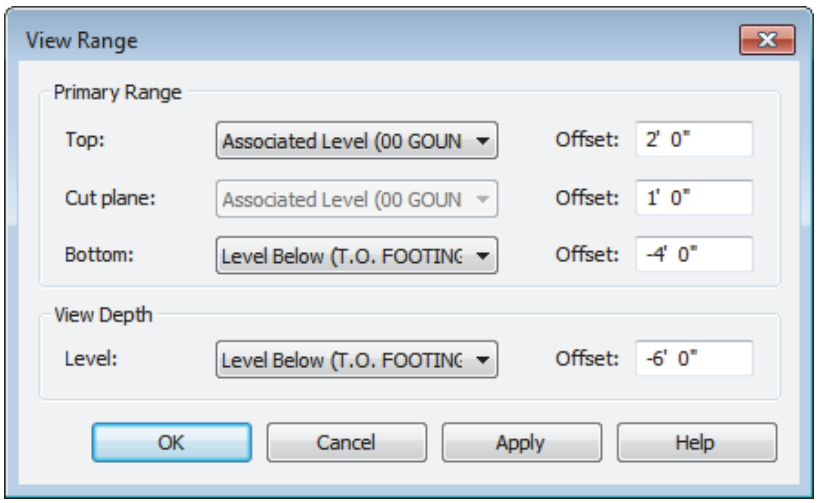

Figure 7–25

6. Click OK.

Task 2 - Create and apply wall footings.

1. In the Project Browser, navigate to *Families>Structural Foundations>Wall Foundation*. Right-click on **Bearing Footing – 36" x 12"** and select **Duplicate**, as shown in Figure 7–26.

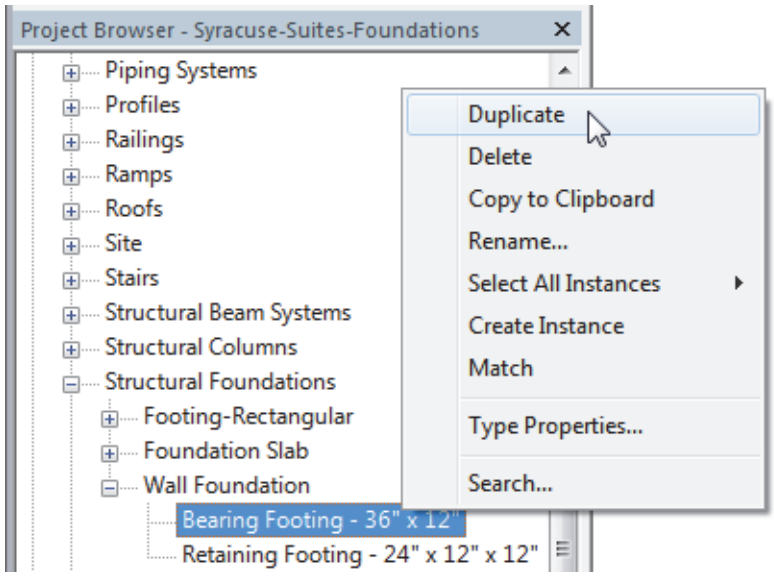

Figure 7–26

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2. Right-click on the copy and select **Rename**.
3. Name the new footing **Bearing Footing – 24” x 12”**.
4. Click on the new bearing footing type.
5. In the Type Properties dialog box, under *Dimensions*, set the *Width* to **2’-0”** as shown in Figure 7–27.

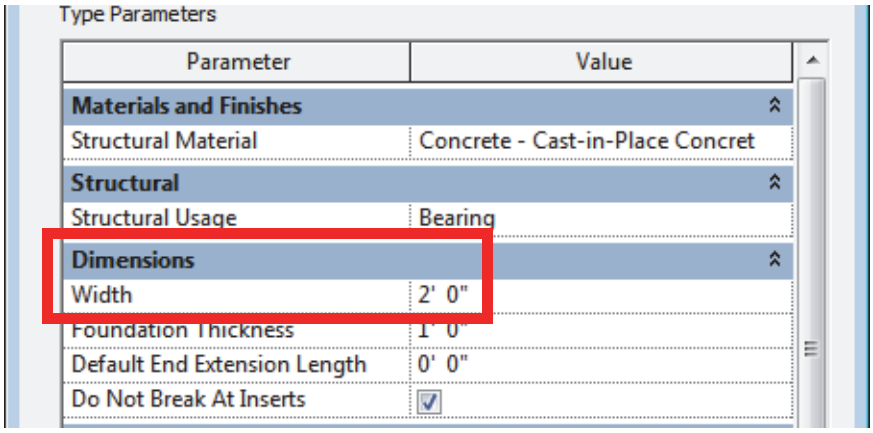


Figure 7–27

6. Click OK.
7. In the *Structure* tab>Foundation panel, click (Wall) or type **FT**.
8. In the Type Selector, select the new **Wall Foundation: Bearing Footing - 24” x 12”** as shown in Figure 7–28.

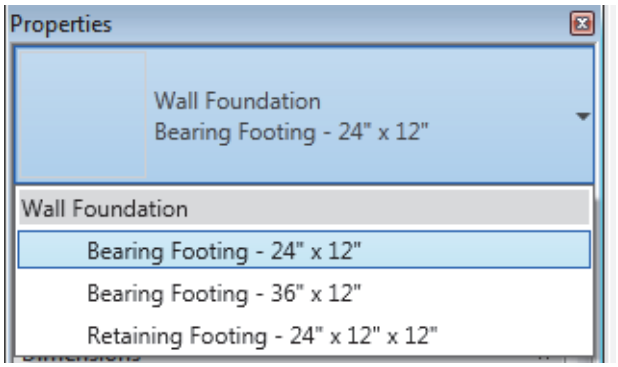


Figure 7–28

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. End the command.

11. In the Quick Access Toolbar, click to go to a 3D view and verify that the footing is placed correctly as shown in part in Figure 7–29.

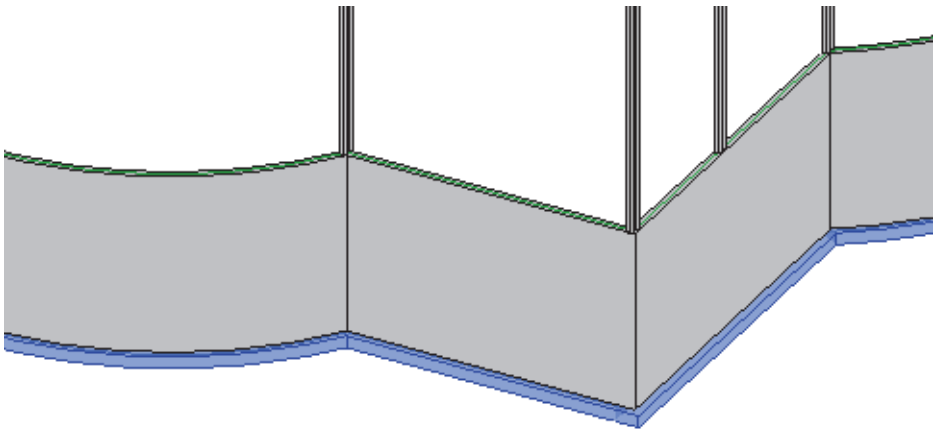
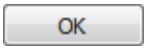


Figure 7–29

12. Save the project.

Task 3 - Create a new column type and place piers and pilasters.

1. Open the **Structural Plans: FOUNDATION PLAN** view.
2. In the *Structure* tab>Structure panel, click (Column), or type **CL**.
3. In the Type Selector, select one of the **Concrete-Rectangular-Column** types.
4. In Properties, click (Edit Type).
5. In the Type Properties dialog box, click .
6. Rename the column as **24 x 24** (the family name, **Concrete-Rectangular-Column** is automatically applied to the name) and click  .

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7. In the Type Properties dialog box, change the dimensions for both *b* (base) and *h* (height) to **2’-0”** as shown in Figure 7–30.

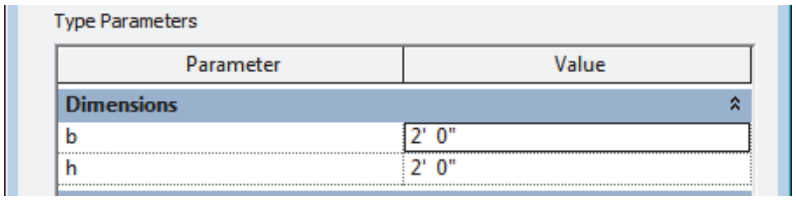

Figure 7–30

8. Click OK.
9. In the Options Bar, set the ***Depth*** to ***T.O. Footing***.
10. In the ***Modify | Place Structural Column*** tab> Placement panel, click (Vertical Column).
11. Place a pier or pilaster (concrete columns) at each existing column.
12. View the model in a 3D view. In the View Control Bar, click (Hide Analytical Model) to display the new elements, as shown in Figure 7–31.

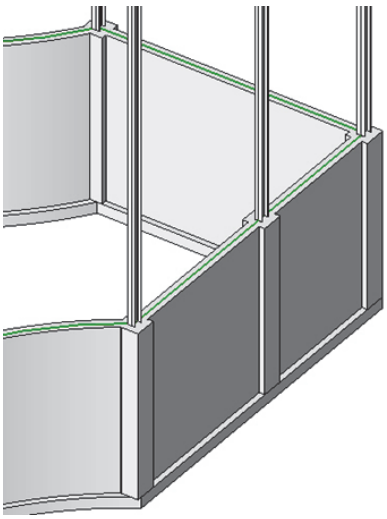

Figure 7–31

13. Hover the cursor over the top of one of the walls and press <Tab> until the linked Revit model is highlighted. (Watch the Status Bar to see which elements are highlighted.)
14. Select the linked model and type **VH** to hide it in this view.
15. Save the project.

Task 4 - Place isolated footings.

1. Open the **Structural Plans: T.O. FOOTING** view.
2. In the *Structure* tab>Foundation panel, click (Isolated).
3. In Properties, click (Edit Type).
4. In the Type Properties dialog box, click Duplicate....
5. Name the new type **36”x36”x12”**.
6. Click OK.
7. In the Type Properties dialog box, set the *Width* to **3’-0”**, *Length* to **3’-0”**, and *Thickness* to **1’-0”** as shown in Figure 7–32.

Type Parameters:

Parameter	Value
Dimensions	
Width	3' 0"
Length	3' 0"
Thickness	1' 0"

Figure 7–32

8. Click OK.
9. Zoom in and place the isolated footing underneath a pilaster. The isolated footing and wall footing automatically join together as shown in Figure 7–33.

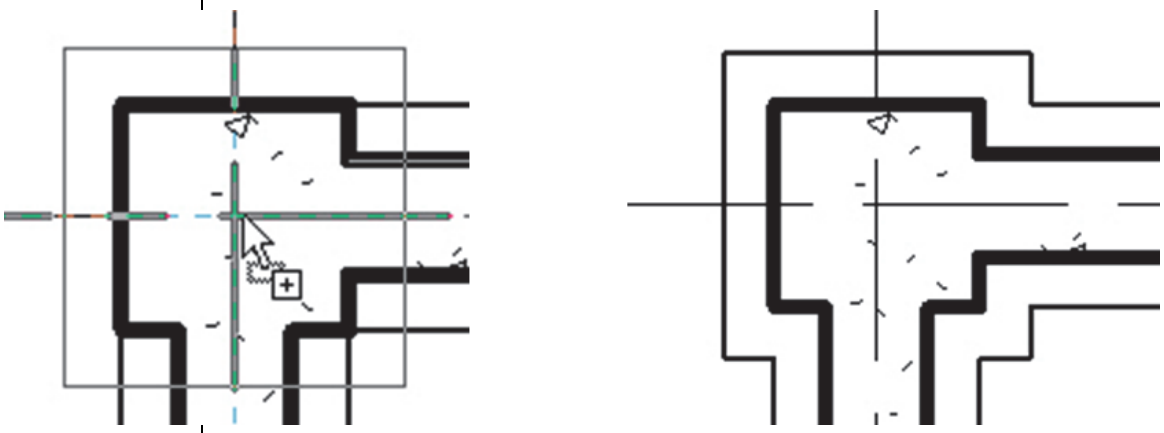

Figure 7–33

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10. 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).

11. Press <Esc> or click (Modify) to end the command.

12. Open a 3D view.

13. Select one of the steel columns and then right-click and select **Select All Instances>Visible in View**

14. In the View Control Bar, click (Temporary Hide/Isolate) and select **Hide Element**.

15. There should be an isolated footing under each pier and pilaster, as shown in Figure 7–34.

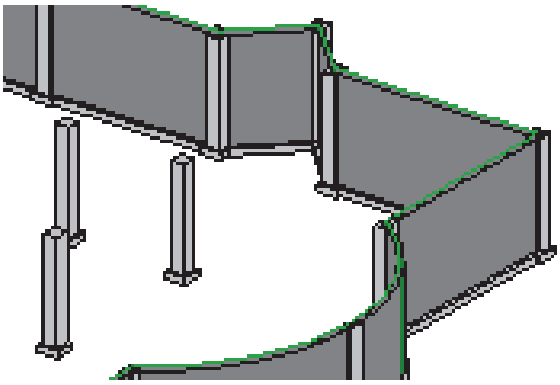

Figure 7–34

16. Save the project.

Chapter Review Questions

1. Which command do you use to insert a pier or a pilaster such as those shown in Figure 7–35?

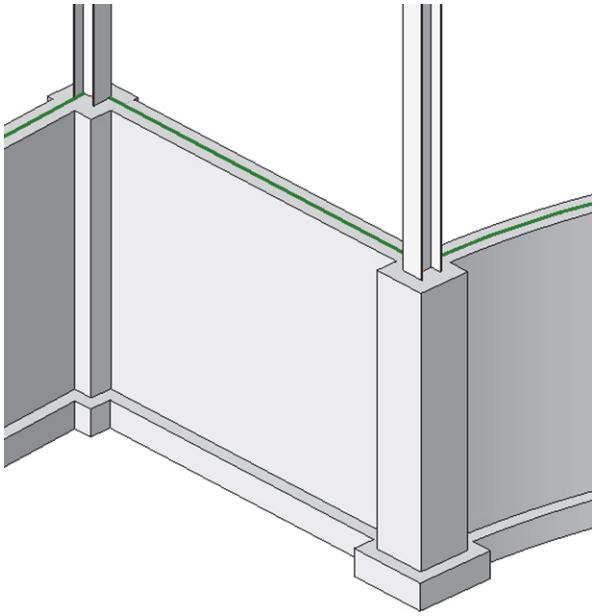

Figure 7–35

   a. **Structural Pier**
   b. **Isolated Foundation**
   c. **Structural Column**
   d. **Isolated Column**

2. How do you create additional column sizes for column types already in the project?

   a. In Properties, duplicate an existing type and change the sizes.
   b. Start a new Autodesk Revit project and draw it there.
   c. Import additional sizes from another project.
   d. In the Library, load additional sizes from other families.

3. Which element is the host for an isolated footing?

   a. Column
   b. Wall
   c. Slab
   d. Floor

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4. The (Structural Foundation: Wall) command requires a host wall to already be in place.

   a. True

   b. False

5. Which command do you use to add a custom footing type under a wall such as the ones shown in Figure 7–36?

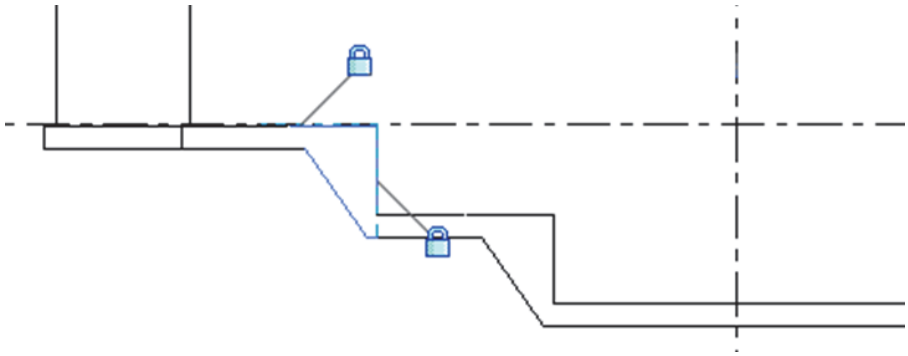

Figure 7–36

   a. **Component**

   b. **Structural Foundation: Isolated**

   c. **Structural Foundation: Wall**

   d. **Component: Structural Foundation**

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Command Summary

Button	Command	Location
	Edit Profile	• **Ribbon:** *Modify* | *Walls* tab> Mode panel
	Structural Foundation: Slab	• **Ribbon:** *Structure* tab>Foundation panel, expand Slab
	Structural Foundation: Wall	• **Ribbon:** *Structure* tab>Foundation panel
	Structural Foundation: Isolated	• **Ribbon:** *Structure* tab>Foundation panel

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