

Autodesk® Revit® Structure 2012 Fundamentals

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Chapter 5

Modify Commands

In this chapter you learn how to move and copy, rotate, array, mirror, align, split, offset, and trim/extend.

This chapter introduces:

- ✓ **Move and Copy**
- ✓ **Rotate**
- ✓ **Array**
- ✓ **Mirror**
- ✓ **Align**
- ✓ **Split**
- ✓ **Offset**
- ✓ **Trim and Extend**

5.1 Move and Copy

The Autodesk® Revit® Structure software contains editing tools and temporary dimensions that enable you to edit elements. Additional modifying tools can be used with individual elements or any selection of elements. They are located in the *Modify* tab>Modify panel as shown in Figure 5–1, and in the contextual tabs.





Figure 5–1

- The process of copying an element is identical to moving an element, except that by default, a copy is moved instead of the original object.

How to:

Move or Copy Elements

1. Select the element(s) that you want to move.
 2. In the Modify panel, click  (Move) or type **MV** or click  (Copy) or type **CO**. A boundary box displays around the selected element(s).
 3. Select a base point on or near the element.
 4. Select a second point.
 5. Use alignment lines and temporary dimensions to help place the element(s). Snaps are also helpful for placement.
 6. The element(s) remain highlighted, enabling you to start another command, or you can press <Esc> to end the command.
- If you select a modification command, such as **Move** or **Copy**, before you select any elements you can still use the command. Select the element(s) and press <Enter> to end the selection set. The rest of the prompts are the same as if you selected the elements first.

Move/Copy Options

The **Move** and **Copy** commands have several options that display in the Options Bar, as shown in Figure 5–2.

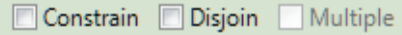





Figure 5–2

Constrain	Restricts the movement of the cursor to horizontal or vertical, or along the axis of an item that is at an angle. This keeps you from selecting a point at an angle by mistake. Constrain is off by default.
Disjoin (Move only)	Breaks any connections between the elements being moved and other elements. If Disjoin is on, the elements move separately. If it is off, the connected elements also move or stretch. Disjoin is off by default.
Multiple (Copy only)	Enables you to make multiple copies of one selection. Multiple is off by default.

- These commands only work within the current view, not between views or projects. To copy between views or

projects, use  (Copy to Clipboard) and  (Paste from Clipboard).

Hint: Scale



The Autodesk Revit Structure software is designed with full-size elements. Therefore, not much can be scaled. However, you can use  (Scale) in reference planes, images, and imported files from other programs.

5.2 Rotate

The **Rotate** command enables you to rotate element(s) based on a center point. The Autodesk Revit Structure software automatically finds the center point of a group of elements about which to rotate. If this center point is not adequate, you can drag the **Rotate** icon to the required location.

How to:

Rotate Elements

1. Select the element(s) that you want to rotate.
2. In the Modify panel, click  (Rotate) or type **RO**.
3. The origin is automatically set to the center of the element or group of elements, as shown at the top in Figure 5–3. To change the origin, as shown at the bottom in Figure 5–3, use the following:
 - Drag the  (Center of Rotation) control to a new point.
 - In the Options Bar, next to **Origin**, click and use snaps to move the origin.
 - Press the <Spacebar> to select the origin.

NEW IN 2012!

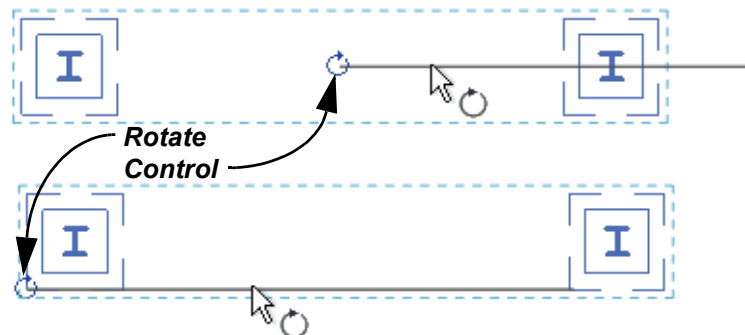


Figure 5–3

- To start the **Rotate** command with an automatic prompt to select the center of rotation, type **R3**.
4. In the Options Bar, specify whether you want to make a Copy (select the **Copy** option), type an angle in the *Angle* field as shown in Figure 5–4, and press <Enter>. You can also specify the angle on screen.

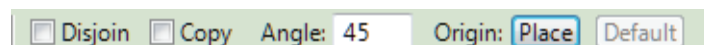


Figure 5–4

5. The rotated element(s) remains highlighted, enabling you to start another command or press <Esc> to finish.



- To specify the angle on screen, select a point for the **rotate start ray** (the reference line for the rotation angle). Then select a second point, using the temporary dimension to help you set the angle.
- The **Disjoin** option breaks any connections between the elements being rotated and other elements. If **Disjoin** is on (selected), the elements rotate separately. If it is off (cleared), the connected elements also move or stretch. **Disjoin** is off by default.

5.3 Array

In the Autodesk Revit Structure software, you can array an element based on two methods: **Linear** or **Radial**. A Linear array is line-based, while a Radial array is curve-based. Linear and Radial arrays are powerful tools when repeating layouts involving elements, such as custom trusses and rafters.

How to:

Create a Linear Array

1. Select the element(s) that you want to array.
 2. In the Modify panel, click  (Array) or type **AR**.
 3. In the Options Bar, click  (Linear).
 4. Specify the other options as needed.
 5. Select a start point and an end point to set the spacing and direction of the array. The array is displayed.
- If you have the **Group and Associate** option toggled on, you are prompted again for the number of items, as shown in Figure 5–5. Type a new number to change the amount of elements required. Click on the screen to end the command.

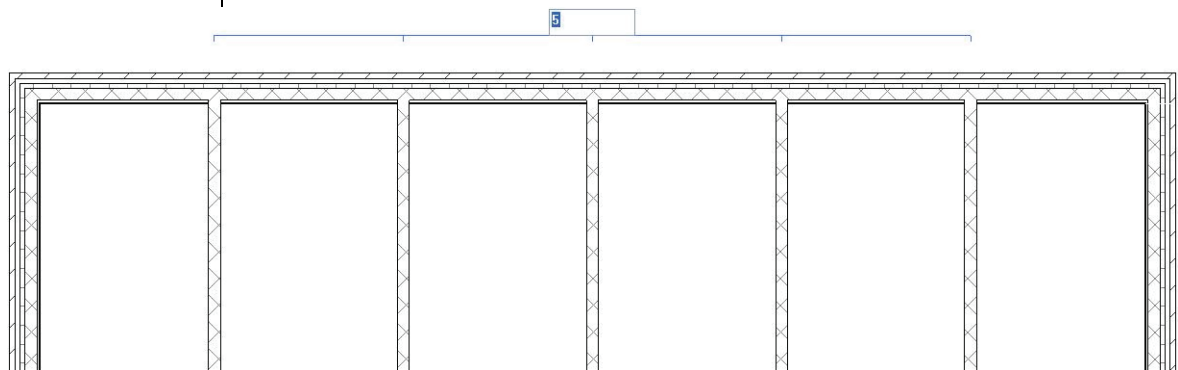





Figure 5–5

- To create a linear array in two directions, you need to array one direction first, select the arrayed elements, and then array them again in the other direction.

How to:

Create a Radial Array

1. Select the element(s) that you want to array.
2. In the Modify panel, click  (Array) or type **AR**.

3. In the Options Bar, click  (Radial).
4. Drag the  (Center of Rotation) control or use to move the origin to the appropriate location, as shown in Figure 5–6. Remember to set the center point rotate control first, because you cannot move it after specifying the angle.

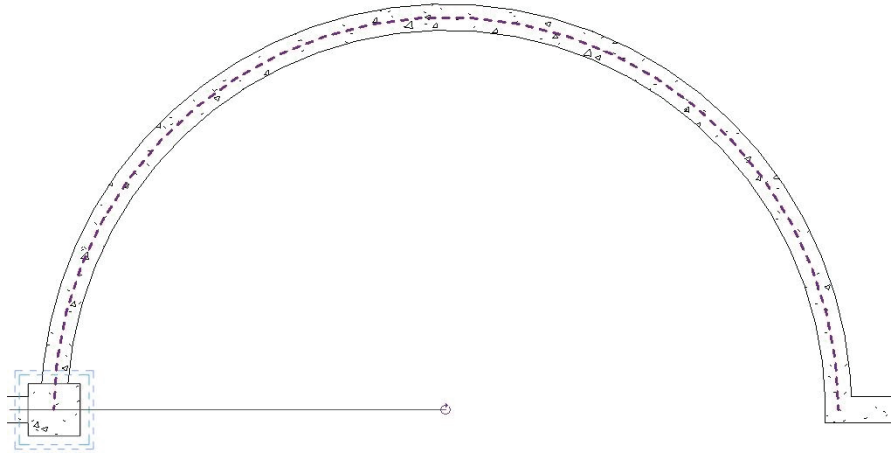
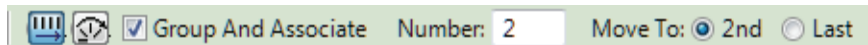


Figure 5–6

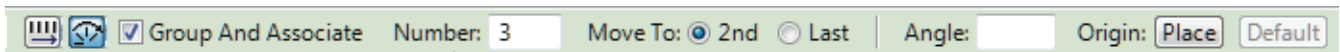
5. In the Options Bar, type an angle and press <Enter>, or specify the rotation angle by selecting points on the screen.

Array Options

In the Options Bar, set the options for the **Linear Array** or **Radial Array**, as shown in Figure 5–7.



Linear Array



Radial Array

Figure 5–7

Group and Associate	Creates a group element out of all arrayed elements. Groups can be selected by selecting any elements in the group.
Number	Specifies how many instances you want in the array.
Move To:	2nd specifies the distance or angle between the center points of the two elements. Last specifies the overall distance or angle of the entire array.
Constrain	Restricts the direction of the array to only vertical or horizontal (Linear only).

Angle	Specifies the angle (Radial only).
Origin	Specifies a location for the origin of rotation (Radial only).

Modifying Arrays

When you select an arrayed element that has been grouped, the associated shape controls and dimensions display, as shown in Figure 5–8. You can modify the number of instances and for radial arrays, the distance to the center.

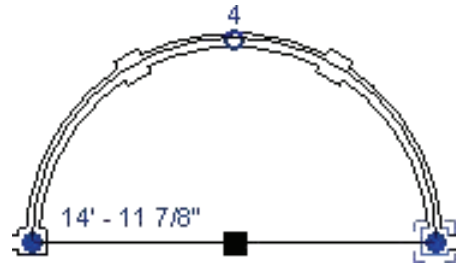



Figure 5–8



- To remove the constraint on the group, select one of the elements in the group and click  (Ungroup) in the *Modify* contextual tab>Group panel. When ungrouping, it is recommended that you ungroup all of the elements in that group.

5.4 Mirror

The **Mirror** command is similar to mirroring within most other CAD drafting programs. In the Autodesk Revit Structure software, the **Mirror** command is frequently used to mirror large numbers of elements at the same time. When mirroring, it is important to consider the final result because the Autodesk Revit Structure software automatically joins elements (such as walls). Care should be taken when selecting the elements to mirror to achieve the required results.


How to:

Mirror Elements

1. Select the element(s) to mirror.
2. In the Modify panel, select the method that you want to use:
 -  (Pick Mirror Axis) or type **MM**. You are prompted to select an element as the Axis of Reflection (mirror line).
 -  (Draw Mirror Axis) or type **DM**. you are prompted to select two points to define the axis about which the elements are going to mirror.
3. The new mirrored element(s) remain highlighted, enabling you to start another command, or press <Esc> to end the command.
 - By default, the original elements that were mirrored are not removed. To delete the original elements, clear the **Copy** option in the Options Bar.

Hint: Reference Planes

Establishing reference planes is useful in a building layout during the early design stages. Reference planes are dashed construction lines in your model that help define important working points, such as the centerline of the building. They can be any length and can be placed by drawing or by picking existing elements. By default, reference planes do not plot. Although they appear to be 2D elements, reference planes are infinite planes that extend through other views. For example, when a reference plane is drawn in a first floor plan, it displays in all other floor plans, corresponding elevations, and sections. This can be very helpful when lining up elements in the model.

In the *Home* tab>Work Plane panel, click  (Ref Plane). In the *Modify|Place Reference Plane* tab>Draw panel, use either



(Line) or



(Pick Lines) to draw the reference plane.

Practice 5a

Estimated time for completion: 10 minutes

Manipulating Elements

In this practice you will use **Move** and **Copy** to create a column grid with columns using existing elements in a project. You will then rotate one of the gridlines and the columns along that grid line. Then you will mirror the new gridlines to create the opposite part of the building, array a set of columns around an arc, and create a gridline of the array as shown in Figure 5–9.

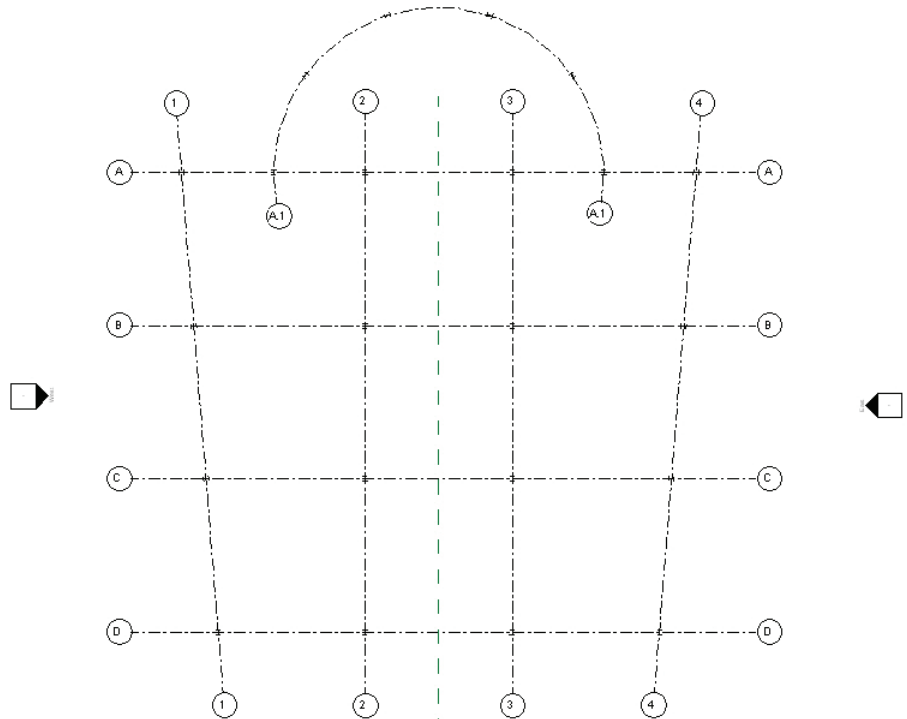



Figure 5–9

Task 1 - Move and copy elements.

1. Open the file **Class-Model-Editing.rvt** from your class folder.
2. Select **Grid 1** and the structural column that is at the intersection. (Hint: hold down <Ctrl> to select more than one element.)
3. In the *Modify|Multi-Select* tab>Modify panel, click  (Copy).
4. In the Options Bar, select **Multiple** as shown in Figure 5–10.

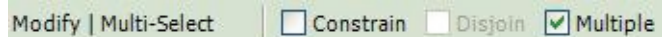



Figure 5–10

5. Pick a point anywhere along the grid line for the start point.

6. Move to the right and type **24'**. Copy the elements to the right again **24'-0"** until you have a total of four vertical grid lines and click  (Modify) to end.
7. Renumber the grid lines as shown in Figure 5–11.

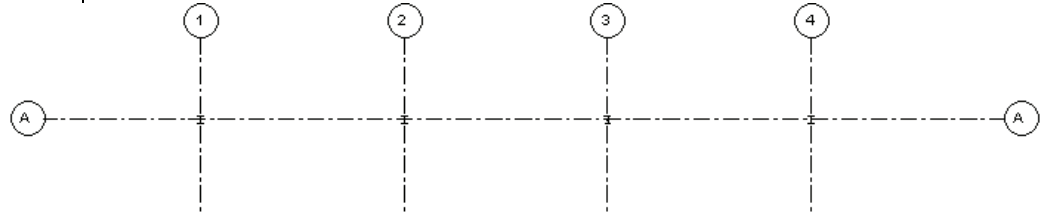



Figure 5–11

8. Select **Grid A** and the four columns along Grid A.
9. Copy them down **24'-0"** apart until there are a total of **4** horizontal grid lines and columns at each intersection.
10. Renumber the horizontal gridlines **B, C, and D**.
11. Zoom in on column A1.
12. Select the column (but not the grid line). In the *Modify* tab > Modify panel, click  (Move) and move it **6'-0"** to the left as shown in Figure 5–12.

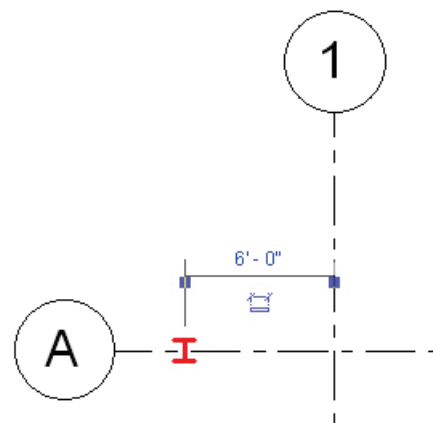




Figure 5–12

13. Save the project.

Task 2 - Rotate elements.

1. Delete Grid 4 and its columns.
2. Select **Grid 1**.

3. In the *Modify|Grids* tab>Modify panel, click  (Rotate).
4. In the Options Bar, click  and select the midpoint of column D1 as the center of rotation.
5. To start rotating, select the intersection of grid lines A1.
6. To finish rotating, select the midpoint of the column you moved earlier as shown in Figure 5–13.

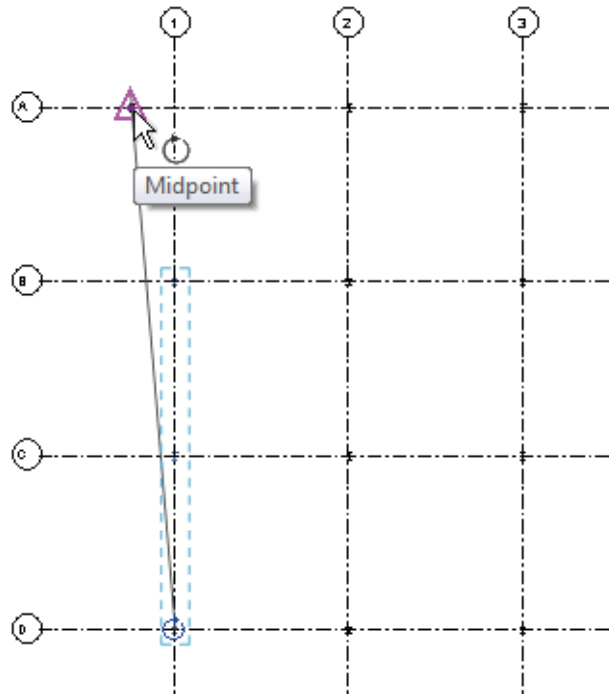



Figure 5–13

7. Zoom in on Column A1.
8. Select **Column A1** and click  (Rotate). The center point is in the correct location.
9. For the start angle, select a point to the right along Grid A as shown in Figure 5–14.

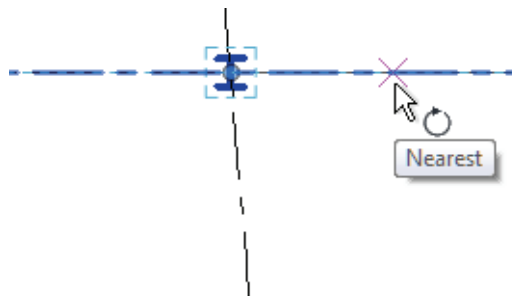


Figure 5–14

10. For the second angle, select a point along Grid 1, as shown on the left in Figure 5–15. The column is now rotated perpendicular to the angle of Grid 1 as shown on the right in Figure 5–15.

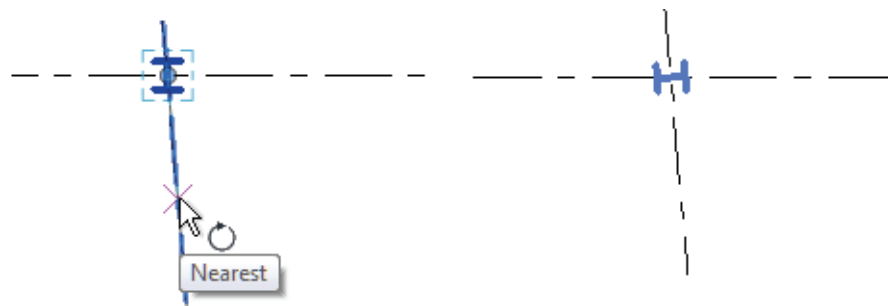





Figure 5–15

11. Repeat the process for the rest of the columns along that line.
12. Save the project.

Task 3 - Mirror elements.

1. In the *Home* tab>Work Plane panel, click  (Ref Plane).
2. In the *Modify|Place Reference Plane* tab>Draw panel, click  (Line). Draw a vertical line between **Grid 2** and **Grid 3** and use temporary dimensions to set the distances from each grid to **12'-0"** as shown in Figure 5–16, and click  (Modify) to end.

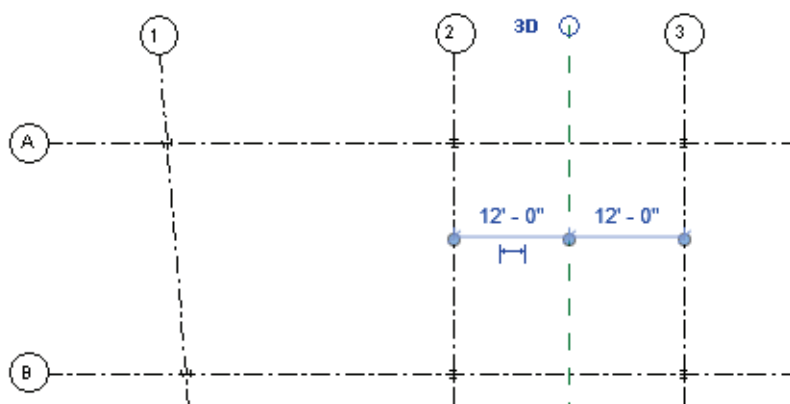



Figure 5–16

3. Select **Grid 1** and all of the columns in the grid. (To select multiple elements, draw a window around the group or hold down <Ctrl> as you select.)

- In the *Modify|Multi-Select* tab>Modify panel, click  (Pick Mirror Axis).
- Select the vertical reference plane that you created earlier as shown in Figure 5–17. Renumber the new gridline to **4**.

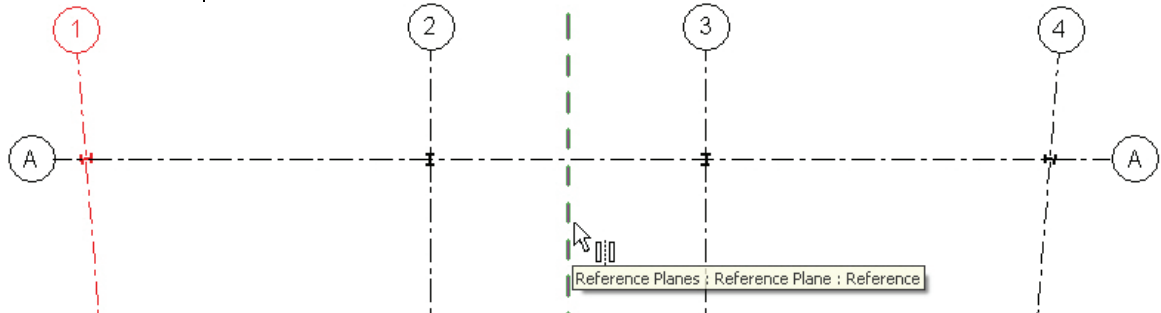


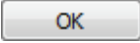


Figure 5–17

- Save the project.

Task 4 - Array elements.

- Select column **A3**. Click  (Copy) and copy *column A3* to the right by **15'-0"**. The new column is selected.
- In the *Modify|Structural Columns* tab>Modify panel, click  (Array).
- A Warning box opens as shown in Figure 5–18. This issue is corrected in later steps. Click .

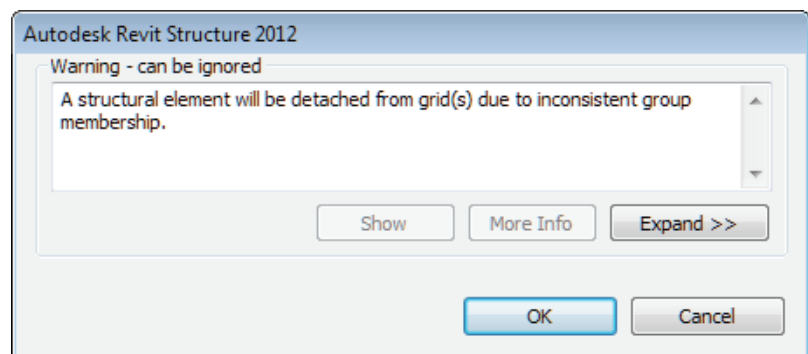




Figure 5–18

- In the Options Bar, click  (Radial), select **Group and Associate**, set the *Number* to **8**, and set *Move to:* to **Last**.

- Relocate the center of the array by dragging  to the intersection of the vertical ref plane and Grid 1 as shown in Figure 5–19.

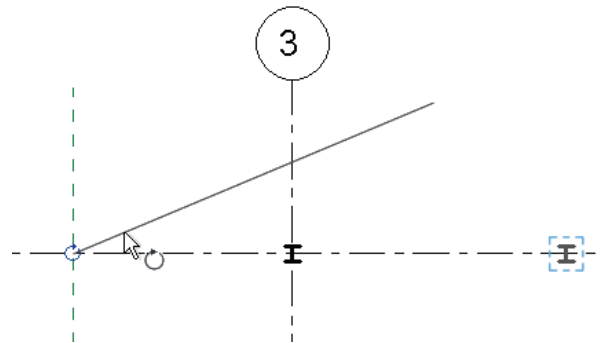


Figure 5–19

- In the Options Bar, set the *Angle* to **180** and press <Enter>. The new columns display along the arc with the number still selected as shown in Figure 5–20.

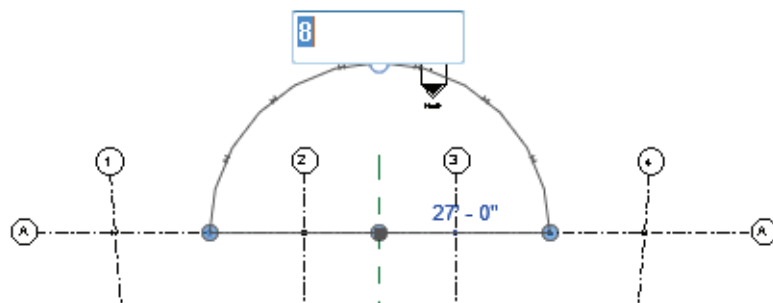




Figure 5–20

- Change the number to **6**.
- Click in empty space to release the selection.
- Move the elevation marker out of the way.
- In the *Home* tab>Datum panel, click  (Grid).
- In the Draw panel, click  (Pick Lines).

12. Move your cursor over the area of the array as shown in Figure 5–21. When an arc displays, select it.

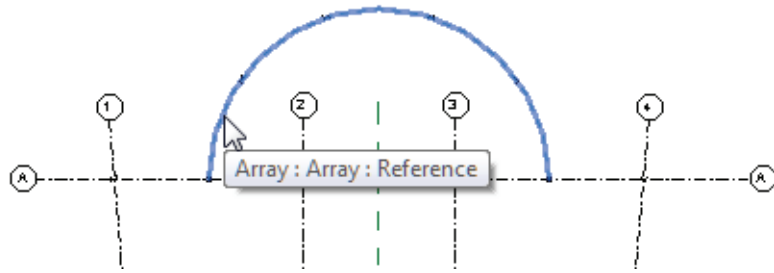


Figure 5–21

13. Click  (Modify).

14. Drag the grid bubbles down past the columns and rename the new grid **A.1** as shown in Figure 5–22.

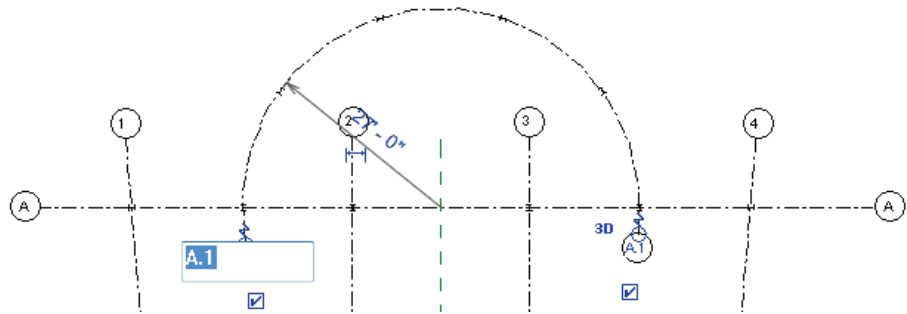


Figure 5–22

15. Save the project.


5.5 Align

The **Align** command enables you to align elements and then lock them in place. Elements can easily be aligned to other elements and reference planes. **Align** also has an option of locking the elements once they are aligned correctly. Locking ensures that if an element gets moved, the locked element(s) are moved with it.

- Be careful not to lock everything that is aligned. If you lock too many elements, you can over-constrain the model.

How to:

Align Elements

1. In the *Modify* tab>Modify panel, click  (Align) or type **AL**.
2. Select a line or point on the element that is going to remain stationary. For walls, press <Tab> to select the correct wall face.
3. Select a line or point on the element to be aligned. The second element moves into alignment with the first one as shown in Figure 5–23.

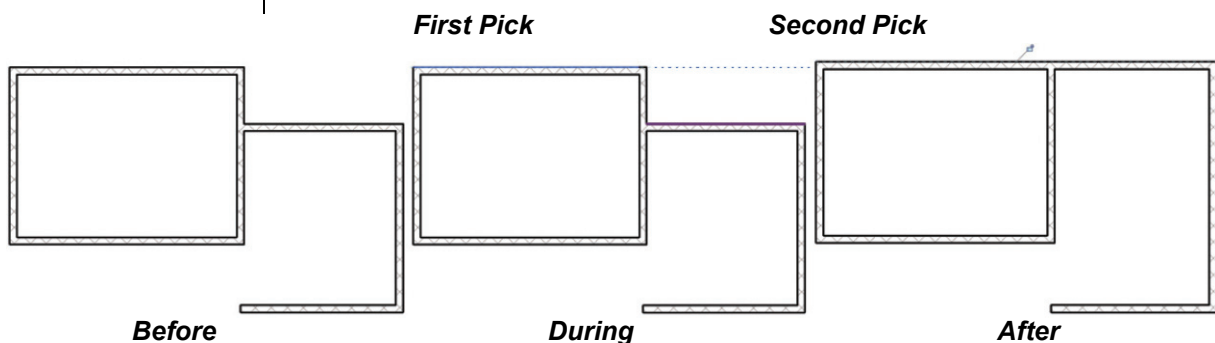


Figure 5–23

- The **Align** command works in both plan and elevation views.
- The **Align** command also works in 3D views. Make sure you select the correct component of the elements to be aligned. For example, to line up two beams vertically, select the top face of the flange of each beam. Zoom in if needed.

Locking elements enlarges the size of the project file, so use this option carefully.

- You can lock alignments so that the elements move together if either one is moved. Once you have created the alignment, a padlock is displayed. Click on the padlock to lock it, as shown in Figure 5–24.



Figure 5–24

- Use the **Multiple Alignment** option to select multiple elements to align with the first element. You can also hold down <Ctrl> to make multiple alignments.
- For walls, you can specify whether you want the command to use **Wall centerlines**, **Wall faces**, **Center of core** or **Faces of core**, as shown in Figure 5–25. The core reflects to the structural members of a wall as opposed to facing materials, such as sheetrock.

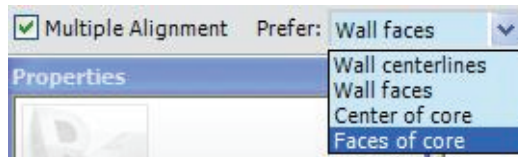



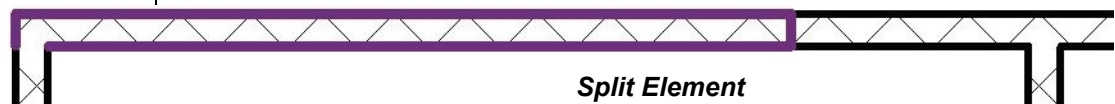
Figure 5–25

5.6 Split

The **Split** command is useful in modeling and when creating line work while drafting. The **Split** command works in two ways: you can divide a wall or element into segments or remove a portion of a wall or element between two specified points. For example, if a portion of wall needs to be demolished, the wall can be split where the demolition is to occur. The two resulting segments of wall can then be selected individually and worked with separately.


How to: Split Elements

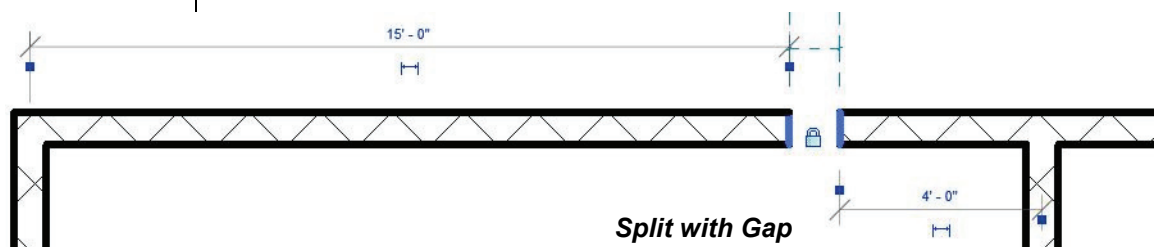
1. In the *Modify* tab>Modify panel, click  (Split Element) or type **SL**.
2. In the Options Bar, select or clear the **Delete Inner Segment** option, as needed.
3. Select a point on the element that you are splitting.
4. Repeat for any additional split locations.
5. Modify the items that were split, as needed.
 - The **Delete Inner Segment** option can be used when you select two split points along a wall or line. When the option is selected, the line or wall segment between the two split points is automatically removed.
 - You can split walls in plan, elevation, or 3D views as shown in Figure 5–26.



Split Element

Figure 5–26

-  (Split with Gap) splits the wall at a selected point as shown in Figure 5–27, and also creates a **Joint Gap** as specified in the Options Bar.



Split with Gap

Figure 5–27

5.7 Offset

The **Offset** command is not often used in the Autodesk Revit Structure software because it is embedded into the functionality of most commands. However, it is still available as a separate command and enables you to create parallel copies of walls, beams, model lines, and detail lines at a specified distance.

- If you offset a wall in which components have been embedded, such as rebar, the elements are copied with the offset wall.
- The offset distance can be set by typing the distance in the Options Bar (Numerical method shown in Figure 5–28) or by selecting points on the screen (Graphical method).

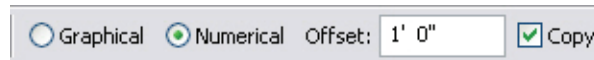


Figure 5–28

How to: Offset Elements using the Numerical Method




1. In the Modify panel, click  (Offset) or type **OF**.
2. In the Options Bar, select the **Numerical** option.
3. In the Options Bar, type the required distance in the *Offset* field.
4. Move the cursor over the element that you want to offset. A dashed alignment line previews the offset location as shown in Figure 5–29. Move the cursor to flip the sides, as needed.

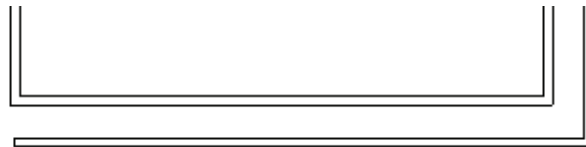


Figure 5–29

5. Click to create the offset.
6. Repeat Steps 4 and 5 to offset other elements by the same distance or change the distance for another offset.
7. Press <Esc> or click  (Modify) to end the command.

How to:**Offset Elements using the Graphical Method**


1. In the Modify panel, click  (Offset) or type **OF**.
 2. In the Options Bar, select the **Graphical** option.
 3. Select the element to offset.
 4. Select two points that define the distance of the offset and the side on which it is to be applied. Type an override for the temporary dimension for the second point.
- The **Copy** option is selected by default and creates a copy of the element being offset. If this option is cleared, the **Offset** command moves the selected element.
 - With the **Numerical** option, you can also select a chain of walls or lines for offsetting. Hover your cursor over one wall or line and press <Tab> until all of the required elements are highlighted. When the chain is visible, select the element that you want to offset. This enables you to offset all of them at once.
 - Walls connected at a corner, if offset to the outside of the corner, automatically extend to meet at the offset distance, as shown in Figure 5–30.

**Figure 5–30**

5.8 Trim and Extend

The **Trim/Extend** command enables you to either **Trim** or **Extend** walls, beams, braces, and lines. There are three trim methods: **Trim/Extend to Corner**, **Trim/Extend Single Element**, and **Trim/Extend Multiple Elements**.

How to: Trim/Extend to Corner

1. In the *Modify* tab>Modify panel, click  (Trim/Extend to Corner) or type **TR**.
2. Select the first wall or line on the side that you want to keep.
3. Select the second wall or line on the side that you want to keep, as shown in Figure 5–31.

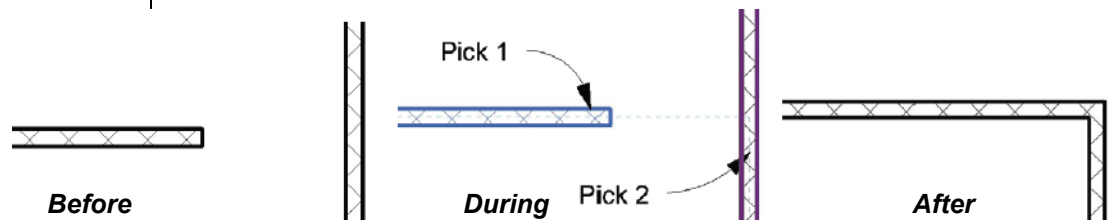



Figure 5–31

How to: Trim/Extend Single Element

1. In the *Modify* tab>Modify panel, click  (Trim/Extend Single Element).
2. Select the cutting or boundary edge.
3. Select the wall or line to be trimmed or extended, as shown in Figure 5–32.

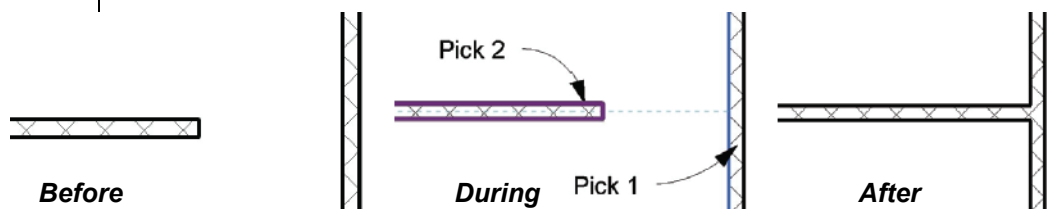

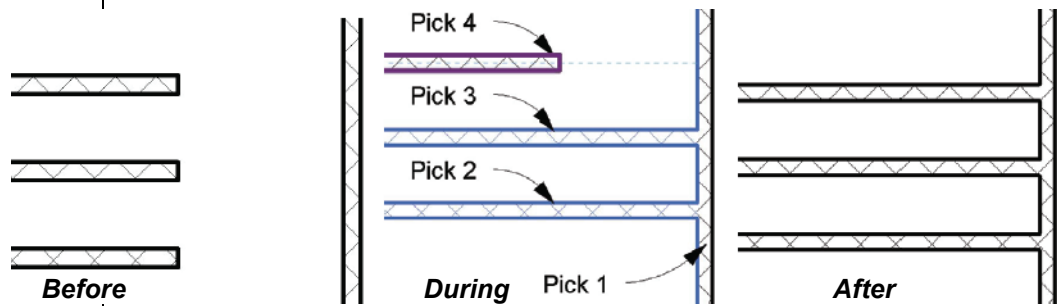


Figure 5–32

How to: **Trim/Extend Multiple Elements**

1. In the *Modify* tab>Modify panel, click  (Trim/Extend Multiple Elements).
2. Select the cutting or boundary edge.
3. Select the walls or lines that you want to trim or extend. For trimming, select the side that you want to keep, as shown in Figure 5–33.

**Figure 5–33**

- You can click in a blank space to clear the selection and then select another cutting edge or boundary.

Practice 5b

Estimated time for completion: 10 minutes

Modifying Elements

In this practice you will use **Split** and **Trim** to clean up existing walls in a project. You will then offset the entire foundation 4" from the centerline, as shown in Figure 5–34, where it can support an architectural brick facade.

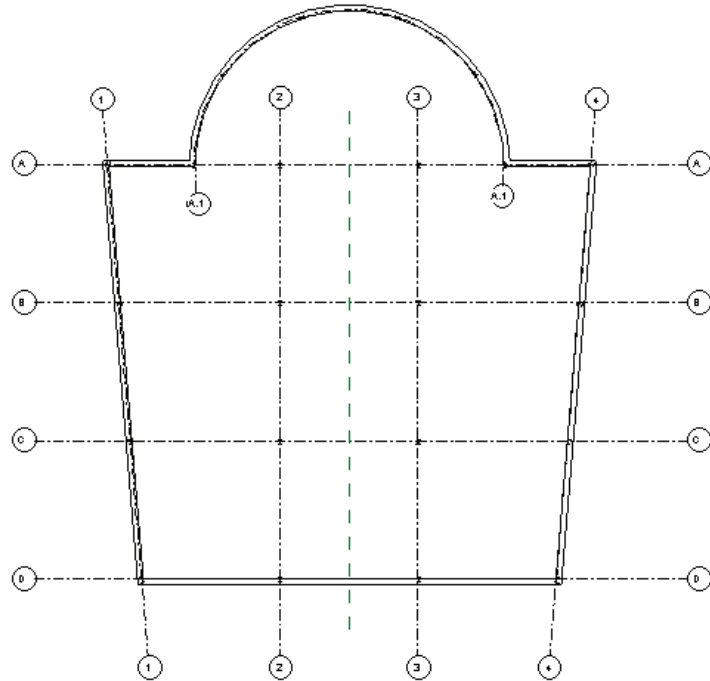



Figure 5–34

Task 1 - Split and trim elements.

1. Open the project **Class-Model-Modify.rvt**.
2. Select the horizontal foundation wall near the curved wall.
3. In the *Modify|Walls* tab>Modify panel, click  (Split Element).

4. Select the intersection of the reference plane and the foundation wall along **Grid A** as shown in Figure 5–35.

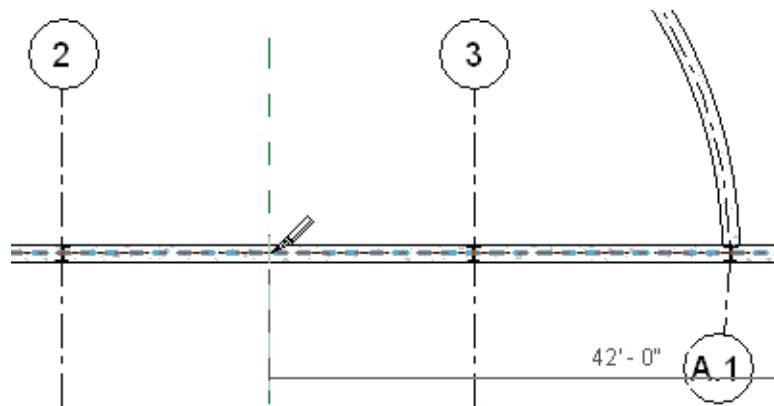



Figure 5–35

5. In the *Modify* tab>Modify panel, click  (Trim/Extend to Corner).
6. Select the horizontal wall as shown in Figure 5–36. Remember to select the side of the wall that you want to keep.

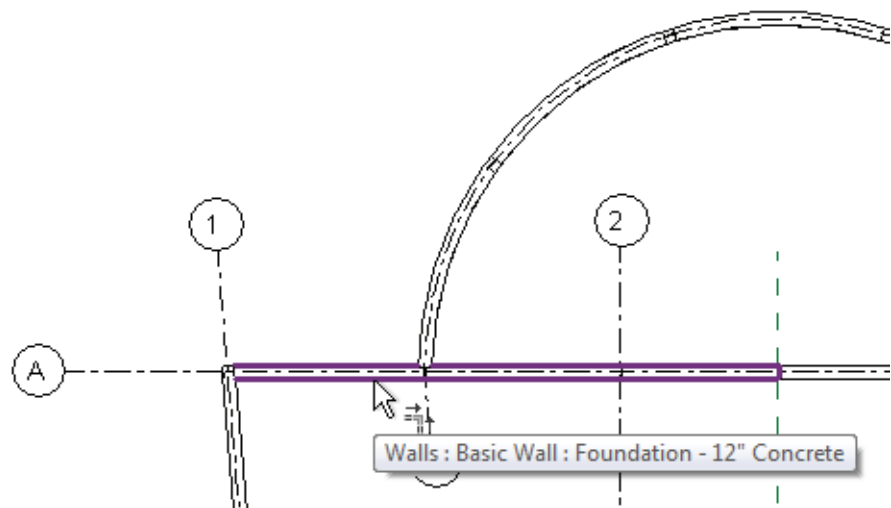


Figure 5–36

7. Select the curved wall. The walls are trimmed as shown in Figure 5–37.

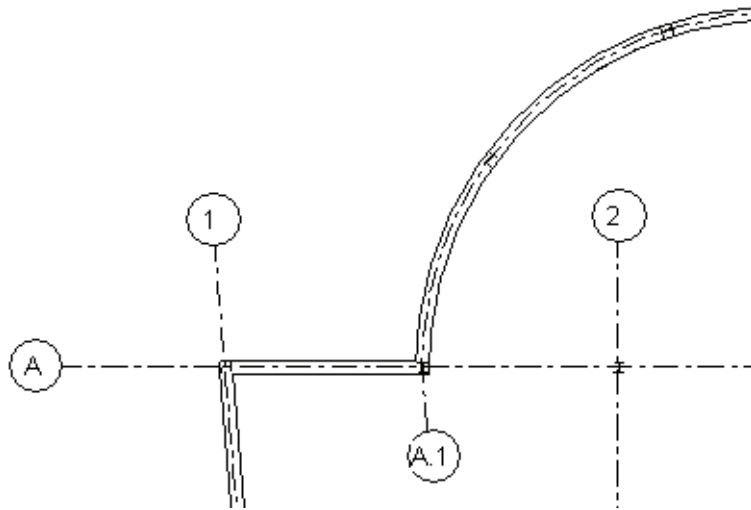



Figure 5–37

8. If the Reset analytical model warning opens, close it.
9. Repeat the process on the other end.

Task 2 - Offset elements.

1. In the *Modify* tab>Edit panel, click  (Offset).
2. In the Options Bar, select **Numerical**, set the *Offset* to **4"**, and clear the **Copy** option as shown in Figure 5–38.

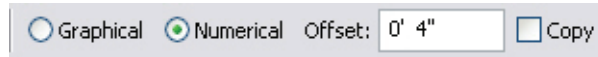


Figure 5–38

3. Hover your cursor over one of the foundation walls but do not select the wall. The blue alignment line should display on the outside of the grid line.

4. Press <Tab>. All of the foundation walls are selected as shown in Figure 5–39.

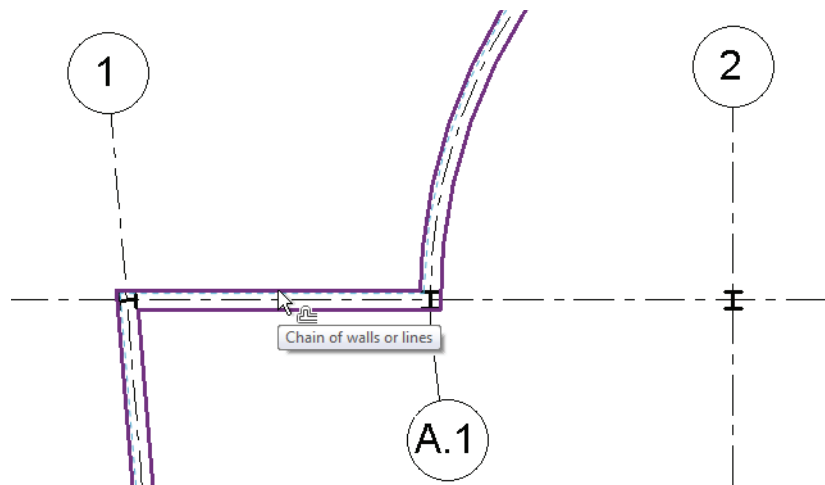


Figure 5–39

5. Once all of the walls are highlighted and the blue alignment line displays on the outside of the grid line, select a point. The foundation is offset from the grid line as shown in Figure 5–40.

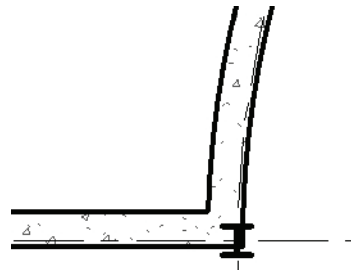

















Figure 5–40

6. Save and close the model.

Chapter Review Questions

1. While using the **Move** command, how can you change it to make a copy?
2. In the **Array** command, what is the difference between *moving to second* and *moving to last*?
3. How can you remove the middle segment during the **Split** command?
4. How do you change the center of rotation during the **Rotate** command?

Command Summary

Button	Command	Location
	Align	<ul style="list-style-type: none"> ■ Ribbon: <i>Modify</i> tab>Modify Panel ■ Shortcut: AL
	Array	<ul style="list-style-type: none"> ■ Ribbon: <i>Modify</i> tab>Modify Panel ■ Shortcut: AR
	Copy	<ul style="list-style-type: none"> ■ Ribbon: <i>Modify</i> tab>Modify Panel ■ Shortcut: CO
	Mirror - Draw Axis	<ul style="list-style-type: none"> ■ Ribbon: <i>Modify</i> tab>Modify Panel ■ Shortcut: DM
	Mirror - Pick Axis	<ul style="list-style-type: none"> ■ Ribbon: <i>Modify</i> tab>Modify Panel ■ Shortcut: MM
	Move	<ul style="list-style-type: none"> ■ Ribbon: <i>Modify</i> tab>Modify Panel ■ Shortcut: MV
	Offset	<ul style="list-style-type: none"> ■ Ribbon: <i>Modify</i> tab>Modify Panel ■ Shortcut: OF
	Ref Plane	<ul style="list-style-type: none"> ■ Ribbon: <i>Home</i> tab>Work Plane Panel ■ Shortcut: RP
	Rotate	<ul style="list-style-type: none"> ■ Ribbon: <i>Modify</i> tab>Modify Panel ■ Shortcut: RO
	Scale	<ul style="list-style-type: none"> ■ Ribbon: <i>Modify</i> tab>Modify Panel ■ Shortcut: RE
	Split Element	<ul style="list-style-type: none"> ■ Ribbon: <i>Modify</i> tab>Modify Panel ■ Shortcut: SL
	Split with Gap	<ul style="list-style-type: none"> ■ Ribbon: <i>Modify</i> tab>Modify Panel
	Trim/Extend Multiple Elements	<ul style="list-style-type: none"> ■ Ribbon: <i>Modify</i> tab>Modify Panel
	Trim/Extend Single Element	<ul style="list-style-type: none"> ■ Ribbon: <i>Modify</i> tab>Modify Panel
	Trim/Extend to Corner	<ul style="list-style-type: none"> ■ Ribbon: <i>Modify</i> tab>Modify Panel ■ Shortcut: TR