Autodesk® Revit® Architecture 2014 Fundamentals

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Chapter 2

Basic Drawing and Editing Tools

In this chapter you learn how to use the basic drawing and editing tools that apply to almost all types of elements. These tools also include alignment lines, temporary dimensions, snaps, and the Properties palette. You learn how to select elements for editing. You also learn how to move, copy, rotate, mirror, and array elements.

This chapter contains the following topics:

- ✓**General Drawing Tools**
- ✓**Editing Elements**
- ✓**Basic Modifying Tools**

2.1 General Drawing Tools

Learning Objectives

- Use contextual Ribbon tabs, the Options Bar and Properties as you draw and modify.
- Draw elements using draw and pick tools.
- Use drawing aids including alignment lines, temporary dimensions and snaps.

When you start a drawing command, the contextual Ribbon, Options Bar, and Properties palette enable you to set up features for each element you are placing in the drawing. As you are drawing, several features called *drawing aids* display, as shown in Figure 2–1. They help create designs quickly and accurately.

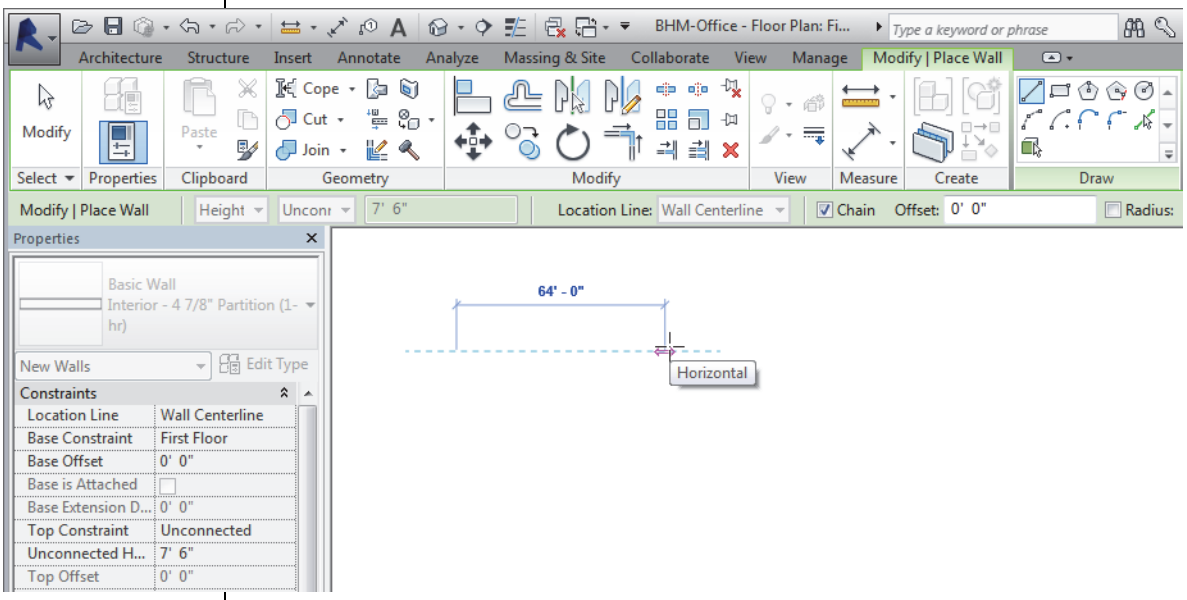

Figure 2–1

Contextual Ribbon

In the Select panel, click  *(Modify) to finish the command and return to the main tab at any time.*

When you select a command, the Ribbon displays the *Modify* tab with the contextual tools. For example, when you click  (Wall), the *Modify* | *Place Wall* tab opens, as shown in Figure 2–1.

- The Modify tools are always displayed to the left of the Ribbon and the contextual tools to the right with a green panel title.

Options Bar

The Options Bar displays the most used options for an element, as shown in Figure 2–2. These options are also typically found in the Properties palette.

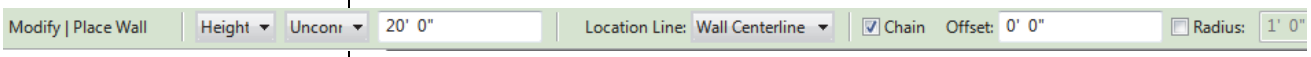

Figure 2–2

Properties Palette

The Properties palette displays the current element type in the Type Selector. You can select other types and modify some of the related parameters for the selected object, as shown in Figure 2–3.

Some of the properties parameters are only available when you are editing an element. They are grayed out when you are creating an element.

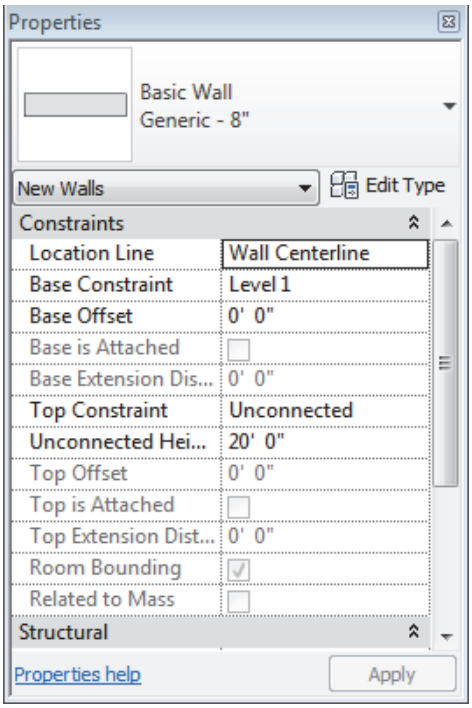

Figure 2–3

- Changes in the palette do not take effect until you click Apply or move your cursor away from the palette. If you click in the window, it applies the change but clears the elements.

Enhanced in 2014

To dock the palette, drag the titlebar over the titlebar of the Project Browser.

- The Properties palette can be floated and moved around the interface. You can also dock it on top of the Project Browser and then switch between them using the tabs at the bottom of the palette, as shown in Figure 2–4.

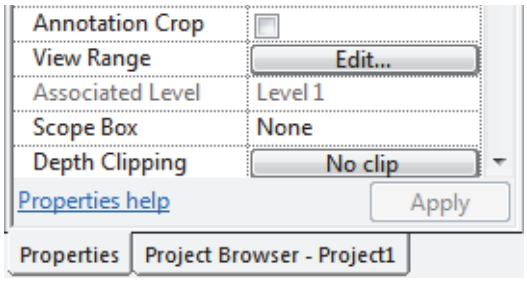

Figure 2–4

- If the Properties palette is toggled off, you can toggle it on by clicking (Properties) in the *Modify* tab>Properties panel or by typing **PP**. This is an on/off toggle.

Draw Tools

Draw tools are used to draw linear elements, such as the walls shown in Figure 2–5. They display in the contextual Ribbon when you start a command to draw any element. The available tools vary according to the element being drawn.

Linear elements include walls, lines, detail lines, and sketches for floors, roofs, stairs, and railings.

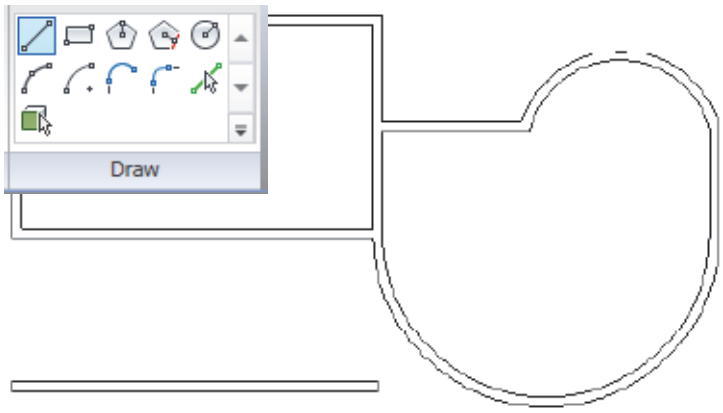

Figure 2–5

- Two styles of tools are available: one where you *draw* the element using a geometric form, and another where you *pick* an existing element (such as a line, face, or wall) as the basis for the new element's geometry.

How to:

Draw Linear Elements

1. Start the command you want to use, such as (Wall).
2. In the contextual tab>Draw panel, select a drawing tool, such as (Line), as shown in Figure 2–6. Select points to define the walls using other drawing aids, such as temporary dimensions, alignment lines, and snaps.

You can change from one Draw tool to another in the middle of a command.

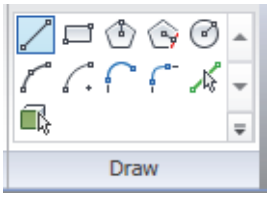

Figure 2–6

- You can also select a pick tool, such as (Pick Lines), and select an element. (Pick Face) is only available if you are in a 3D view.

3. Click (Modify) to finish the command.

Draw Tools

	Line	Draws a straight linear element defined by the first and last points. If **Chain** is enabled, you can continue selecting end points for multiple segments.
	Rectangle	Draws four linear elements defined from two opposing corner points. You can adjust the dimensions after selecting both points.
	Inscribed Polygon	Draws a polygon inscribed in a hypothetical circle with the number of sides specified in the Options Bar.
	Circumscribed Polygon	Draws a polygon circumscribed around a hypothetical circle with the number of sides specified in the Options Bar.
	Circle	Draws a circular linear element defined by a center point and radius.
	Start-End-Radius Arc	Draws a curved linear element defined by a start, end, and radius of the arc. The outside dimension shown is the included angle of the arc. The inside dimension is the radius.
	Center-ends Arc	Draws a curved linear element defined by a center, radius, and included angle. The selected point of the radius also defines the start point of the arc.

	Tangent End Arc	Draws a curved linear element tangent to another element. Select an end point for the first point, but do not select the intersection of two or more elements. Then select a second point based on the included angle of the arc.
	Fillet Arc	Draws a curved linear element defined by two other linear elements and a radius. Because it is difficult to select the correct radius by clicking, this command automatically moves to edit mode. Select the dimension and then modify the radius of the fillet.
	Spline	Draws a curved linear element based on selected points. The curve does not actually touch the points (Model and Detail Lines only).
	Ellipse	Draws an ellipse from a primary and secondary axis (Model and Detail Lines only).
	Partial Ellipse	Draws only one side of the ellipse, like an arc. A partial ellipse also has a primary and secondary axis (Model and Detail Lines only).

Pick Tools

	Pick Lines	Use this option to select existing linear elements in the project. This is useful when you start the project from an imported 2D drawing.
	Pick Face	Use this option to select the face of a 3D massing element (walls and 3D views only).
	Pick Walls	Use this option to select an existing wall in the project to be the basis for a new sketch line (floors, ceilings, etc.).

Draw Options

When you are in Drawing mode, several options display in the Options Bar, as shown in Figure 2–7.

Other options display according to the type of element you are drawing.

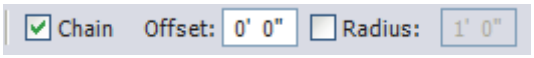

Figure 2–7

- The **Chain** option controls how many segments are drawn in one process. If it is not selected, the **Line** and **Arc** tools only draw one segment at a time. If it is selected, you can continue drawing segments until you select the command again.
- The *Offset* field enables you to enter values to draw the linear elements at a specified distance from the selected points. For example, set *Offset* to **10'-0"** and select the end points of an existing wall to create a new wall 10'-0" away.

- When using a radial draw tool, you can select the **Radius** option and add a radius in the edit field.
- To draw angled lines, move your cursor to the desired angle shown by the temporary dimensions, and type the distance value. The angle increments shown vary depending on how far in or out the view is zoomed.

Hint: Reference Planes

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. are construction lines that do not plot. In the *Home* tab>Work Plane panel, click (Ref Plane) or type **RP** and then draw or pick lines.

Drawing Aids

As soon as you start drawing in the software, three drawing aids display on the screen: *alignment lines*, *temporary dimensions*, and *snaps*. These are available with most drawing and many modification commands.

Alignment Lines

Dashed *alignment lines* display as soon as you select your first point, as shown in Figure 2–8. They help keep lines horizontal, vertical, or at a specified angle. They also line up with the implied intersections of walls and other elements.

Angles display at 90, 45, 15, 5, and 1 degree increments. The order of the angle list controls the power level of the snap. For example, the 90 degree angle is most likely to display if you are close to horizontal or vertical.

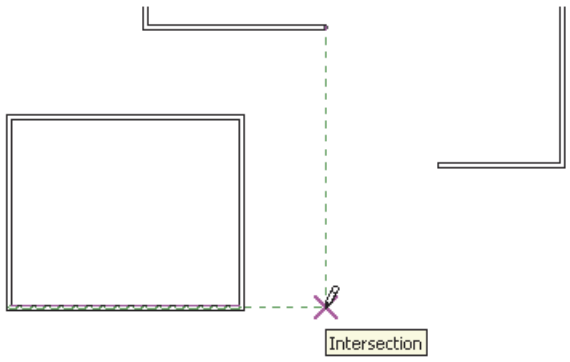

Figure 2–8

- Hold down <Shift> to force the alignments to be orthogonal.

Temporary Dimensions

Along with alignment lines, *temporary dimensions* display as you draw to help place linear elements (such as walls) at the proper length and location, as shown in Figure 2–9.

You can move the cursor to the exact dimension, or place it approximately and then modify the dimension as needed. This enables you to sketch the building and then come back and use the parametric engine to update the model with greater precision.

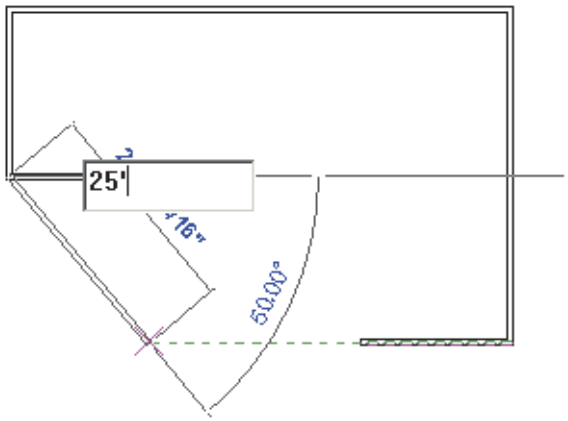

Figure 2–9

- For Imperial measurements (feet and inches), the software understands a default of feet. For example, when you type **4**, it assumes 4’-0”. To indicate inches, type the inch mark (”) after the distance. For a distance such as 4’-6”, you can type any of the following: **4’-6”**, **4’6**, **4-6**, or **4 6** (the numbers separated by a space).
- The increments displayed for dimensions change as you zoom in closer to the elements. These *dimension snap* increments are for both linear and angular dimensions, and can be set in the Snaps dialog box.
- Temporary dimensions disappear as soon as you finish drawing linear elements. If you want to make them permanent, select the control shown in Figure 2–10.

Dimensions are a powerful tool to help create and annotate the model.

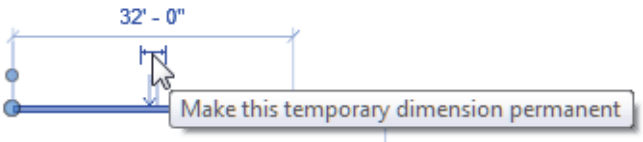

Figure 2–10

- The size of the temporary dimensions, in pixels, can be set in the Options dialog box on the *Graphics* tab.

Snaps

Snaps are key points that help you reference existing elements to exact points when drawing, as shown in Figure 2–11.

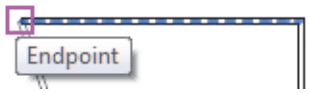

Figure 2–11

They include *Endpoints*, *Midpoints*, *Nearest*, *Work Plane Grid*, *Quadrants*, *Intersections*, *Centers*, *Perpendicular*, *Tangents*, and *Points*. When you move your cursor over an element, the **Snap** symbol displays. Each snap location type displays with a different symbol.

- To modify the snap settings, in the *Manage* tab>Settings panel, click (Snaps). This opens the Snaps dialog box, where you can set which snap points are active, as well as the snap distances (for dimension and angular increments). It also shows the keyboard shortcuts for each snap, which you can use to override the automatic snapping.

Hint: Temporarily Overriding Snap Settings

You can use shortcut key combinations (displayed in the Snaps dialog box) or right-click and select **Snap Overrides** to temporarily override snap settings. Temporary overrides only affect a single pick but can be very helpful when there are snaps nearby other than the one you want to use.

2.2 Editing Elements

Learning Objectives

- Select elements to modify.
- Modify elements using the Ribbon, Properties, temporary dimensions, and controls.
- Filter selection sets.

Building design projects typically involve extensive changes to the positions of walls, doors, and other elements. The Autodesk® Revit® software was designed to make such changes easy.

(Modify) works with all of the different element types.

- When you select an element during an active command, there are a number of ways to change it, as shown in Figure 2–12:
  - Modify commands and element-specific tools display in the contextual tab in the Ribbon.
  - The Properties palette displays the Type Selector and associated parameters.
  - *Temporary dimensions* enable you to change the element's dimensions.
  - *Controls* enable you to drag, flip, lock, and rotate the element.
- When you hover your cursor over an element, a tooltip displays information about it.

The Type Selector can also be found in the Modify tab of the Ribbon or on the Quick Access Toolbar.

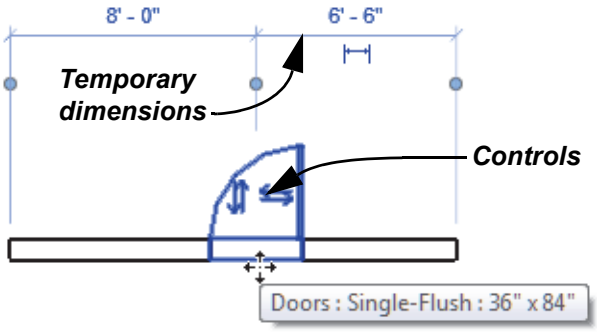

Figure 2–12

- To delete an element, select it and press <Delete>, right-click and select **Delete**, or click (Delete) in the Modify panel.

- When working with temporary dimensions, the default location of the dimension line might not be where you need it. For example, as shown on the left in Figure 2–13, instead of setting the distance of the selected wall from the center of the left wall, you might want to modify the distance from the grid line. Drag the square control (also called the witness line) to the grid line, as shown on the right in Figure 2–13.

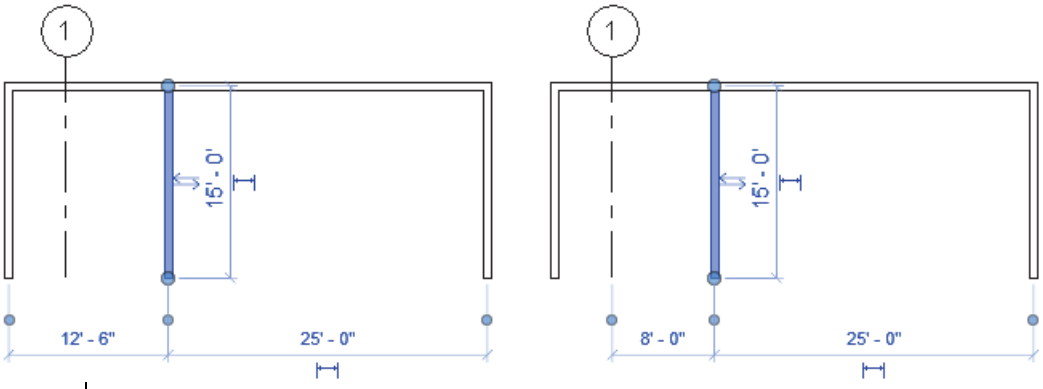

Figure 2–13

- You can click on the square control to move the witness line from one part of the selected wall to another or drag it to a new location.
- The new location of a temporary dimension is remembered as long as you are in the same session of the software.

Hint: Nudge

Nudge is a feature that is often overlooked. It enables you to move an element in short increments. When an element is selected, you can press one of the four arrow (direction) keys to move the element in that direction. The snap increments specified in the Snap dialog box determine the distance that is applied each time the arrow keys are pressed, depending how far in or out you are zoomed. This is very useful with annotation elements.

Selecting Elements

You can select elements in several ways:

- To select a single element, place your cursor on the edge of the element and click to select.
- To add another element to a selection set, hold down <Ctrl> and select another item.
- To remove an element from a selection set, hold down <Shift> and select the element.

- If you click and drag the cursor to *window* around elements, you have two selection options, as shown in Figure 2–14. If you drag from left to right, you only select the elements completely inside the window. If you drag from right to left, you select elements both inside and crossing the window.

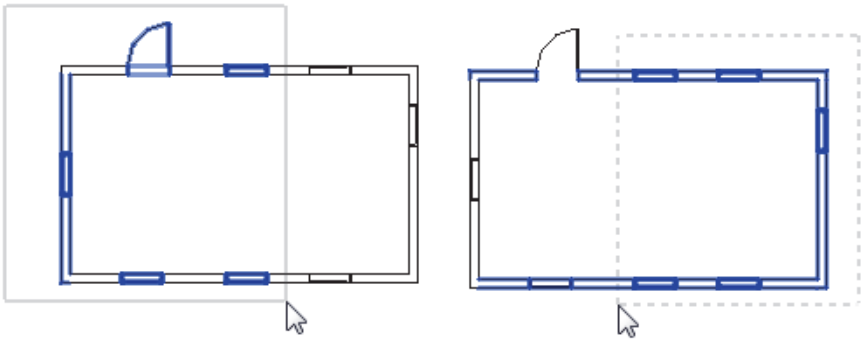

Figure 2–14

- If several elements are on or near each other, press <Tab> to cycle through them before you click. If there are elements that might be linked to each other, such as walls that are connected, pressing <Tab> selects the chain of elements.

- Press <Ctrl>+<Left Arrow> to reselect the previous selection set. You can also right-click in the drawing window with nothing selected and select **Select Previous**.

- To select all elements of a specific type, right-click on an element and select **Select All Instances>Visible in View** or **In Entire Project**, as shown in Figure 2–15.

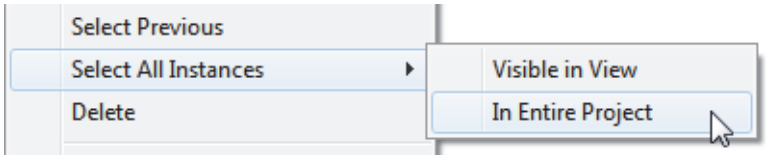

Figure 2–15

New in 2014

Hint: Selection Options

You can control how the software selects specific elements in a project by toggling them on and off on Status Bar or in the expanded **Modify** icon as shown in Figure 2–16.

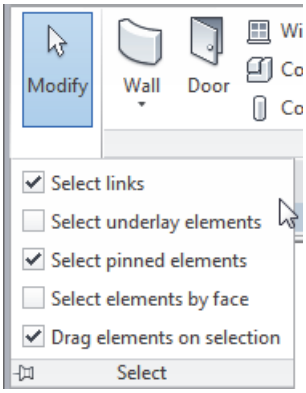

Figure 2–16

- **Select links:** When toggled on, you can selected linked drawings or Autodesk Revit models. When it is toggled off you cannot select them when using **Modify** or **Move**.
- **Select underlay elements:** When toggled on, you can select underlay elements. When toggled off, you cannot select them when using **Modify** or **Move**.
- **Select pinned elements:** When toggled on, you can selected pinned elements. When toggled off, you cannot select them when using **Modify** or **Move**.
- **Select elements by face:** When toggled on you can select elements (such as the floors or walls in an elevation) by selecting the interior face or selecting an edge. When toggled off, you can only select elements by selecting an edge.
- **Drag elements on selection:** When toggled on, you can hover over an element, select it, and drag it to a new location. When toggled off, the Crossing or Box select mode starts when you press and drag, even if you are on top of an element. Once elements have been selected they can still be dragged to a new location.

Modifying Multiple Elements

When multiple element types are selected, the *Multi-Select* contextual tab opens in the Ribbon, as shown in Figure 2–17. This gives you access to all of the Modify tools, as well as the **Filter** command and tools to create and use selection sets.

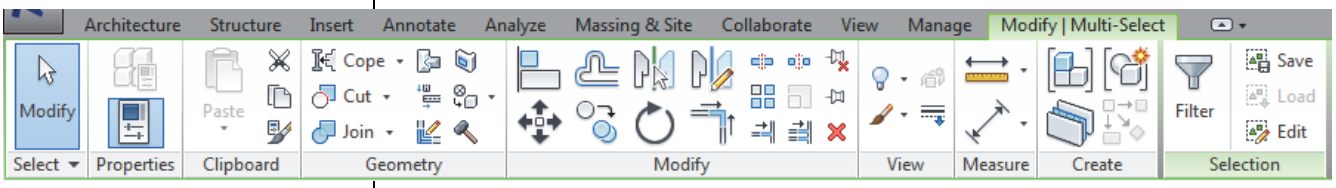

Figure 2–17

- The Properties palette displays tools that are common to all element types if they are available. You can also select just one type and make modifications, as shown in Figure 2–18.

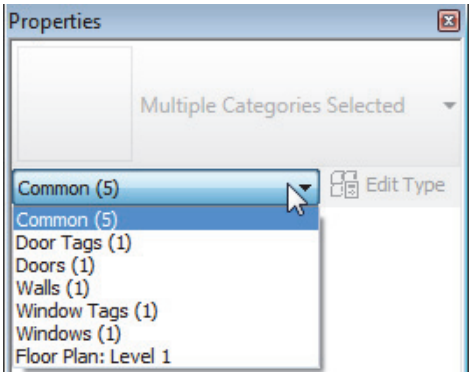

Figure 2–18

Filtering Selection Sets

The **Filter** command enables you to specify the types of elements to select. For example, you might only want to select doors, as shown in Figure 2–19.

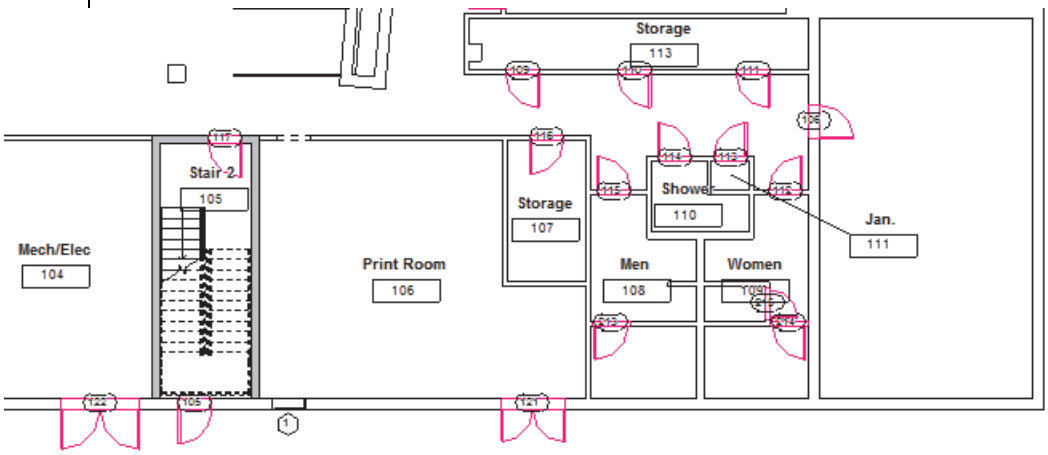

Figure 2–19

How to:

Filter a Selection Set

1. Select everything in the required area.
2. Click (Filter) in the *Modify* | *Multi-Select* tab or in the Status Bar. The Filter dialog box opens, as shown in Figure 2–20.

The Filter dialog box displays all types of elements in the original selection.

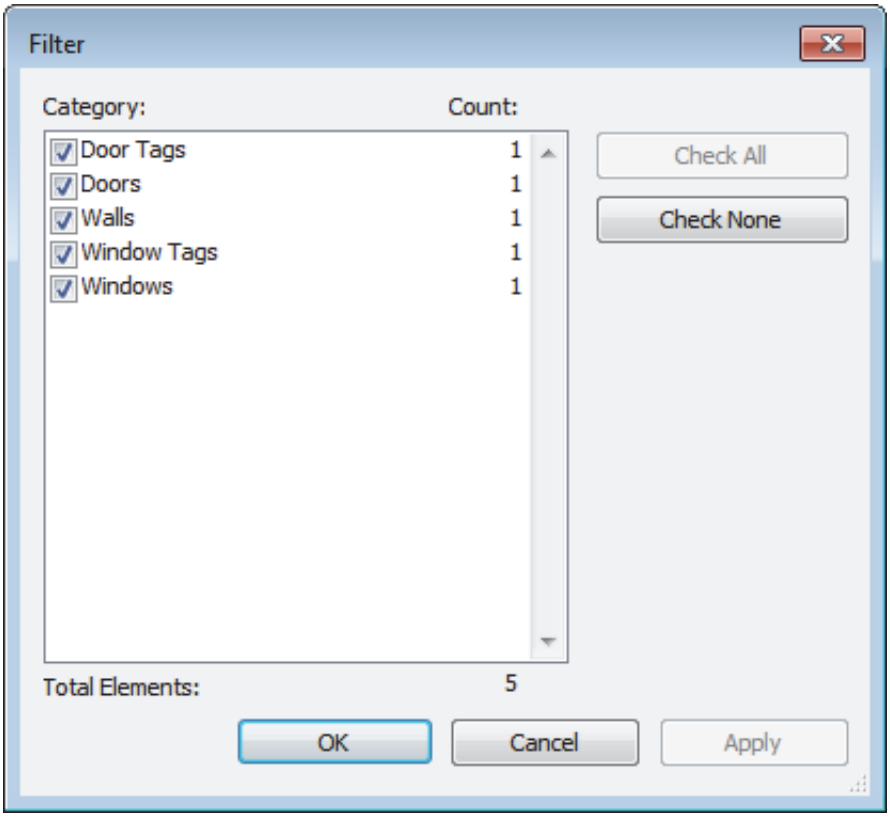

Figure 2–20

3. Click Check None to clear all of the options and then select the element types that you want included in the selection.
4. Click OK. The selection set is now limited to the elements you specified.

- In the Status Bar, :6 (Filter) displays how many elements you selected.

Reusing Selection Sets

When multiple elements types are selected you can save the selection set so that it can be reused. For example, a structural column and an architectural column need to move together. Instead of picking each element, create a selection set that you can quickly access as shown in Figure 2–21. You can also edit selection sets to add or remove elements from the set.

Selection sets are a type of filter.

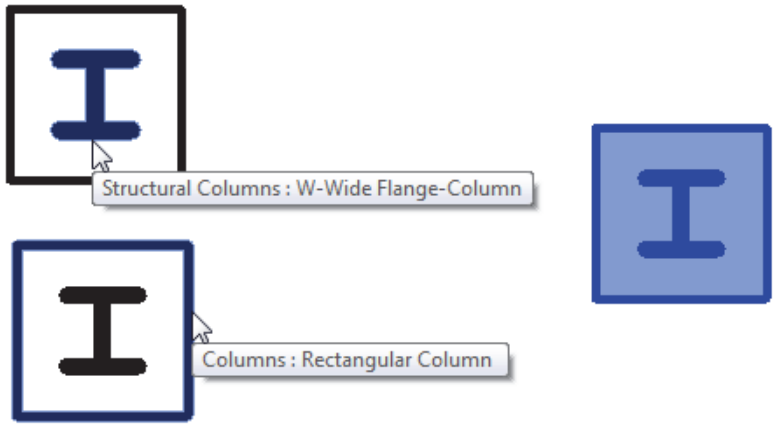

Figure 2–21

How to:

Save Selection Sets

1. Select the elements that you want to include in the selection set.
2. In the *Modify* | *Multi-Select* tab>Selection panel, click (Save).
3. In the Save Selection dialog box, type a name for the set as shown in Figure 2–22, and click OK.

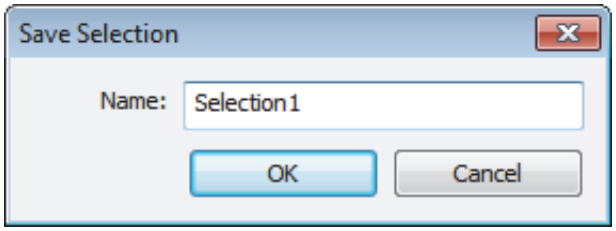

Figure 2–22

How to:

Retrieve Selection Sets

1. Select any other elements you might want to use. In the *Modify* | *Multi-Select* tab>Selection panel, click (Load). Alternatively, without any other selection, in the *Manage* tab> Selection panel, click (Load).
2. In the Retrieve Filters dialog box (shown in Figure 2–23), select the set that you want to use and click OK.

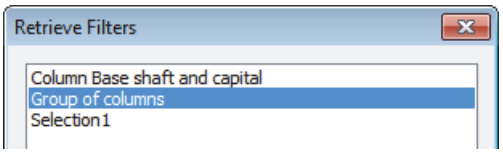

Figure 2–23

3. The elements are selected and you can continue to select other elements or use the selection.

How to:

Edit Selection Sets

1. If elements are selected, in the *Modify* | *Multi-Select* tab> Selection panel, click (Edit). Alternatively, without any selection, in the *Manage* tab>Selection panel, click (Edit).
2. In the Filters dialog box (shown in Figure 2–24), select the set that you want to edit and click Edit....

Some filters in this dialog box are not selection sets but apply to categories of elements, such as the Interior filter shown in Figure 2–24.

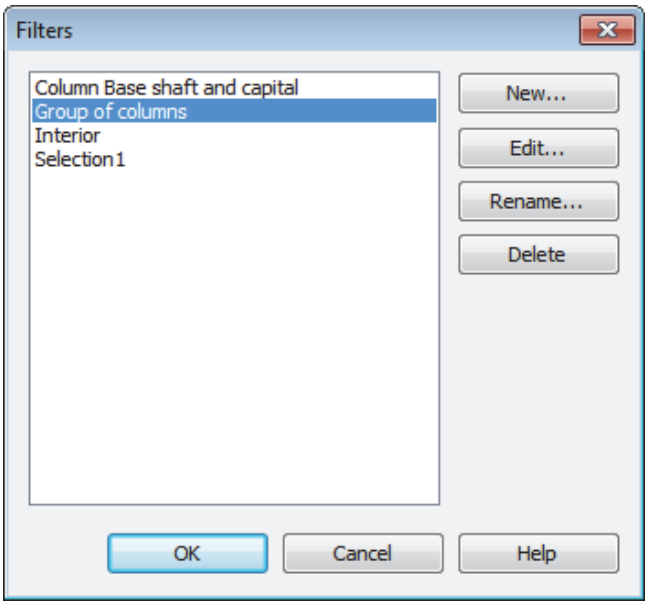

Figure 2–24

- If you want to modify the name of the Filter, click Rename....

3. The selection set elements remain black while the rest of the elements are grayed out. The *Edit Selection Set* contextual tab displays as well, as shown in Figure 2–25.

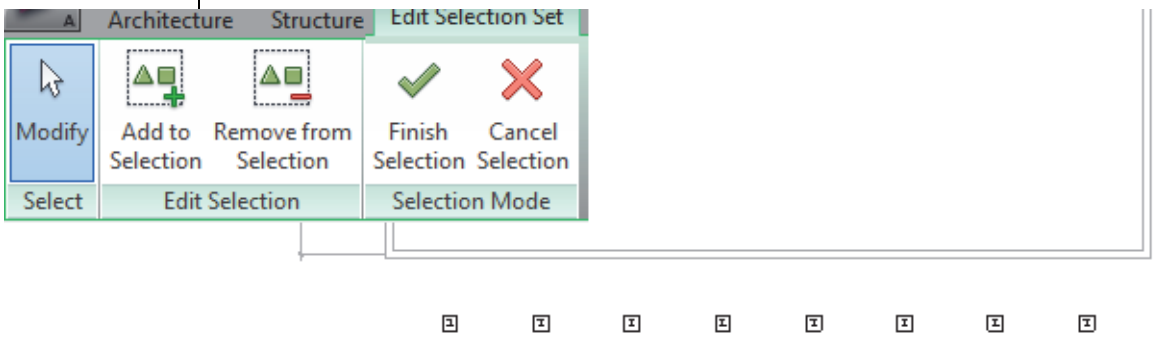

Figure 2–25

4. Use (Add to Selection) to select additional elements for the set and (Remove from Selection) to delete elements from the set.
5. When you have finished editing, click (Finish Selection).
6. In the Filters dialog box, click OK to finish.

Practice 2a

General Drawing and Editing

Learning Objectives

- Create walls using draw tools and drawing aids.
- Add and modify a door.
- Add a column.
- Create a selection set.

Estimated time for completion: 10 minutes

In this practice you will use the **Wall** command along with Draw tools and drawing aids, such as temporary dimensions and snaps. You will use the **Modify** command and modify the walls using grips, temporary dimensions, the Type Selector, and Properties. You will add a door and modify it using temporary dimensions and controls. You will also add a structural and an architectural column and use them to create a selection set. The completed drawing is shown in Figure 2–26.

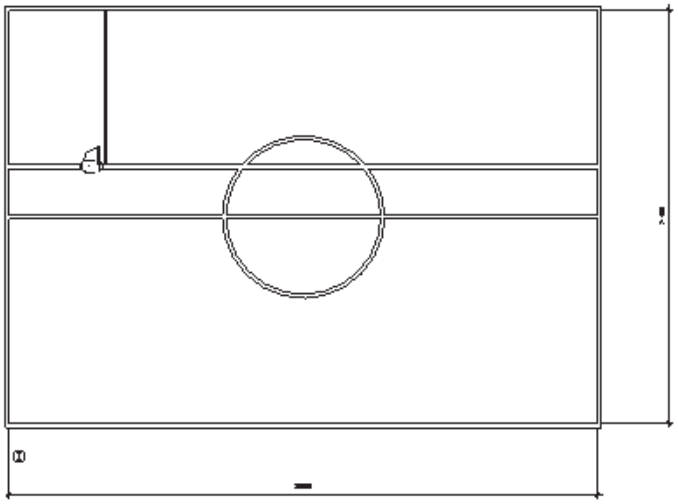

Figure 2–26

Task 1 - Draw and modify walls.

1. In the Application Menu, click (New)> (Project).
2. In the New Project dialog box, select **Architectural Template** in the Template file drop-down list, and click OK.

3. In the Quick Access Toolbar, click (Save). When prompted, name the project **Simple Building.rvt**.

4. In the *Architecture* tab>Build panel, click (Wall).

5. In the *Modify* | *Place Wall* tab>Draw panel, click|

   (Rectangle) and draw a rectangle approximately **100’ x 70’**. You do not have to be precise because you can change the dimensions later.

6. Note that the dimensions are temporary. Select the vertical dimension text and type **70’ 0"**, as shown in Figure 2–27. Press <Enter>.

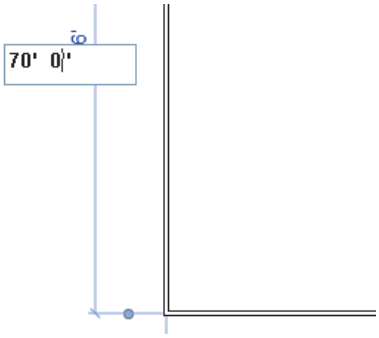

Figure 2–27

7. The dimensions are still displayed as temporary. Click the dimension controls of both the dimensions to make them permanent, as shown in Figure 2–28.

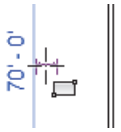

Figure 2–28

   - You will change the horizontal wall dimension using the permanent dimension.

8. In the Select panel, click (Modify).

9. Select either vertical wall. The horizontal dimension becomes active (changes to blue). Click the dimension text and type **100’ 0"**, as shown in Figure 2–29.

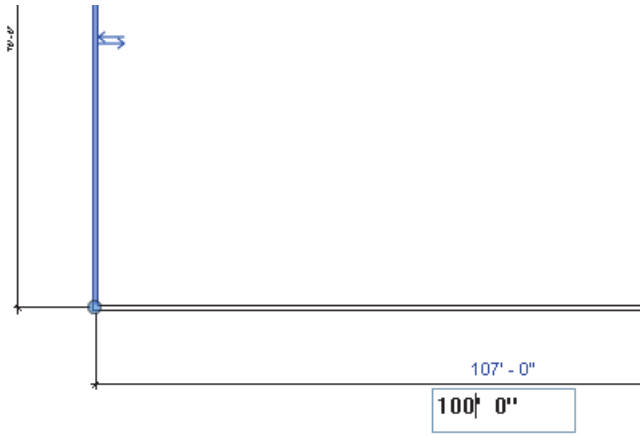

Figure 2–29

10. Click in an empty space to end the selection. You are still in the **Modify** command.

11. In the *Architecture* tab>Build panel, click (Wall). In the Draw panel, verify that (Line) is selected. Draw a wall horizontally from midpoint to midpoint of the vertical walls.

12. Draw another horizontal wall **8’-0"** above the middle horizontal wall. You can use temporary dimensions or the *Offset* field to do this.

13. Draw a vertical wall exactly **16’-0"** from the left wall, as shown in Figure 2–30.

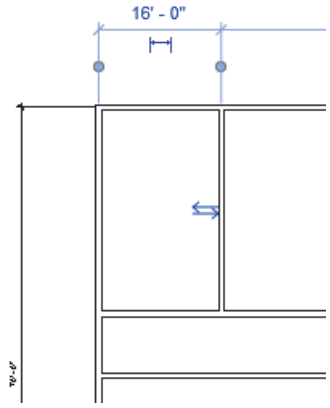

Figure 2–30

14. In the Draw panel, click (Circle) and draw a **14’-0"** radius circular wall at the midpoint of the lower interior horizontal wall, as shown in Figure 2–31.

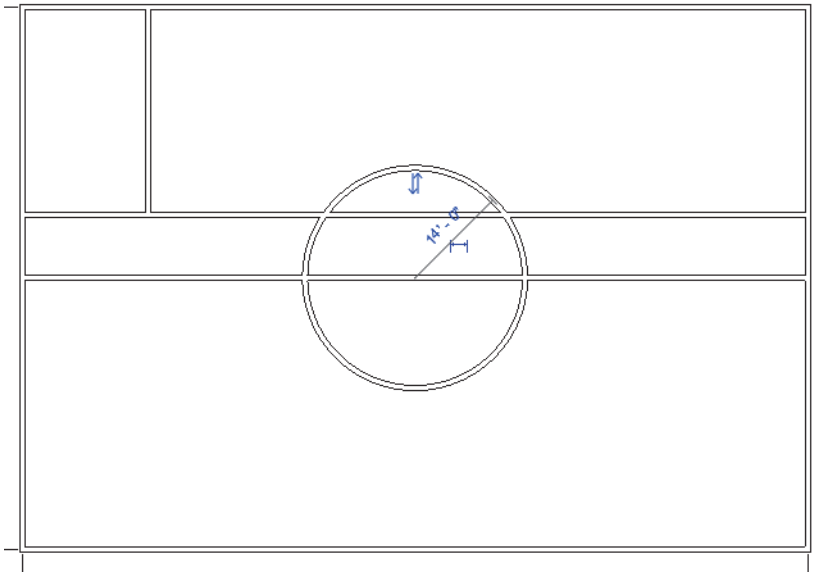

Figure 2–31

15. Click (Modify) to finish the command.

16. Hover your cursor over one of the outside walls, press <Tab> to highlight the chain of outside walls, and click to select the walls.

17. In the Type Selector, select **Basic Wall: Generic-12"**, as shown in Figure 2–32. The thickness of the outside walls change.

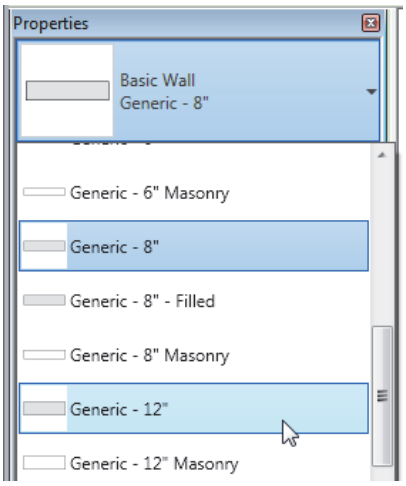

Figure 2–32

18. Click in empty space to release the selection.

19. Select the vertical interior wall and change it to one of the small interior partition styles.
20. Click in an empty space to release the selection.

Task 2 - Add and modify a door.

1. Zoom in on the room in the upper left corner.
2. In the *Architecture* tab>Build panel, click (Door).
3. In the *Modify* | *Place Door* tab>Tag panel, click (Tag on Placement) if it is not already selected.
4. Place a door anywhere along the wall in the hallway.
5. Click (Modify) to finish the command.
6. Select the door. Use temporary dimensions to move it so that it is **2'-6"** from the right interior vertical wall. If required, use controls to flip the door so that it swings into the room, as shown in Figure 2–33.

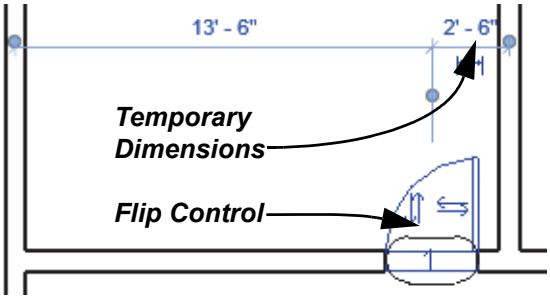

Figure 2–33

7. Type **ZE** to zoom out to the full view.
8. Save the project.

Task 3 - Add Columns and create a selection set.

1. In the *Architecture* tab>Build panel, expand (Column) and click (Structural Column).
2. In the Type selector, verify that **W-Wide Flange - Column: W10x49** is selected.

3. In the Options Bar, set the *Height* (not *Depth*) to **Level 2**, as shown in Figure 2–34.

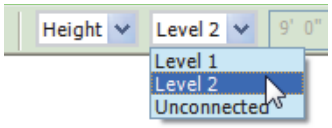

Figure 2–34

4. Place it in the lower left corner outside the building as shown in Figure 2–35. The exact location does not matter.

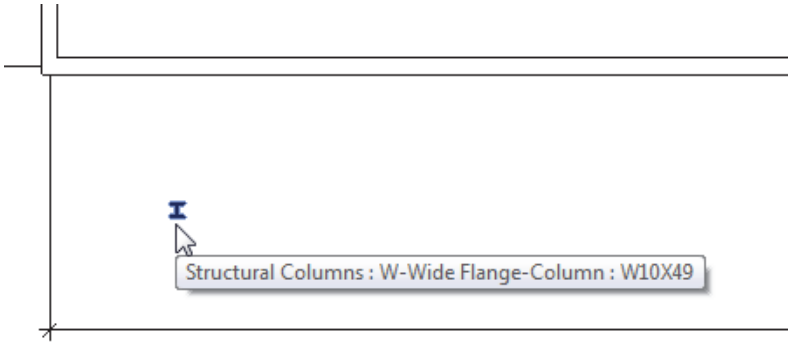

Figure 2–35

5. In the *Architecture* tab>Build panel, expand (Column) and click (Column: Architectural).

6. In the Type Selector, verify that **Rectangular Column:24" x 24"** is selected.

7. Place it using the **Midpoint and Midpoint** snaps as shown in Figure 2–36.

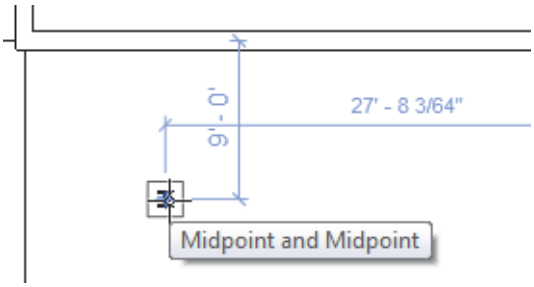

Figure 2–36

8. Click (Modify).

9. Use the mouse to create a selection window around the columns so that both the structural and architectural columns are selected.

10. In the *Modify* | *Multi-Select* tab>Selection panel, click (Save).

11. In the Save Selection dialog box, enter the name **Column Set** as shown in Figure 2–37.

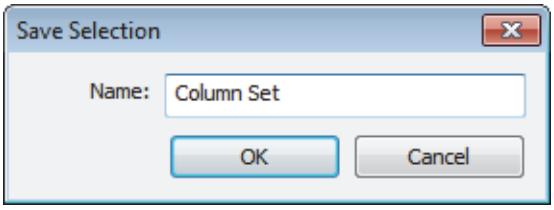

Figure 2–37

12. Click OK.

13. In the *Manage* tab>Selection panel, click (Load Selection).

14. In the Retrieve Filters dialog box, select **Column Set** and click OK.

15. Both columns are selected as shown in Figure 2–38.

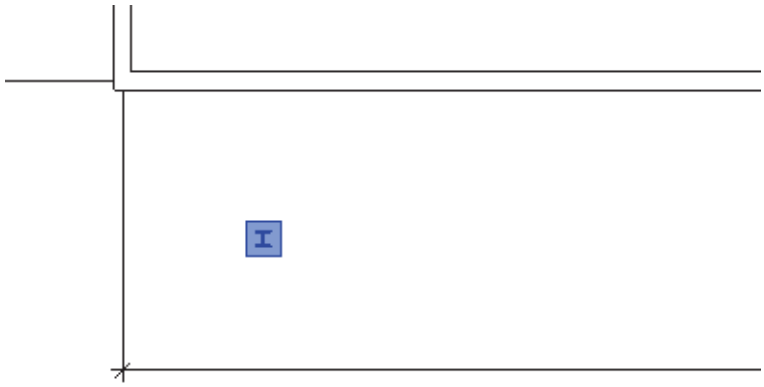

Figure 2–38

16. Click in empty space to release the selection.

17. Double-click the mouse wheel to zoom out the view.

18. Save the project.

2.3 Basic Modifying Tools

Learning Objectives

- Move and copy elements.
- Rotate elements around the center or an origin.
- Mirror elements by picking an axis or by drawing an axis.
- Create Linear and Radial Arrays of elements.

The Autodesk Revit software contains controls 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 found in the *Modify* tab>Modify panel, as shown in Figure 2–39, and in contextual tabs.

You can either select the elements and start the command or start the command, select the elements, and press <Enter> to finish the selection set.

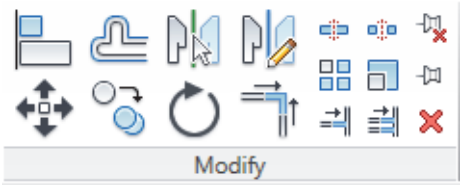

Figure 2–39

- The **Move**, **Copy**, **Rotate**, **Mirror**, and **Array** commands are covered in this topic. Other tools are covered later.

Moving and Copying Elements

The **Move** and **Copy** commands enable you to select the element(s) and move or copy them from one place to another. You can use alignment lines, temporary dimensions, and snaps to help place the elements, as shown in Figure 2–40.

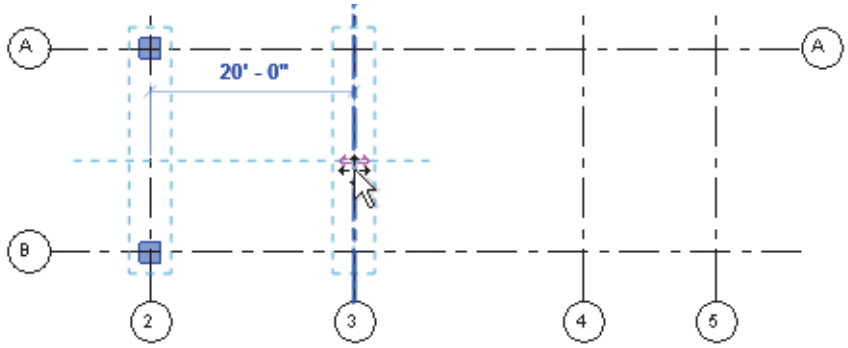

Figure 2–40

How to:

If you click (Move) and hold down <Ctrl>, the elements are copied.

Move or Copy Elements

1. Select the elements you want to move or copy.
2. In the Modify panel, click (Move) or (Copy). A boundary box displays around the selected elements.
3. Select a move start point on or near the element.
4. Select a second point. Use alignment lines and temporary dimensions to help place the elements.
5. The elements remain highlighted, enabling you to start another command, or press <Esc> to finish.

Move/Copy Elements

The **Move** and **Copy** commands have several options that display in the Options Bar, as shown in Figure 2–41.

Figure 2–41

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).

Hint: Pinning Elements

If you do not want elements to be moved, you can (Pin) them in place, as shown in Figure 2–42. Pinned elements can still be copied.

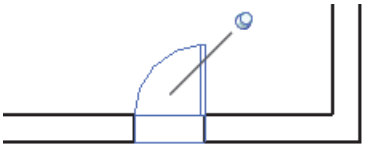

Figure 2–42

Select the element and click (Unpin) to free it.

Rotating Elements

The **Rotate** command enables you to rotate selected elements around a center point or origin. You can use alignment lines, temporary dimensions, and snaps to help specify the center of rotation and the angle. You can also create copies of the element as it is being rotated.

How to:

Rotate Elements

1. Select the element(s) you want to rotate.
2. In the Modify panel, click (Rotate) or type RO.
3. The center of rotation is automatically set to the center of the element or group of elements, as shown on the left in Figure 2–43. To change the center of rotation, as shown on the right in Figure 2–43, use the following:
   - Drag the (Center of Rotation) control to a new point.
   - In the Options Bar, next to *Center of rotation*, click Place and use snaps to move it to a new location.
   - Press the <Spacebar> to select the center of rotation and click to move it to a new location.

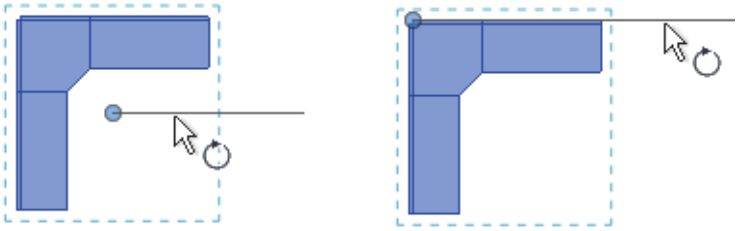

Figure 2–43

   - To start the **Rotate** command with an automatic prompt to select the center of rotation, type **R3**.
4. In the Options Bar, specify if you want to make a Copy (select **Copy** option), type an angle in the *Angle* field (as shown in Figure 2–44), and press <Enter>. You can also specify the angle on screen.

*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.*

Figure 2–44

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

- 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.

Mirroring Elements

The **Mirror** command enables you to mirror elements about an axis defined by a selected element, as shown in Figure 2–45, or by selected points.

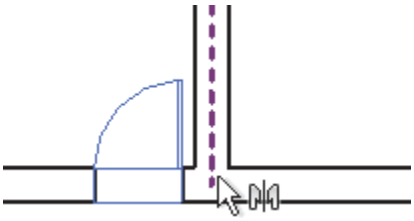

Figure 2–45

How to:

Mirror Elements

1. Select the element(s) to mirror.
2. In the Modify panel, select the method you want to use:
   - Click (Mirror - Pick Axis) or type **MM**. This prompts you to select an element as the **Axis of Reflection** (mirror line).
   - Click (Mirror - Draw Axis) or type **DM**. This prompts you to select two points to define the axis about which the elements mirror.
3. The new mirrored element(s) remain highlighted, enabling you to start another command, or press <Esc> to finish.

- By default, the original elements that were mirrored remain. To delete the original elements, clear the **Copy** option in the Options Bar.

Hint: Scale

The Autodesk Revit 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.

Creating Linear and Radial Arrays

The **Array** command creates multiple copies of selected elements in a linear or radial pattern, as shown in Figure 2–46. For example, you can array a row of columns to create a row of evenly spaced columns on a grid, or array a row of parking spaces. The arrayed elements can be grouped or placed as separate elements.

A linear array creates a straight line pattern of elements, while a radial array creates a circular pattern around a center point.

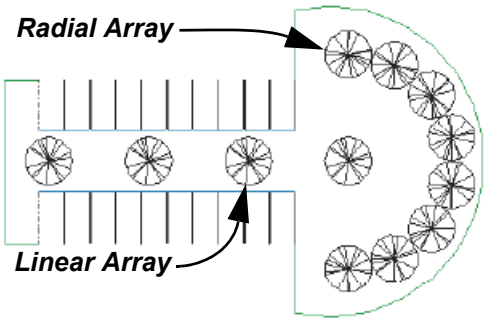

Figure 2–46

How to:

Create a Linear Array

1. Select the element(s) to array.
2. In the Modify panel, click (Array).
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 2–47.

Type a new number or click on the screen to finish the command.

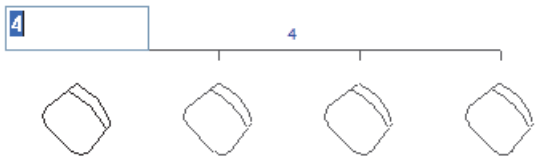

Figure 2–47

- To make 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.

Array Options

In the Options Bar, set up the **Array** options for **Linear Array** (top of Figure 2–48) or **Radial Array** (bottom of Figure 2–48).

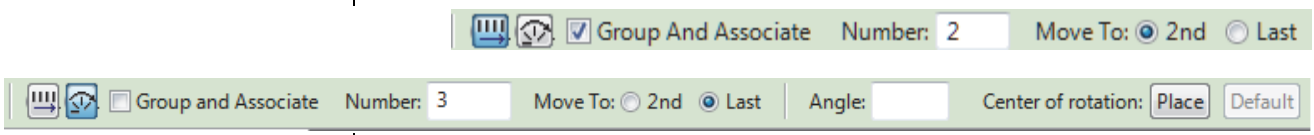

Figure 2–48

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).
Center of rotation	Specifies a location for the origin about which the elements rotate (Radial only).

How to:

Create a Radial Array

1. Select the element(s) to array.
2. In the Modify panel, click (Array).
3. In the Options Bar, click (Radial).
4. Drag (Center of Rotation) or use Place to the move the center of rotation to the appropriate location, as shown in Figure 2–49.

*Remember to set the **Center of Rotation** control first, because it is easy to forget to move it before specifying the angle.*

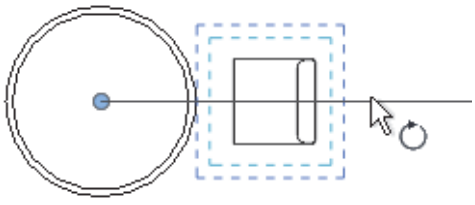

Figure 2–49

5. Specify the other options as needed.
6. In the Options Bar, type an angle and press <Enter>, or specify the rotation angle by selecting points on the screen.

Modifying Arrays

When you select an element in an array that is created as a group, the associated shape controls and dimensions display, as shown in Figure 2–50. You can modify the number of instances and for radial arrays you can modify the distance to the center.

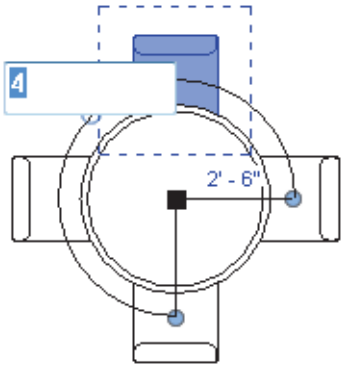

Figure 2–50

- To remove only the array constraint on the group, select one of the elements in the group and click (Ungroup) in the *Modify* contextual tab>Group panel. This only ungroups the array but not the groups created when the array was created. To ungroup all of the elements, select the elements, use (Filter) to only select the groups, and click (Ungroup).

Practice 2b

Modifying Tools

Learning Objectives

- Copy walls to create a series of offices and mirror a door for the last office.
- Draw and array a series of cubicles and modify the last cubicle so that it fits the space.
- Load a selection set and use it to create an array of columns across the front of the building.

Estimated time for completion: 10 minutes

In this practice you will use **Move**, **Copy**, **Mirror**, and **Array** to modify and add elements to a simple building, as shown in Figure 2–51.

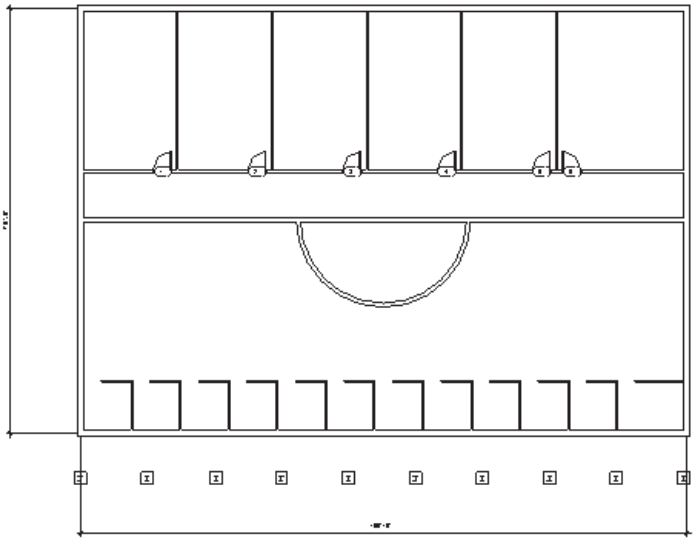

Figure 2–51

Task 1 - Modify walls and doors.

1. Open the project **Simple-Building-1.rvt** from your class folder.
2. Select the top arc of the circular wall.
3. In the Modify panel, click (Delete). The walls that the circular wall crossed are automatically cleaned up.
4. Select the vertical interior wall, door, and door tag. Hold down <Ctrl> to select more than one element.

5. In the Modify panel, click (Copy).
6. In the Options Bar, select the **Multiple** option.
7. For the base point, select the upper left inside corner of the room, as shown in Figure 2–52.
8. For the distance to place the wall, select the corner of the interior wall on the right side, as shown in Figure 2–52.

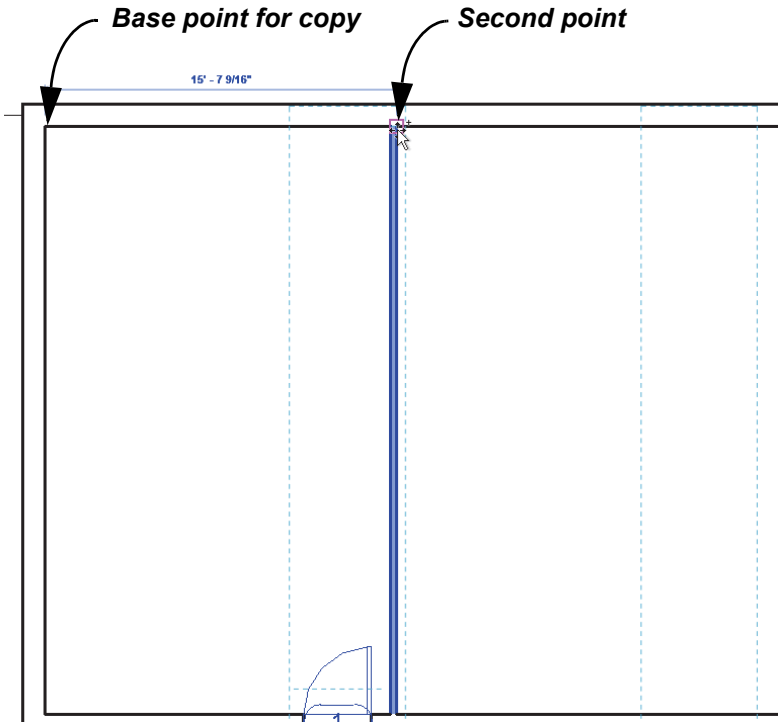

Figure 2–52

9. The wall, door, and door tag are copied to the right side of the first interior wall and the door tag displays 2.
10. Select the corner of the newly copied interior wall on the right side to place another partition wall, door, and door tag to its right.

11. Continue copying until you place the fifth wall, as shown in Figure 2–53.

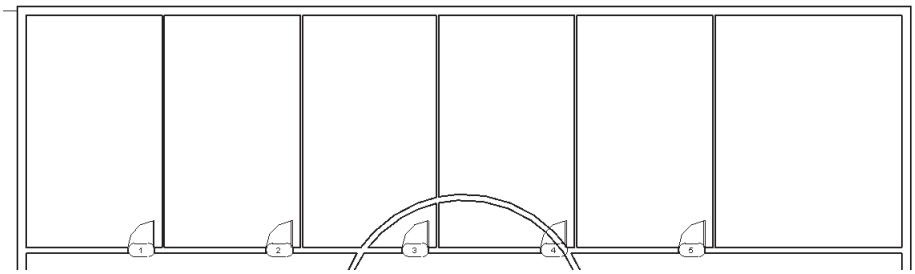

Figure 2–53

12. Press <Esc> twice to finish the command.
13. Zoom in on the room to the far right.
14. Select the door and door tag 5 in the room left to it.
15. In the Modify panel, click (Mirror - Pick Axis).
16. Select the vertical wall between the rooms as the mirror axis and place the new door, as shown in Figure 2–54.

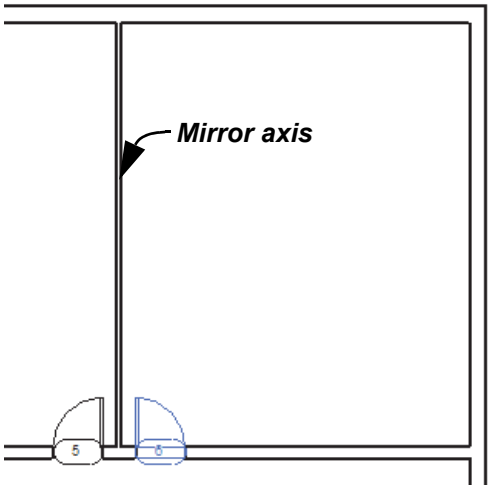

Figure 2–54

17. Click in empty space to release the selection set.

Task 2 - Draw and array cubicles.

1. Pan to the lower left corner of the building.
2. In the Architecture *tab*>Build panel, click (Wall).

You can also click *(Modify) in the Selection panel to finish a command.*

3. In the Type Selector, select **Basic Wall: Interior - 3-1/8" Partition (1 hr)**. Draw the cubicle shown in Figure 2–55 and press <Esc> twice to finish the command.

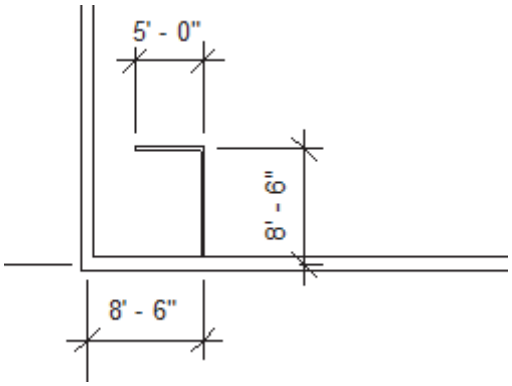

Figure 2–55

4. Select the two cubicle walls.
5. In the Modify panel, click (Array).
6. In the Options Bar, click (Linear) and set the *Number* to **10** and *Move to:* to **2nd**.
7. In the drawing area, select a point on the top horizontal cubicle wall and another point **8'-0"** to the right of the wall. The array displays as shown in Figure 2–56.

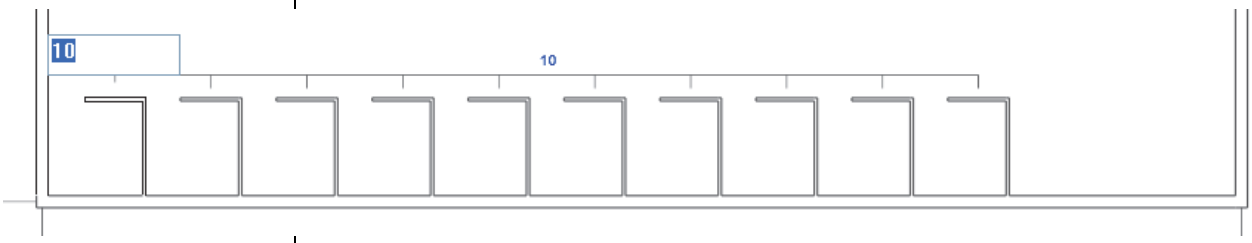

Figure 2–56

8. Enough room is available to add more cubicles. Type **12** at the number prompt and press <Enter> to finish the command.

9. Zoom in on the last cubicle and select it. It is part of a group, as shown in Figure 2–57.

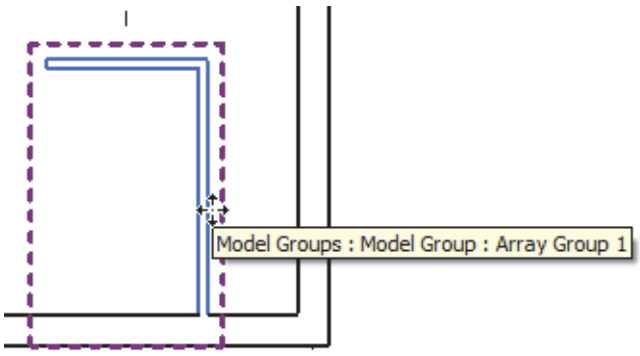

Figure 2–57

10. In the *Modify* | *Model Groups* tab>Group panel, click (Ungroup). This separates the last element from the rest of the group.

11. Delete the vertical wall and use the end control to drag the horizontal wall to the exterior wall, as shown in Figure 2–58.

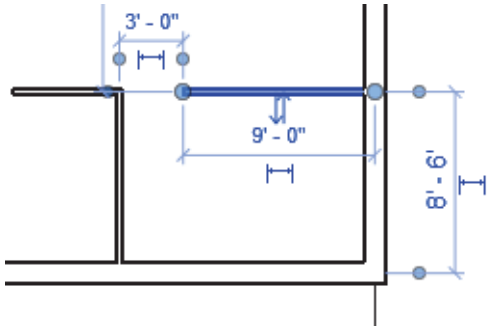

Figure 2–58

12. Zoom out to display the entire view.

Task 3 - Select and array the column set.

1. In the *Manage* tab>Selection panel, click (Load).

2. In the Retrieve Filters dialog box, select **Column Set** (as shown in Figure 2–59), and click OK.

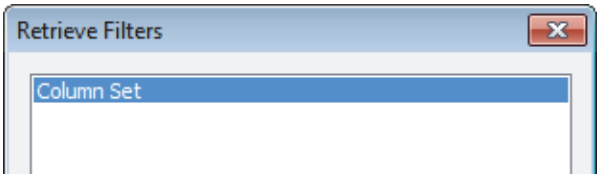

Figure 2–59

3. Zoom in on the selected column set in the lower left corner on the outside of the building.
4. In the *Modify* | *Multi-Select* tab>Modify panel, click (Move).
5. For the move start point, select the top endpoint of the architectural column. Move your cursor to the left. For the end point, select the **Horizontal and Extension** of the center of the wall as shown in Figure 2–60.

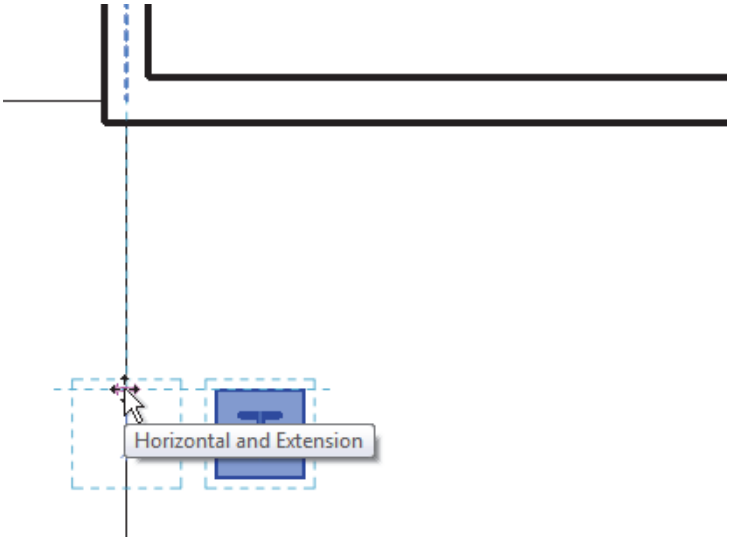

Figure 2–60

6. Do not release the selection.
7. In the *Modify* | *Multi-Select* tab>Modify panel, click (Array).
8. In the Options Bar, click (Linear), clear **Group and Associate**, set the *Number* to **10**, and set *Move To:* to **Last**.

9. For the start point, click the top endpoint of the column. For the endpoint of the array, select the **Horizontal and Extension** of the center of the far right wall as shown in Figure 2–61.

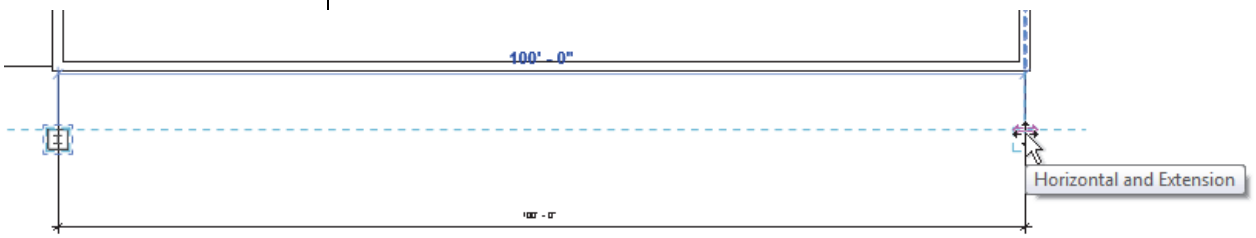

Figure 2–61

10. Zoom out to display the entire building.

11. The columns are arrayed evenly across the front of the building as shown in Figure 2–62.

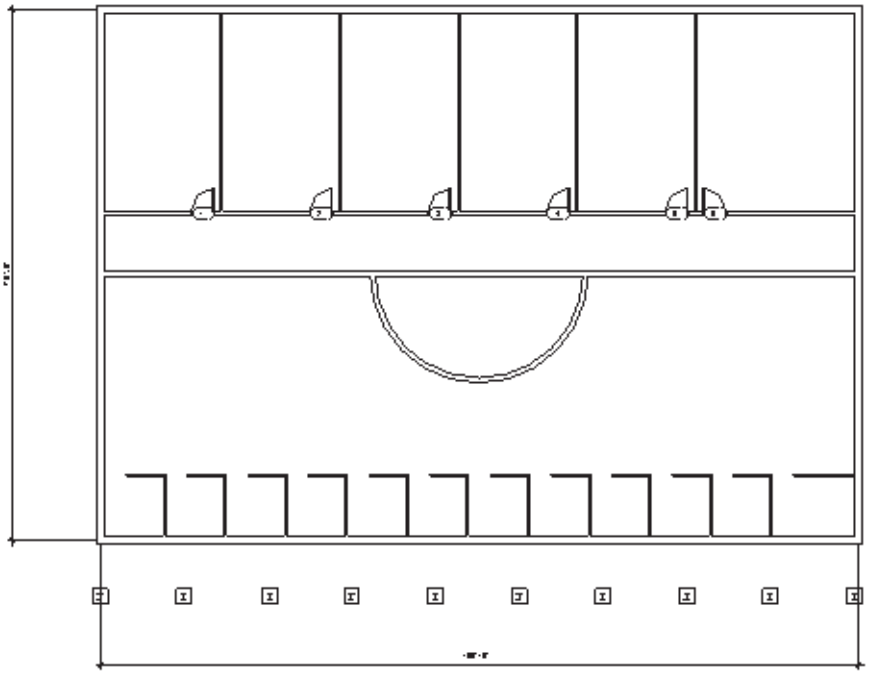

Figure 2–62

12. Save the project.

Chapter Review Questions

1. What is the purpose of an alignment line?
   a. Displays when the new element you are placing or drawing is aligned with the grid system.
   b. Indicates that the new element you are placing or drawing is aligned with an existing object.
   c. Displays when the new element you are placing or drawing is aligned with a selected tracking point.
   d. Indicates that the new element is aligned with true north rather than project north.

2. How do you edit a temporary dimension, such as that shown in Figure 2–63, when you are drawing?

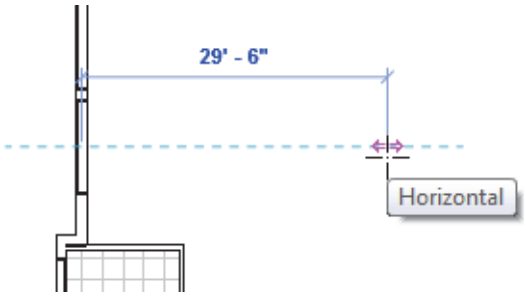

Figure 2–63

   a. Select the temporary dimension and enter a new value.
   b. Type a new value and press <Enter>.
   c. Type a new value in the Distance/Length box in the Options Bar and press <Enter>.

3. How do you select only doors in a view?
   a. In the Family node in the Project Browser, select the *Door* category.
   b. Select one door, right-click and select **Select All Instances>Visible in View**.
   c. Select all of the objects in the view and use  (Filter) to clear the other categories.
   d. Select one door, and click  (Select Multiple) in the Ribbon.

4. What are the two methods for starting (Move) or (Copy)?
   a. Start the command first and then select the objects, or select the objects and then start the command.
   b. Start the command from the *Modify* tab, or select the object and then select **Move** or **Copy** from the right-click menu.
   c. Start the command from the *Modify* tab, or select the objects and select **Auto-Move**.
   d. Use the **Move/Copy** command or **Cut/Copy** and **Paste** using the Clipboard.
5. Where do you change the wall type for a selected wall as shown in Figure 2–64?

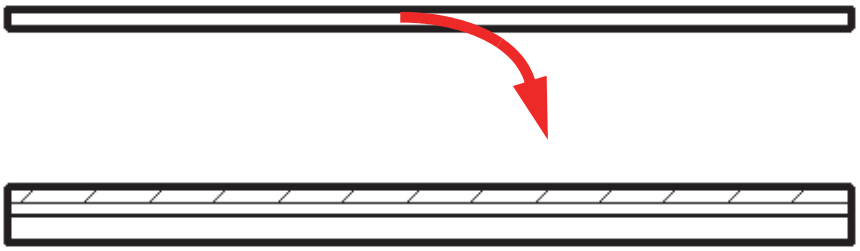

Figure 2–64

   a. In the *Modify* | *Walls* tab> Properties panel, click (Type Properties) and select a new wall type in the dialog box.
   b. In the Options Bar, click Change Element Type.
   c. Select the dynamic control next to the selected wall and select a new type in the drop-down list.
   d. In Properties, select a new type in the Type Selector drop-down list.

6. Both (Rotate) and (Array) with (Radial) have a center of rotation that defaults to the center of the element or group of elements you have selected. How do you move the center of rotation to another point as shown in Figure 2–65? (Select all that apply.)

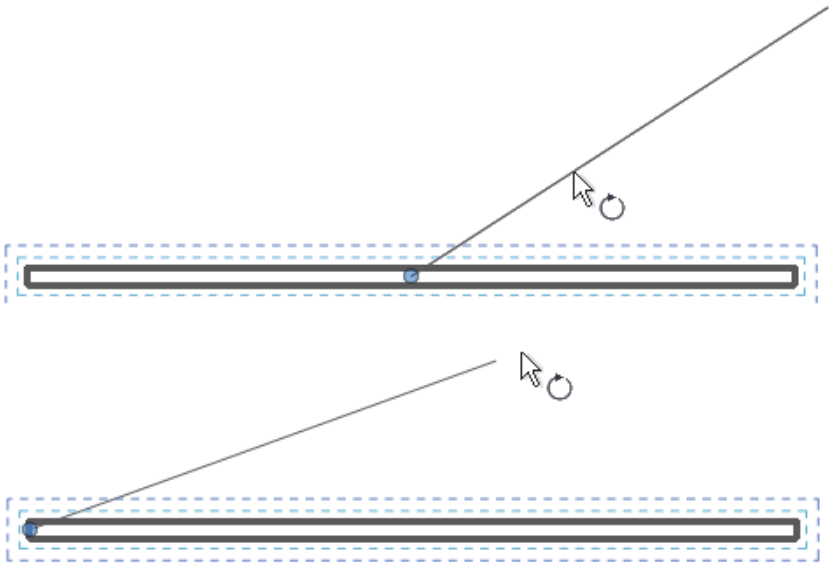

Figure 2–65

a. Select the center of rotation and drag it to a new location.

b. In the Options Bar, click Place and select the new point.

c. In the *Modify* tab> Placement panel, click (Center) and select the new point.

d. Right-click and select **Snap Overrides>Centers** and select the new point.

Command Summary

Button	Command	Location
	**Add to Selection**	■ **Ribbon:** *Edit Selection Set t*ab>Edit Selection panel
	**Array**	■ **Ribbon:** *Modify* tab>Modify panel> Array ■ **Shortcut:** AR
	**Copy**	■ **Ribbon:** *Modify* tab>Modify panel> Copy ■ **Shortcut:** CO
	**Copy to Clipboard**	■ **Ribbon:** *Modify* tab>Clipboard panel> Copy to Clipboard ■ **Shortcut:** <Ctrl>+<C>
	**Drag elements on selection**	■ **Status Bar** ■ **Expanded Select panel**
	**Delete**	■ **Ribbon:** *Modify* tab>Modify panel> Delete ■ **Shortcut:** DE
	**Edit (Selection)**	■ **Ribbon:** *Modify* | *Multi-Select* tab> Selection panel or *Manage* tab> Selection panel
	**Filter**	■ **Ribbon:** *Modify* | *Multi-Select* tab> Filter panel>Filter ■ **Status Bar**
	**Load (Selection)**	■ **Ribbon:** *Modify* | *Multi-Select* tab> Selection panel or *Manage* tab> Selection panel
	**Mirror - Draw Axis**	■ **Ribbon:** *Modify* tab>Modify panel> Mirror ■ **Shortcut:** DM
	**Mirror - Pick Axis**	■ **Ribbon:** *Modify* tab>Modify panel> Mirror ■ **Shortcut:** MM
	**Move**	■ **Ribbon:** *Modify* tab>Modify panel> Move ■ **Shortcut:** MV
	**Paste**	■ **Ribbon:** *Modify* tab>Clipboard panel> Paste ■ **Shortcut:** <Ctrl>+<V>
	**Pin**	■ **Ribbon:** *Modify* tab>Modify panel> Pin ■ **Shortcut:** PN
	**Remove from Selection**	■ **Ribbon:** *Edit Selection Set t*ab>Edit Selection panel

	**Rotate**	■ **Ribbon:** *Modify* tab>Modify panel> Rotate ■ **Shortcut:** RO
	**Save (Selection)**	■ **Ribbon:** *Modify* | *Multi-Select* tab> Selection panel or *Manage* tab> Selection panel
	**Scale**	■ **Ribbon:** *Modify* tab>Modify panel> Scale ■ **Shortcut:** RE
	**Select Elements By Face**	■ **Status Bar** ■ **Expanded Select panel**
	**Select Links**	■ **Status Bar** ■ **Expanded Select panel**
	**Select Pinned Elements**	■ **Status Bar** ■ **Expanded Select panel**
	**Select Underlay Elements**	■ **Status Bar** ■ **Expanded Select panel**