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Autodesk® Revit® 2023 Fundamentals for Structure

Learning Guide

Imperial Units - 1st Edition

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AUTODESK
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ASCENT - Center for Technical Knowledge®
Autodesk® Revit® 2023
Fundamentals for Structure

Imperial Units - 1st Edition

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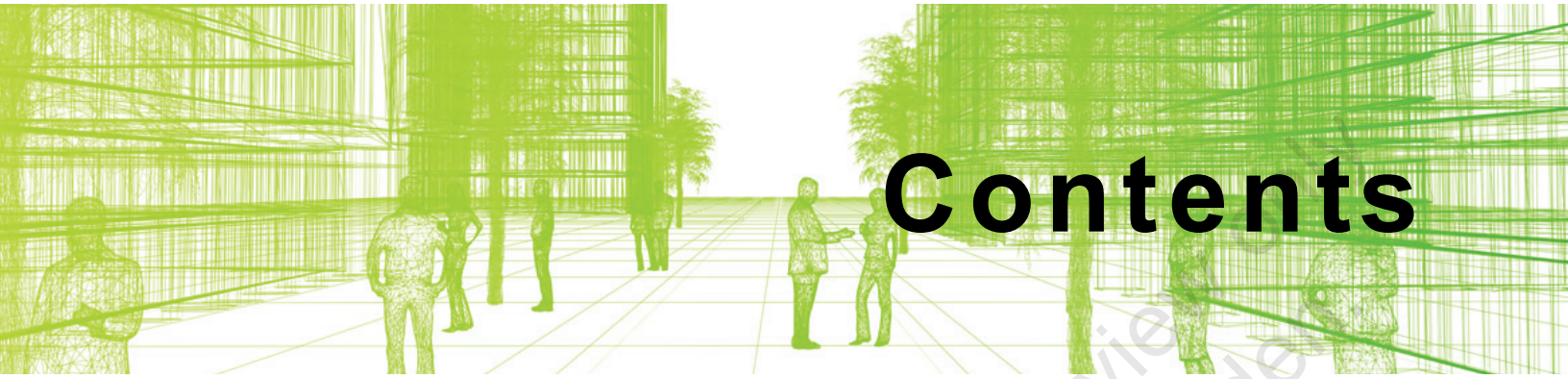

Contents

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Preface

To take full advantage of Building Information Modeling, the *Autodesk® Revit® 2023: Fundamentals for Structure* guide has been designed to teach the concepts and principles of creating 3D parametric models of structural buildings from engineering design through construction documentation.

This guide is intended to introduce you to the user interface and the basic building components of the software that makes Autodesk® Revit® a powerful and flexible structural modeling tool. The goal is to familiarize you with the tools required to create, modify, analyze, and document a parametric model. The examples and practices are designed to take you through the basics of a full structural project, from linking in an architectural model to construction documents.

Topics Covered

- Introduction to the Autodesk Revit software.
- Navigating the Revit workspace and interface.
- Working with the basic sketching and modifying tools.
- Creating levels and grids as datum elements for the model.
- Understanding Revit families and components.
- Understanding the project browser and working with views.
- Starting a structural project based on a linked architectural model.
- Creating a 3D building model.
- Adding structural columns and walls.
- Adding foundations and structural slabs.
- Structural reinforcement.
- Beams, trusses, and framing systems.
- Analytical models and placing loads.
- Project practices to reinforce learning.
- Setting up sheets for plotting with text, dimensions, details, tags, and schedules.
- Creating details.

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Prerequisites

- Access to the 2023.0 version of the software, to ensure compatibility with this guide. Future software updates that are released by Autodesk may include changes that are not reflected in this guide. The practices and files included with this guide might not be compatible with prior versions (e.g., 2022).
- This guide introduces the fundamental skills in learning how to use the Autodesk Revit software, with a focus on the structural tools. It is highly recommended that students have experience and knowledge in structural engineering and its terminology.

Note on Learning Guide Content

- ASCENT's learning guides are intended to teach the technical aspects of using the software and do not focus on professional design principles and standards. The exercises aim to demonstrate the capabilities and flexibility of the software, rather than following specific design codes or standards, which can vary between regions.

Note on Software Setup

This guide assumes a standard installation of the software using the default preferences during installation. This includes the Revit templates and Revit Content (Families) that can be found on the Autodesk website https://knowledge.autodesk.com/ and searching **How to download Revit Content**. Lectures and practices use the standard software templates and default options.

Lead Contributor: Cherisse Biddulph

Cherisse is an Autodesk Certified Professional for Revit as well as an Autodesk Certified Instructor. She brings over 19 years of industry, teaching, and technical support experience to her role as a Learning Content Developer with ASCENT. With a passion for design and architecture, she has worked in the industry assisting firms with their CAD management and software implementation needs as they modernize to a Building Information Modeling (BIM) design environment. Although her main devotion is the Revit design product, she is also proficient in AutoCAD, Autodesk BIM 360, and Autodesk Navisworks. Today, Cherisse continues to expand her knowledge in the ever-evolving AEC industry and the software used to support it.

Cherisse Biddulph has been the Lead Contributor for *Autodesk Revit: Fundamentals for Structure* since 2020.

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In This Guide

The following highlights the key features of this guide.

Feature	Description
Practice Files	The Practice Files page includes a link to the practice files and instructions on how to download and install them. The practice files are required to complete the practices in this guide.
Chapters	A chapter consists of the following: Learning Objectives, Instructional Content, Practices, Chapter Review Questions, and Command Summary. • **Learning Objectives** define the skills you can acquire by learning the content provided in the chapter. • **Instructional Content**, which begins right after Learning Objectives, refers to the descriptive and procedural information related to various topics. Each main topic introduces a product feature, discusses various aspects of that feature, and provides step-by-step procedures on how to use that feature. Where relevant, examples, figures, helpful hints, and notes are provided. • **Practice** for a topic follows the instructional content. Practices enable you to use the software to perform a hands-on review of a topic. It is required that you download the practice files (using the link found on the Practice Files page) prior to starting the first practice. • **Chapter Review Questions**, located close to the end of a chapter, enable you to test your knowledge of the key concepts discussed in the chapter. • **Command Summary** concludes a chapter. It contains a list of the software commands that are used throughout the chapter and provides information on where the command can be found in the software.
Appendices	Appendices provide additional information to the main course content. It could be in the form of instructional content, practices, tables, projects, or skills assessment.

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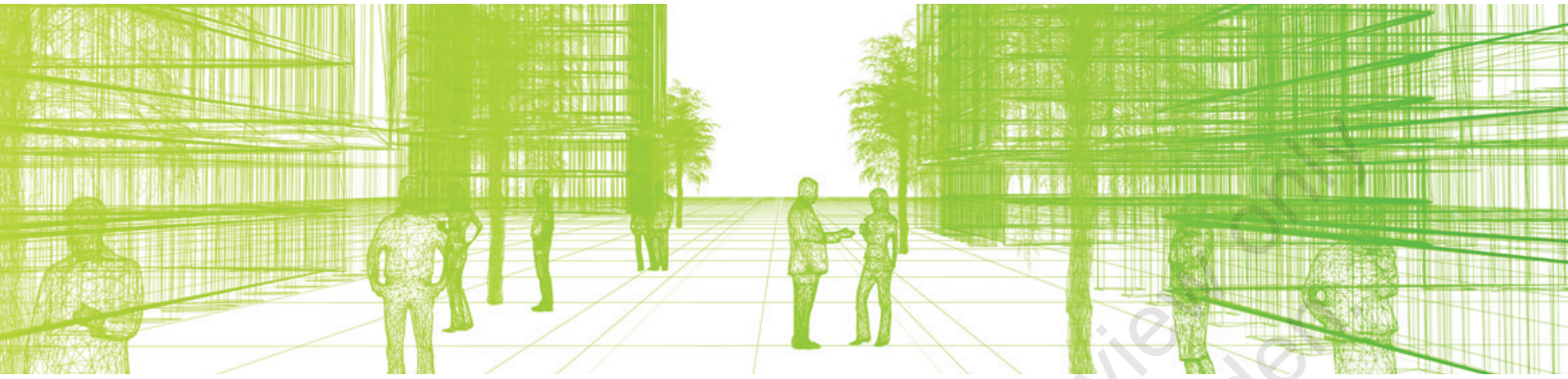

Revit Tools and Project Setup

This guide is divided into three sections: Revit Tools and Project Setup, Design Development, and Construction Documentation.

The first section provides an introduction to the Autodesk® Revit® software, including working with the software interface, setting up a drawing, incorporating datum elements, adding families, and using the basic drawing and modify tools.

This section includes the following chapters:

- 1: Introduction to Revit
- 2: Starting a Project
- 3: Working with Views
- 4: Revit Families
- 5: Basic Sketching and Modify Tools

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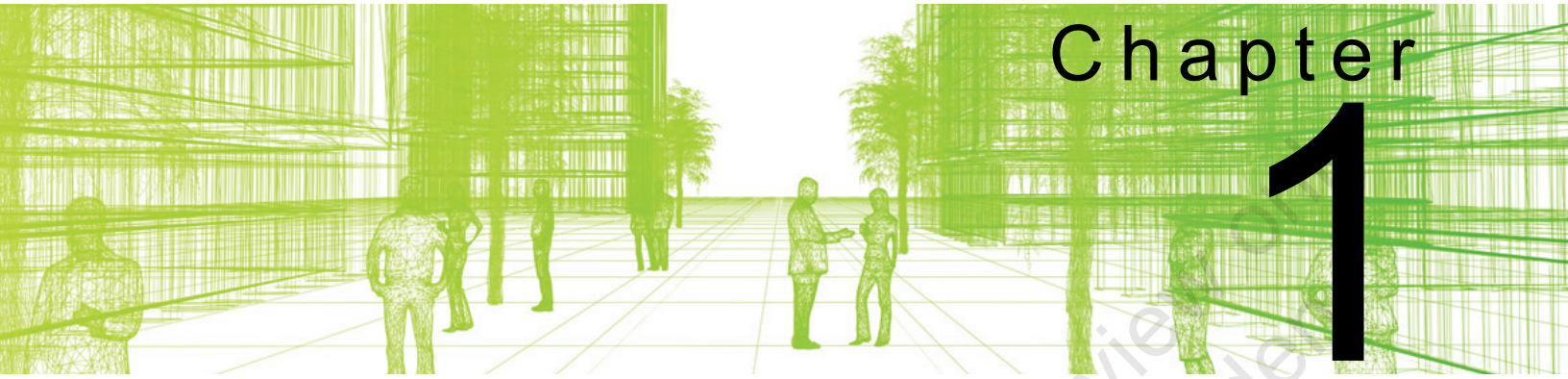

Chapter 1

Introduction to Revit

Building Information Modeling (BIM) and Revit® work hand in hand to help you create smart, 3D models that are useful at all stages in the building process. Understanding the software interface and terminology enhances your ability to create and navigate around in the various views of the model.

Learning Objectives in This Chapter

- Describe the concept of Building Information Modeling in conjunction with applying Revit.
- Navigate the graphic user interface, including the ribbon (where most of the tools are found), Properties (where you make modifications to element information), and the Project Browser (where you can open various views of the model).
- Open existing projects and save projects.
- Use viewing commands to navigate around the model in 2D and 3D views.

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1.1 BIM and Revit

Building Information Modeling (BIM) is an approach to the entire building life cycle, including design, construction, and facilities management. The BIM process supports the ability to coordinate, update, and share design data with team members across disciplines.

Revit is a model authoring software. It enables you to create complete 3D building models (as shown on the left in Figure 1–1) that provide considerable information reported through construction documents, and enables you to share these models with other programs for more extensive analysis.

Figure 1–1

Revit is a Parametric Building Modeler software:

- *Parametric:* A relationship is established between building elements: when one element changes, all other related elements and/or geometry is modified as well. For example, when you place a door in a wall, the door removes part of the wall and stays inside that wall if it moves.
- *Building:* The software is designed for working with buildings and the surrounding landscape, as opposed to gears or highways.
- *Modeler:* A project is built in a single file based on the 3D building model, as shown on the left in Figure 1–1. All views, such as plans (as shown on the right in Figure 1–1), elevations, sections, details, construction documents, and reports are generated based on the model.
- It is important that everyone who is collaborating on a project works in the same version and build of the software.

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Workflow and BIM

BIM has changed the process of how a building is planned, budgeted, designed, constructed, and (in some cases) operated and maintained.

In the traditional design process, construction documents are created independently, typically including plans, sections, elevations, details, and notes. Sometimes, a separate 3D model is created in addition to these documents. Changes made in one document, such as the addition of a light fixture in a plan, have to be coordinated with the rest of the documents and schedules in the set, as shown in Figure 1–2.

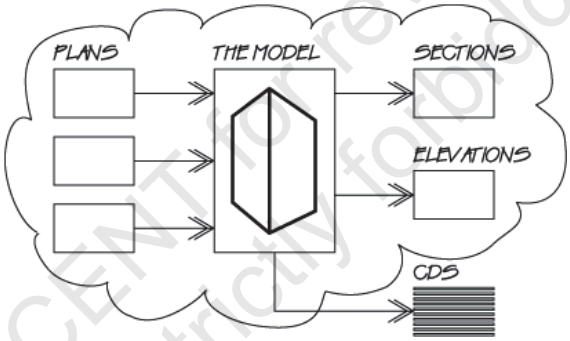

Figure 1–2

In BIM, the design process revolves around the model, as shown in Figure 1–3. Plans, elevations, and sections are simply 2D versions of the 3D model, while schedules are a report of the information stored in the model. Changes made in one view automatically update in all views and related schedules. Even construction documents update automatically with callout tags in sync with the sheet numbers. This is called bidirectional associativity.

By creating complete models and associated views of those models, Revit takes much of the tediousness out of producing a building design.

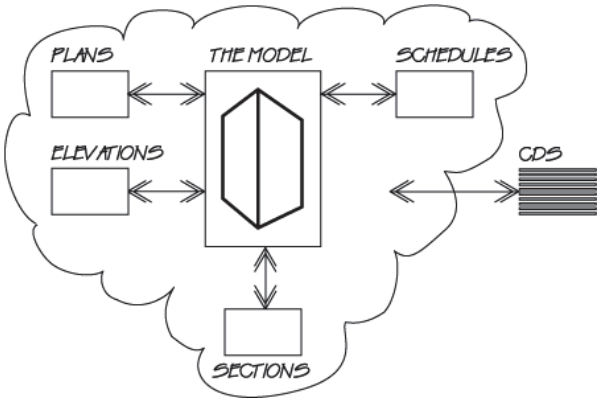

Figure 1–3

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Revit Terms

When working in Revit, it is important to know the typical terms used to describe items. Views and reports display information about the elements that form a project. There are three types of elements: Model, Datum, and View-specific, as shown in Figure 1–4 and described below:

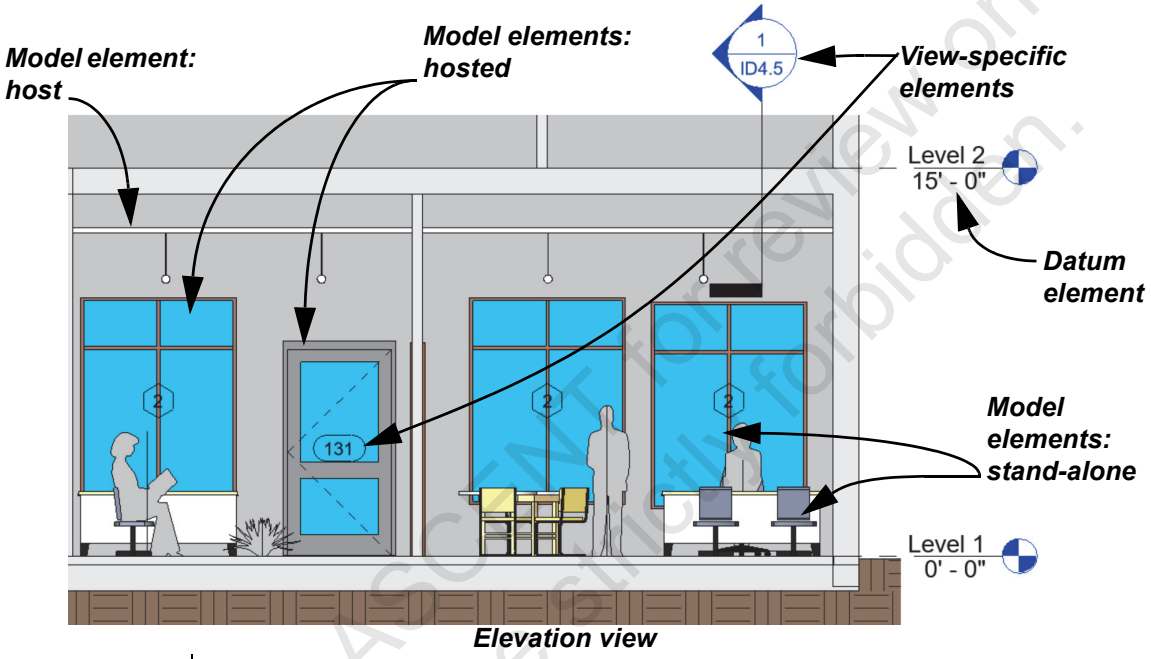

Figure 1–4

Views	Views enable you to display and manipulate the model. For example, you can view and work in floor plans, ceiling plans, elevations, sections, schedules, and 3D views. You can change a design from any view. All views are stored in the project.
Reports	Reports, including schedules, gather information from the building model element that can be presented in the construction documents or used for analysis.
Model Elements	Model elements include all parts of a building, such as walls, floors, ceilings, and roofs.
Component Elements	Component elements are placed from inserted families, such as plumbing fixtures, lighting fixtures, mechanical equipment, columns, beams, furniture, and plants. • Host elements, such as walls, support other categories of components like doors, windows, and casework. • Hosted elements must be attached to a host element, such as doors must be placed on a (host) wall. • Stand-alone elements do not require hosts.
Datum Elements	Datum elements define the project context, such as the levels for the floors, grids, and reference planes.

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View-specific Elements	View-specific elements only display in the view in which they are placed. The view scale controls their size. These include annotation elements such as dimensions, text, tags, and symbols as well as detail elements such as detail lines, filled regions, and 2D detail components.

The software includes tools for architectural, mechanical, electrical, plumbing, and structural design.

- Revit elements are “smart”: the software recognizes them as walls, columns, beam, plants, ducts, or lighting fixtures, etc. This means that the information stored in their properties automatically updates in schedules, which ensures that views and reports are coordinated across an entire project, and are generated from a single model.

Revit and Construction Documents

In the traditional workflow, the most time-consuming part of the project is the construction documents. With BIM, the base views of those documents (i.e., plans, elevations, sections, and schedules) are produced automatically and update as the model is updated, saving hours of work. The views are then placed on sheets that form the construction document set.

For example, a floor plan is duplicated. Then, in the new view, all but the required categories of elements are hidden or set to halftone and annotations are added. The plan is then placed on a sheet, as shown in Figure 1–5.

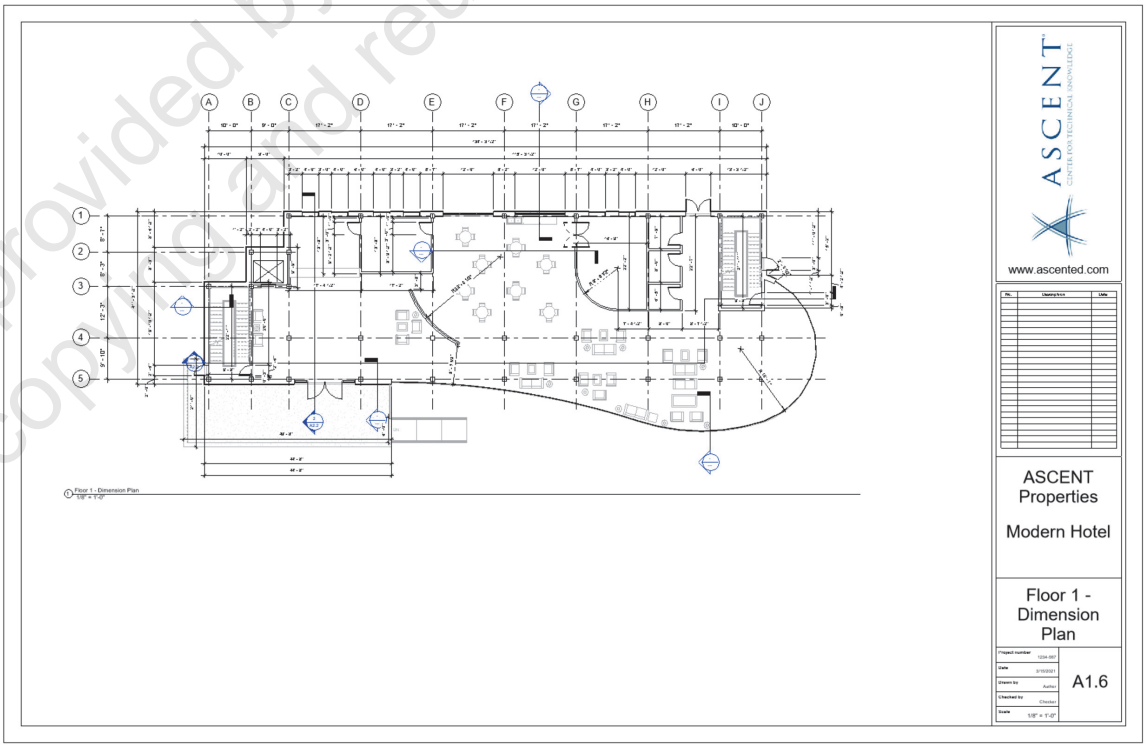

Figure 1–5

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- Work can continue on a view and is automatically updated on the sheet.
- Annotating views in the preliminary design phase is often not required. You might be able to wait until you are further along in the project.

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1.2 Overview of the Interface

The Revit interface is designed for intuitive and efficient access to commands and views. It includes the ribbon, Quick Access Toolbar, Navigation Bar, and Status Bar, which are common to most of the Autodesk software. It also includes tools that are specific to Revit, including Properties, the Project Browser, and the View Control Bar. Revit includes access to tools for architectural, mechanical, electrical, plumbing, and structural design but can be altered by setting up a customized workspace that is more tailored to your specific discipline. A breakdown of the Revit interface is shown in Figure 1–6.

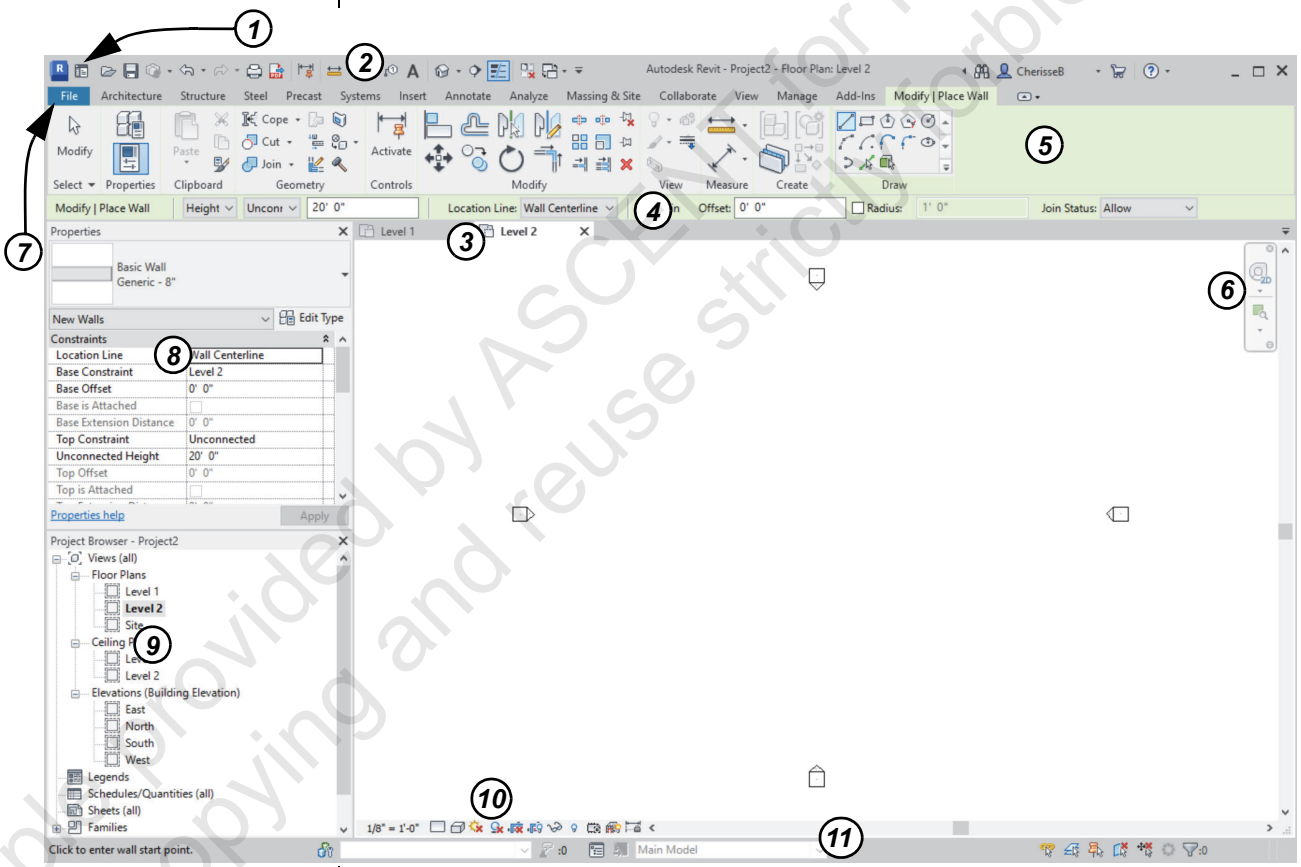

Figure 1–6

1. Home Screen	7. File Tab
2. Quick Access Toolbar	8. Properties
3. View Tabs	9. Project Browser
4. Options Bar	10. View Control Bar
5. Ribbon	11. Status Bar
6. Navigation Bar	

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1. The Home Screen

When you first open Revit, the **Home** screen displays with recently used projects and families, as shown in Figure 1–7.

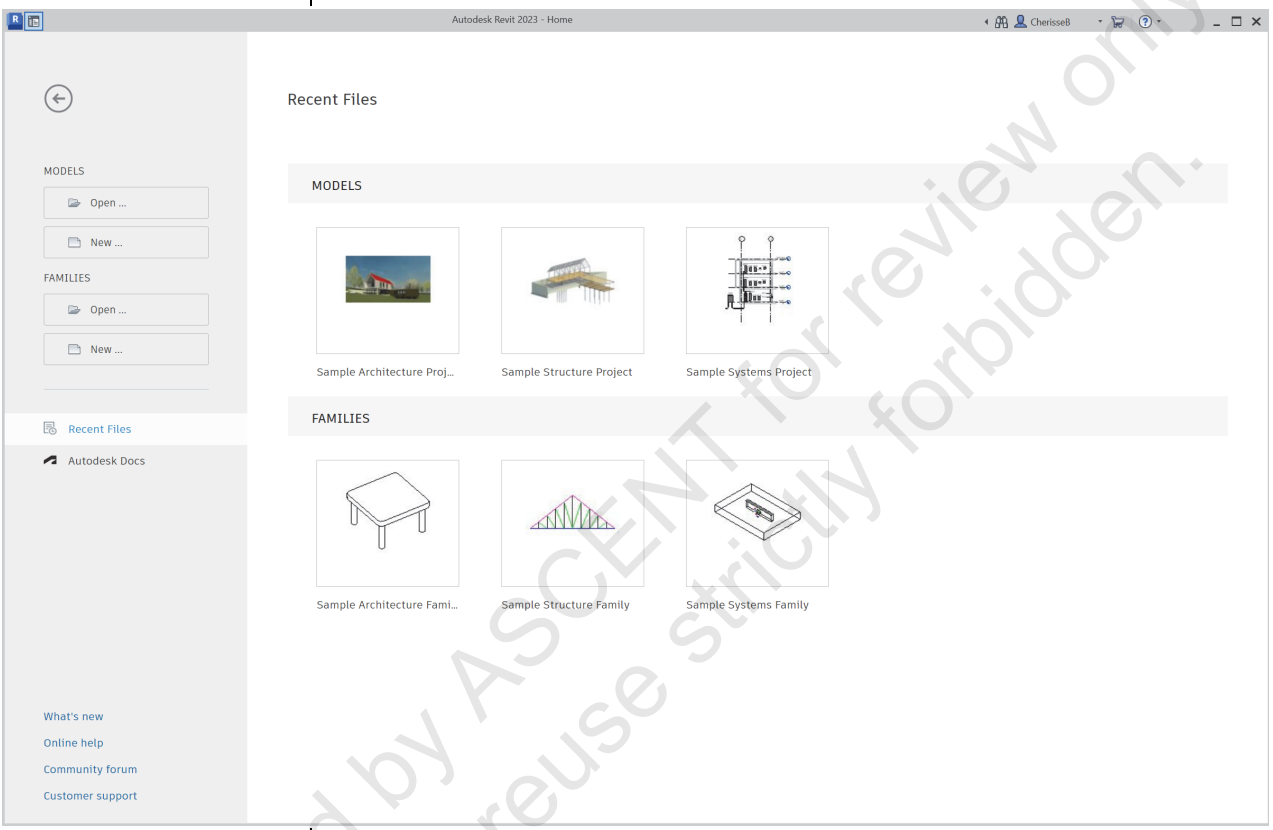

Figure 1–7

- From the Home screen, you can select the picture of a recently opened project or use one of the options on the left to open or start a new project using the default templates.
- In the Quick Access Toolbar, click (Home) to return to the screen.
- In the Home screen, click (Back) to return to the active model.
- Press <Ctrl>+<D> to toggle between the Home screen and the active model.

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2. Quick Access Toolbar

The Quick Access Toolbar (shown in Figure 1–8) includes commonly used commands, such as **Home, Open**, **Save**, **Undo**, **Redo, Print**, and **PDF**. It also includes **Activate Controls and Dimensions** to reduce clutter when selecting multiple elements in a view, and frequently used annotation tools, including Measuring tools, **Aligned Dimension**, **Tag by Category**, and **Text**. Viewing tools, including several different 3D Views and **Sections**, are also easily accessed here.

Figure 1–8

Hint: Using Thin Lines

The software automatically applies line weights to views, as shown for a section on the left in Figure 1–9. If a line weight seems heavy or obscures your work on the elements, toggle off the line weights. In the Quick Access Toolbar or in the *View* tab>Graphics panel, click  (Thin Lines) or type **TL**. The lines display with the same weight, as shown on the right in Figure 1–9.

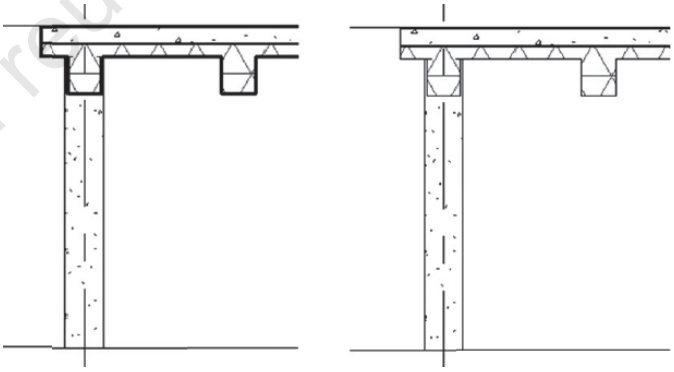

Figure 1–9

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

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The top toolbar also hosts the InfoCenter (as shown in Figure 1–10), which includes the Autodesk sign-in, access to the Autodesk App Store, and Help options. A search field, as shown in Figure 1–11, is also available to find help on the web.

Figure 1–10

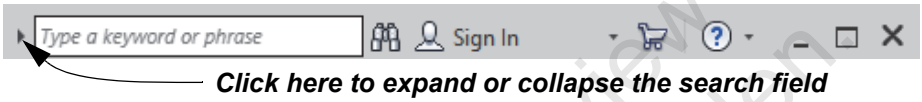

Figure 1–11

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Hint: Customizing the Quick Access Toolbar

Right-click on the Quick Access Toolbar, as shown in Figure 1–12, to change the docking location of the toolbar to be above or below the ribbon, or to add, relocate, or remove tools on the toolbar.

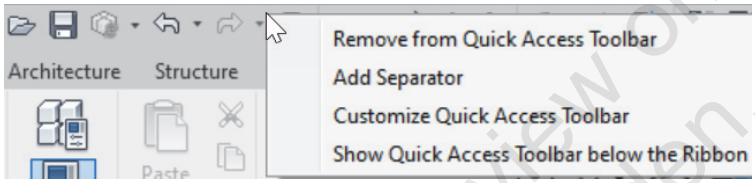

Figure 1–12

You can also right-click on a tool in the ribbon (e.g., the **Move** command) and select **Add to Quick Access Toolbar**, as shown in Figure 1–13.

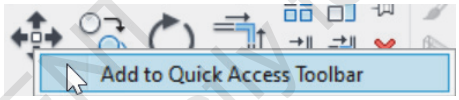

Figure 1–13

If you have added a lot of icons to the Quick Access Toolbar, (Expand) will display at the end of the toolbar. Click to show the additional tool icons you have added, as shown in Figure 1–14.

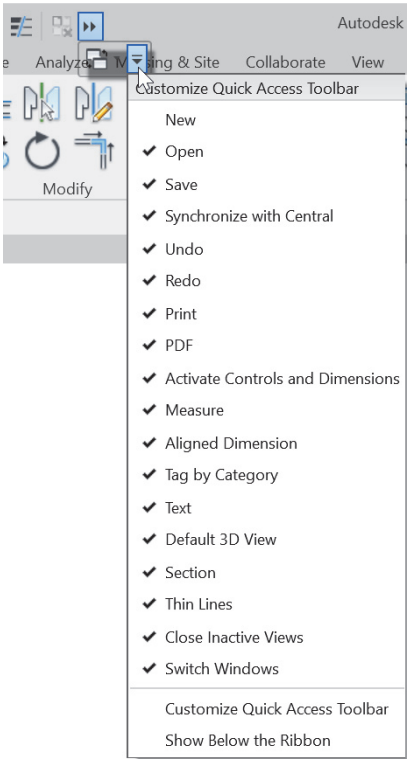

Figure 1–14

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3. View Tabs

In 3D views, you can also use the ViewCube to orbit the view.

Each view of a project opens in its own tab and can be pulled out of the application window and moved to another monitor. Each view displays a Navigation Bar (for quick access to viewing tools), the View Control Bar, and elevation markers, as shown in Figure 1–15.

- To close a tab, press the **X** that displays when you hover over the tab or the name in the list, as shown in Figure 1–15.

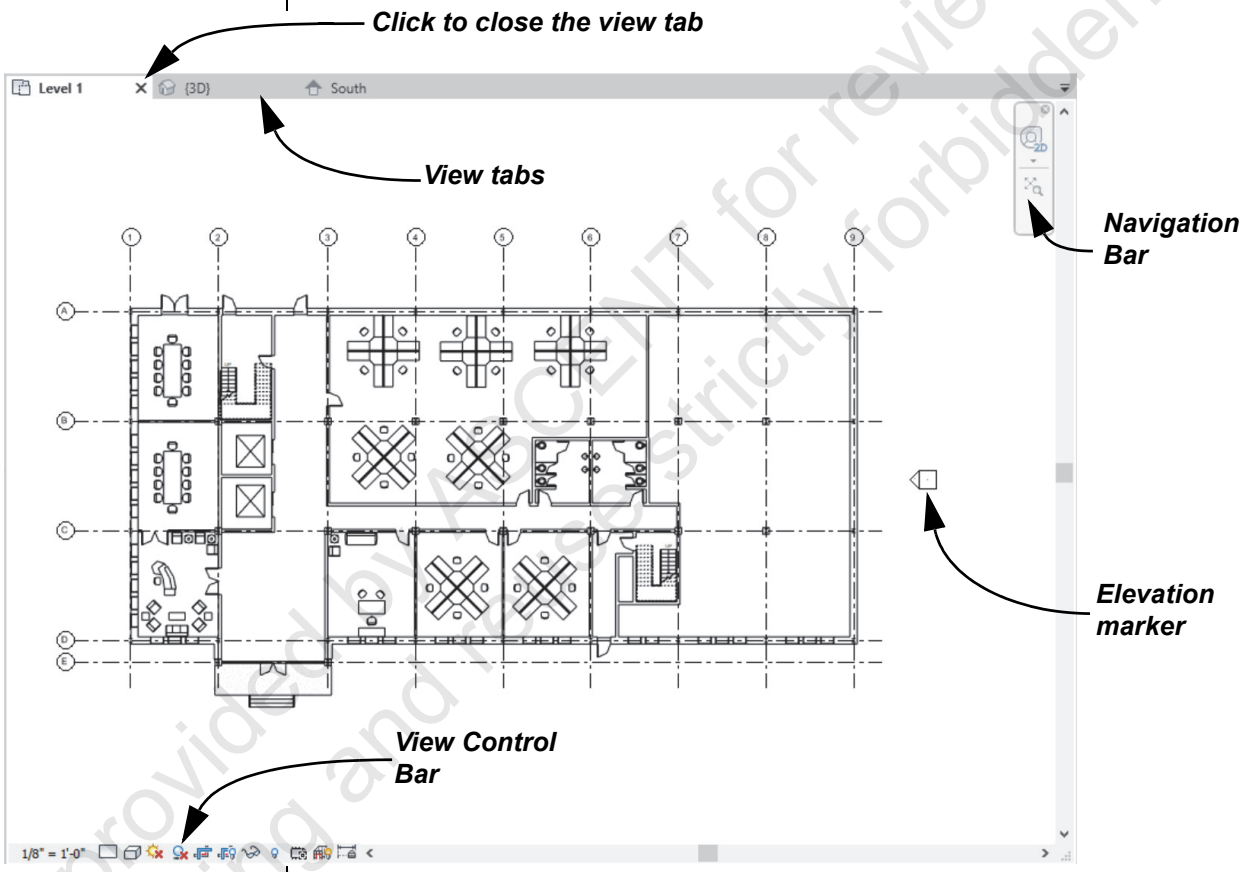

Figure 1–15

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Hint: Elevation Markers

You can hover your cursor over a marker's arrowhead to see what the view name is, as shown in Figure 1–16. You can also double-click on the arrowhead to open the view.

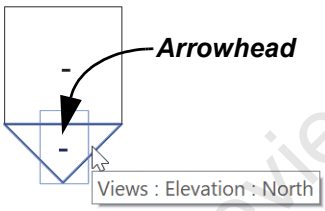

Figure 1–16

- Click on the tab along the top of the drawing area to switch between views. You can also:
  - Press <Ctrl>+<Tab>.
  - Select the view in the Project Browser.
  - In the Quick Access Toolbar (shown on the left in Figure 1–17) or *View* tab>Windows panel (shown on the right in Figure 1–17), expand (Switch Windows) and select the view from the list.

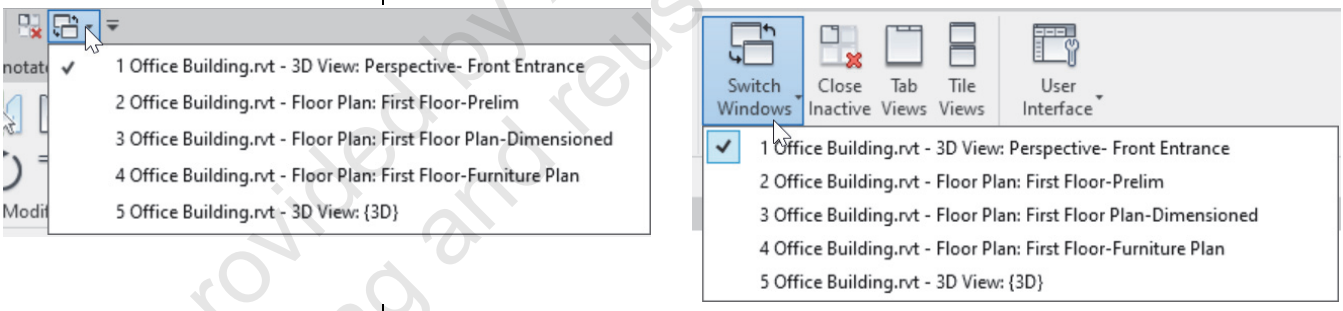

Figure 1–17

- Expand the drop-down list at the far end of the tabs, as shown in Figure 1–18 to select a view from the list.

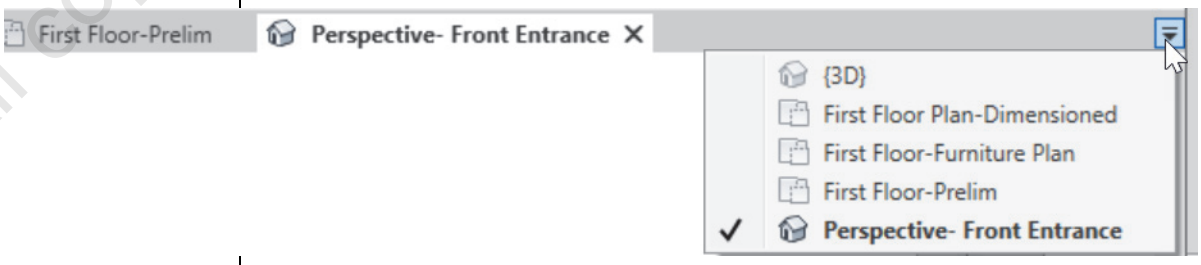

Figure 1–18

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- To close all open views except the current view, in the Quick Access Toolbar or *View* tab>Windows panel, click (Close Inactive Views). If you have multiple projects open, one view of each project remains open. If you have dragged a view to another monitor, that view will need to be manually closed by clicking the **X** in the upper-right corner.

- You can switch between tabbed and tiled views from the *View* tab>Windows panel or by typing shortcuts. For tabbed views (as shown on the left in Figure 1–19), click (Tab Views) or type **TW**. For tiled views (as shown on the right in Figure 1–19), click (Tile Views) or type **WT**.

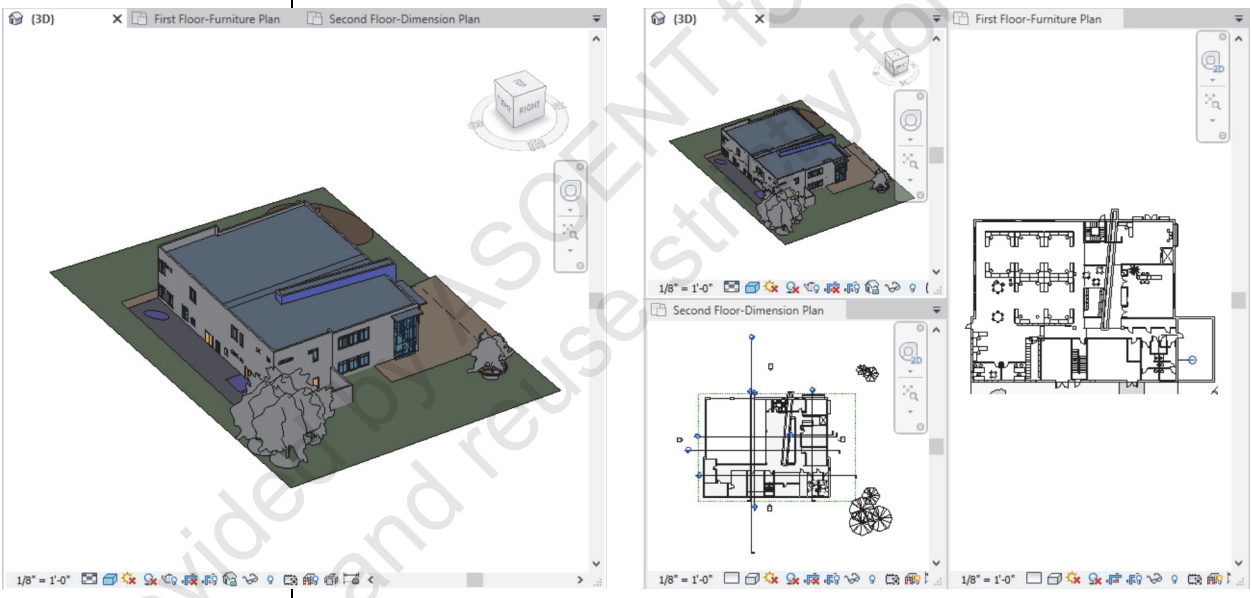

Figure 1–19

- When you are working with tiled views, you can type **ZA** (Zoom All to Fit) to zoom to fit the full model in each of the different views.

- Drag the edge of tiled views to resize them as needed.

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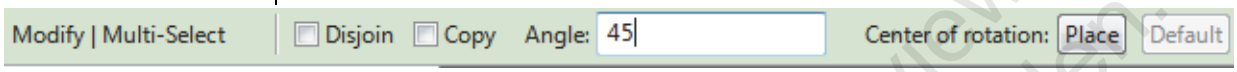
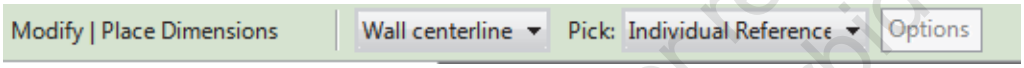
4. Options Bar

The Options Bar displays options that are related to the selected command or element. For example, when the **Rotate** command is active it displays options for rotating the selected elements, as shown at the top in Figure 1–20. When the **Place Dimensions** command is active it displays dimension related options, as shown at the bottom in Figure 1–20.



Options Bar for Rotate command



Options Bar for Dimension command

Figure 1–20

5. Ribbon

The ribbon contains tools in a series of tabs and panels, as shown in Figure 1–21. Selecting a tab displays a group of related panels. The panels contain a variety of tools, grouped by task.

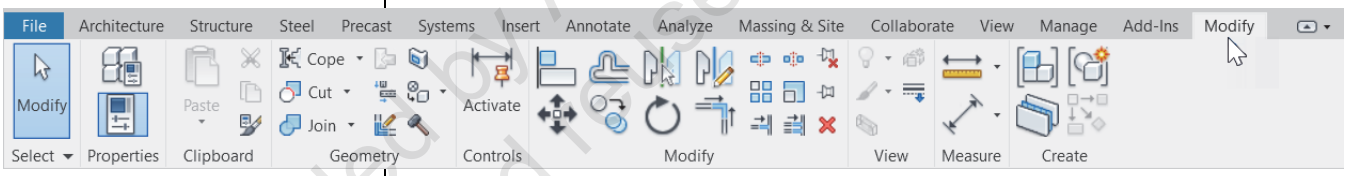


Figure 1–21

When you start a command that creates new elements or you select an element, the ribbon displays the *Modify* contextual tab. This contains general editing commands and command-specific tools, as shown in Figure 1–22.

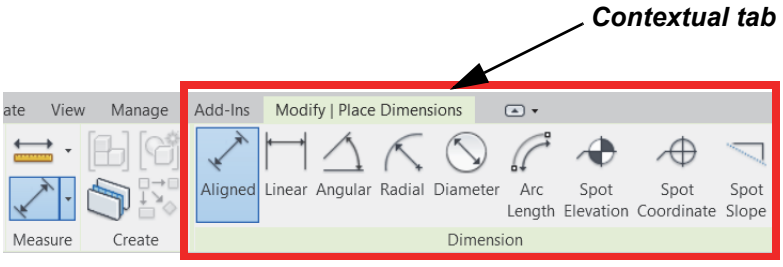


Figure 1–22

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- When a command is toggled on, the icon will be highlighted in blue. When it is toggled off, the icon is gray (not highlighted), as shown in Figure 1–23.

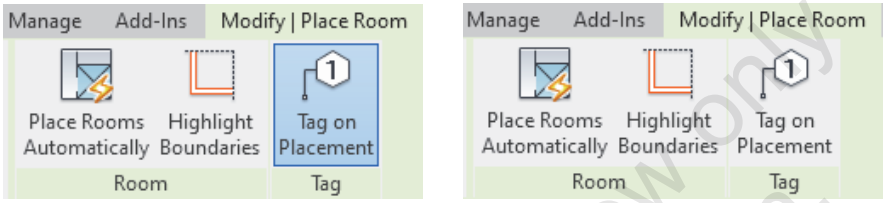

Figure 1–23

- When you hover over a tool on the ribbon, tooltips display the tool's name and a short description. If you continue hovering over the tool, a graphic displays (and sometimes a video), as shown in Figure 1–24.

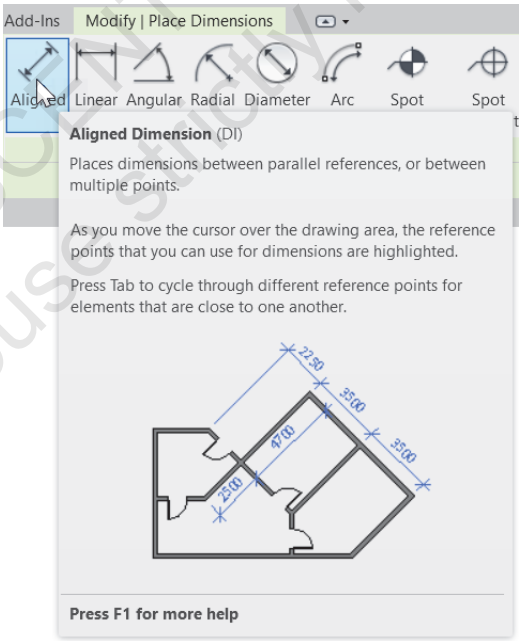

Figure 1–24

- Many commands have shortcut keys. For example, type **AL** for **Align** or **MV** for **Move**. They are listed next to the name of the command in the tooltips. Do not press <Enter> when typing shortcuts. A list of shortcuts can be found in the Autodesk Revit Help, which can be accessed by clicking (Help) in the upper-right corner of the interface or pressing <F1>.

  - For convenience, both the RVTKeyboardShortcuts.xlsx and RVTKeyboardShortcuts.pdf files have been downloaded for you and can be found in the practice files *Reference* folder.

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- To arrange the order in which the ribbon tabs are displayed, select the tab, hold <Ctrl>, and drag it to a new location. The location is remembered when you restart the software.

- Any panel can be dragged by its title into the view window to become a floating panel. Click the **Return Panels to Ribbon** button (as shown in Figure 1–25) to reposition the panel in the ribbon.

Figure 1–25

Hint: Ending a Command

When you are finished working with a tool, you typically default back to the **Modify** command. To end a command, use one of the following methods:

- In any tab on the ribbon, click (Modify).
- Type the shortcut **MD**.
- Press <Esc> once or twice to revert to **Modify**.
- Right-click and select **Cancel...** once or twice.
- Start another command.

6. Navigation Bar

The Navigation Bar enables you to access the 2D and Full Navigation (3D views) Wheel to navigate the view, as well as the Zoom in Region viewing commands, as shown in Figure 1–26.

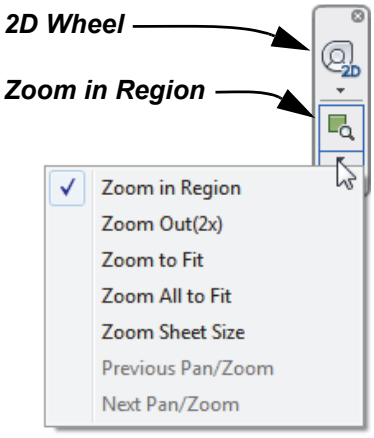

Figure 1–26

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7. File Tab

If you click the primary icon, rather than the arrow, it starts the default command (excluding Save as and Export, which require an option to be selected).

The *File* tab of the ribbon provides access to file commands, Options settings, and documents, as shown in Figure 1–27. Hover the cursor over a command to display a list of additional tools.

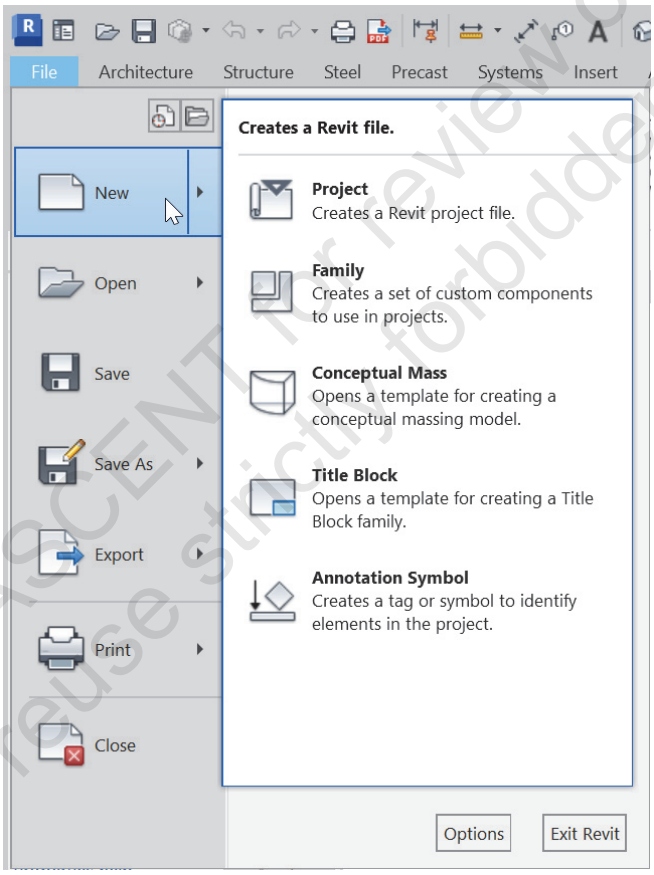

Figure 1–27

- To display a list of recently used documents, click (Recent Documents). The documents can be reordered as shown in Figure 1–28.

Click (Pin) next to a document name to keep it available.

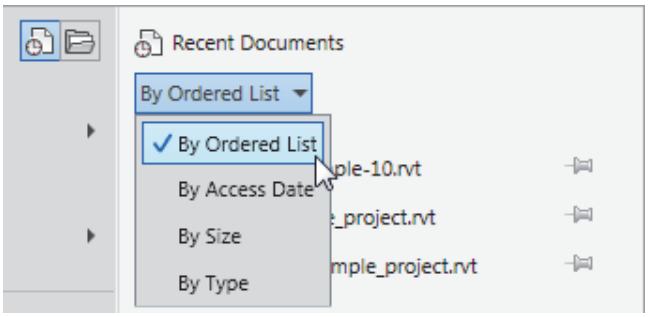

Figure 1–28

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You can use the Open Documents list to change between views.

- To display a list of open documents and views, click (Open Documents). The list displays the documents and views that are open, as shown in Figure 1–29.

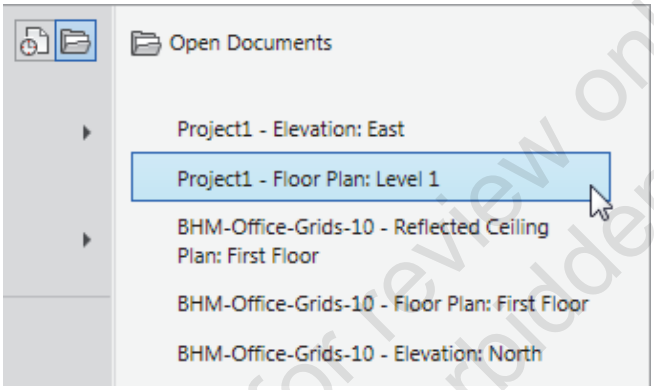

Figure 1–29

- Click (Close) to close the current project.
- At the bottom of the menu, click **Options** to open the Options dialog box or click **Exit Revit** to exit the software.

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8. Properties

Properties contains several parts, as shown in Figure 1–30. The Type Selector can be found at the top, which enables you to choose the size or style of the element you are adding or modifying. The options available in Properties enable you to make changes to information (parameters). There are two types of properties:

- **Instance properties** are set for the individual element(s) you are creating or modifying.
- **Type properties** control options for all elements of the same type. If you modify these parameter values, all elements of the selected type change.

Properties is usually kept open while working on a project to easily permit changes at any time. If it does not display, in the *Modify* tab>Properties panel, click (Properties), or type **PP**. Alternatively, you can right-click in the view and select **Properties**.

Some parameters are only available when you are editing an element. They are grayed out when unavailable.

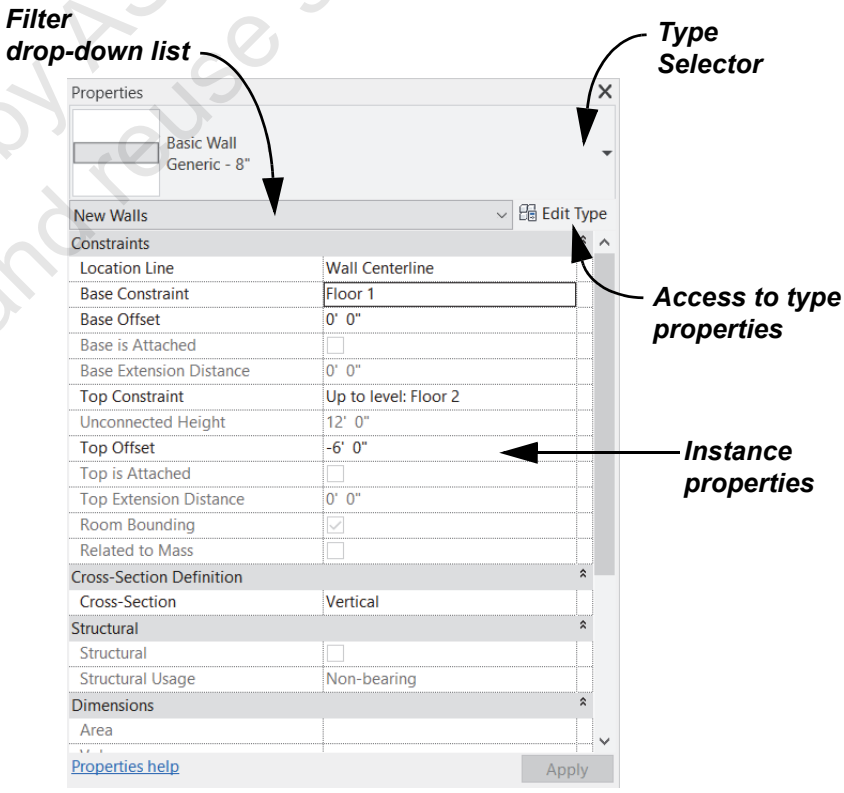

Figure 1–30

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- Options for the current view display if the **Modify** command is active, but you have not selected an element.
- If a command or element is selected, the options for the associated element display.
- You can save the changes either by moving the cursor off of Properties, by pressing <Enter>, or by clicking **Apply**.
- When you start a command or select an element, you can set the element type in the Type Selector, as shown in Figure 1–31.

You can limit what shows in the drop-down list by typing in the search box.

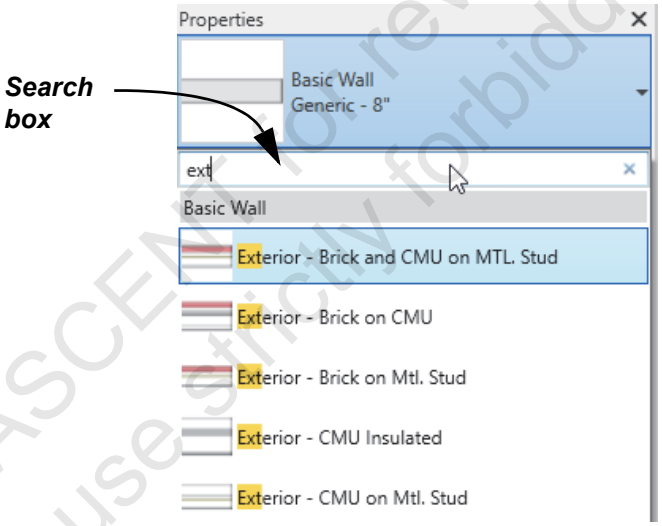

Figure 1–31

- When multiple elements are selected, you can filter the type of elements that display using the drop-down list, as shown in Figure 1–32.
- Properties can be placed on a second monitor, or floated, resized, and docked on top of the Project Browser, as shown in Figure 1–33. Click a tab to display its associated information.

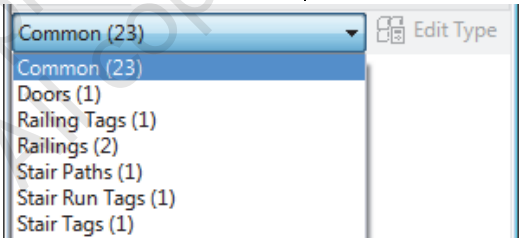

Figure 1–32

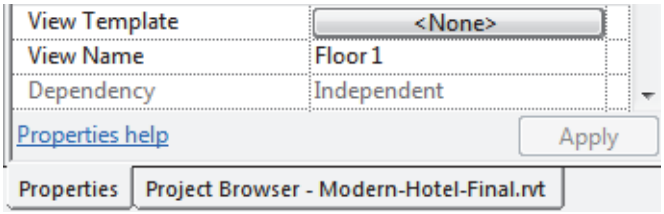

Figure 1–33

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9. Project Browser

The Project Browser (shown in Figure 1–34) lists all the views of the model in which you can work and any additional views that you create, such as floor plans, ceiling plans, 3D views, elevations, sections, etc. It also includes schedules, legends, sheets (for plotting), lists of families by category, groups, and Revit links. The name of the active view is bold, and views that are placed on sheets will have a status icon next to the level's name.

The name of the active project is displayed at the top of the Project Browser.

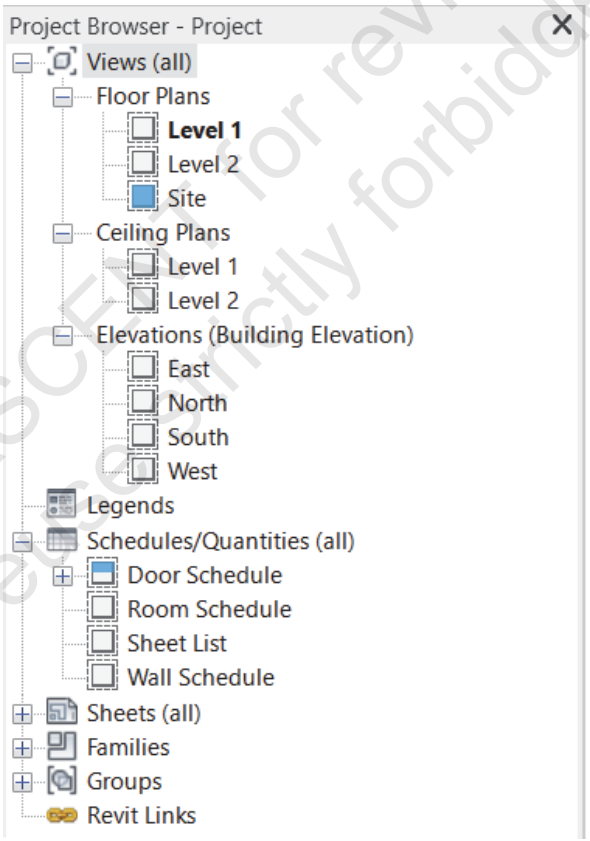

Figure 1–34

- To display the views associated with a view type (e.g., floor plans, ceiling plans, etc.), click (Expand) next to the section name. To hide the views in the section, click (Collapse). You can also expand and collapse sets using the shortcut menu, as shown in Figure 1–35.

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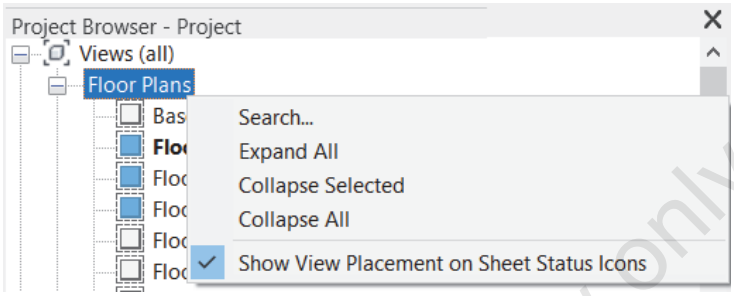

Figure 1–35

- To open a view, double-click on the view name or right-click and select **Open**.

- To rename a view, slowly click twice on the view name and the text will highlight so it can be changed, as shown in Figure 1–36. You can also right-click on a view name and select **Rename...**, or press <F2>.

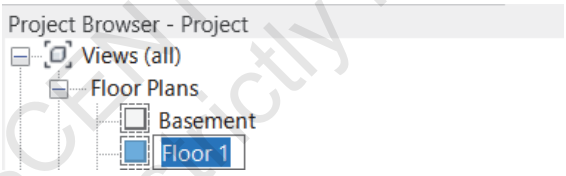

Figure 1–36

- If you no longer require a view, you can delete it. Right-click on its name in the Project Browser and select **Delete**.

- The Project Browser can be customized by changing the Browser Organization or its location within the application. The Project Browser can be floated, resized, or docked on top of Properties.

How To: Search the Project Browser

1. In the Project Browser, right-click on the top level view and select **Search...**.
2. In the Search in Project Browser dialog box, type the words that you want to find (as shown in Figure 1–37) and click **Next**.

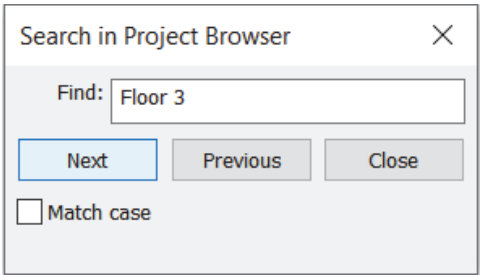

Figure 1–37

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3. In the Project Browser, the first instance of that search highlights, as shown in Figure 1–38.

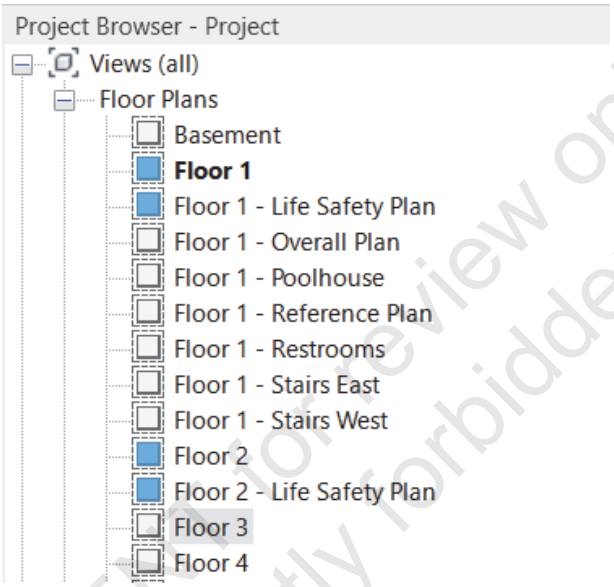

Figure 1–38

4. Continue using **Next** and **Previous** to move through the list.
5. Click **Close** when you are done.

View Placement on Sheet Status Icon

The box to the left of the view name indicates if that view has been placed on a sheet.

- A box that's filled in indicates the view is on a sheet.
- A white (empty) box indicates the view is not on a sheet.
- A half-filled box indicates the view is partially placed on a sheet (e.g., in the case where a schedule has multiple views because of the schedule's length).

Find in Project Browser

When working in a view, you can quickly locate it in the Project Browser by right-clicking in an empty space in the view (with nothing selected) and selecting **Find in Project Browser**. The view will highlight in the Project Browser.

You can also locate an element in the Project Browser by selecting the element in a view, right-clicking, and selecting **Find in Project Browser**.

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10. View Control Bar

The View Control Bar (shown in Figure 1–39) displays at the bottom of each view window. It controls aspects of that view, such as the scale and detail level. It also includes tools that display parts of the view and hide or isolate elements in the view.

Figure 1–39

- The number of options in the View Control Bar change when you are in a 3D view, as shown in Figure 1–40.

Figure 1–40

Tool	Tooltip	Description
1/8" = 1'-0"	**View Scale**	Set the scale of individual views.
	Detail Level	Set the detail level of a view.
	Visual Style	Various graphic style representations.
	Sun Path On/Off	Controls the visibility of the sun's path.
	Shadows On/Off	Controls elements' shadow visibility in a view.
	Show/Hide Rendering Dialog	Available in 3D only. Shows or hides the rendering dialog box.
	Crop View	Define the crop boundaries for a view.
	Show/Hide Crop Region	Display the crop region in a view.
	Unlocked/Locked 3D Views	Lock a 3D view's orientation.
	Temporary Hide/Isolate	Temporarily isolate/hide by category or element (view specific).
	Reveal Hidden Elements	View hidden elements or unhide them in the active view.
	Worksharing Display	Available when worksharing is enabled. Controls display settings.

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	Temporary View Properties	Enable, apply or restore view properties and display recent templates and apply them.
	Show or Hide the Analytical Model	Only used for Structural and MEP to display the analytical information.
	Highlight Displacement Sets	Also known as exploded views.
	Reveal Constraints	Temporarily view the dimension and alignment constraints in the active view.
	Preview Visibility	Available in the Family Editor only. Controls the visibility of the preview.

11. Status Bar

The left-hand side of the Status Bar provides information about the current process, such as the next step for a command, as shown in Figure 1–41.

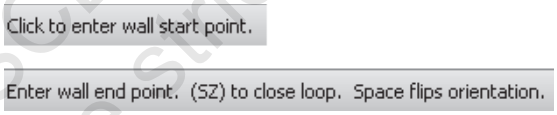

Figure 1–41

The right-hand side of the Status Bar provides selection options that enable you to control how the software selects specific elements in a project by toggling selection options on and off, as shown in Figure 1–42.

Figure 1–42

- **Select links:** When this option is toggled on, you can select linked CAD drawings or Revit models. When it is toggled off, you cannot select them when using **Modify** or **Move**.

- **Select underlay elements:** When this option is toggled on, you can select underlay elements. When it is toggled off, you cannot select them when using **Modify** or **Move**.

- **Select pinned elements:** When this option is toggled on, you can select pinned elements. When it is toggled off, you cannot select them when using **Modify** or **Move**.

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- **Select elements by face:** When this option is 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 it is toggled off, you can only select elements by selecting an edge.

- **Drag elements on selection:** When this option is toggled on, you can hover over an element, select it, and drag it to a new location. When it is 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.

When a selection option is toggled off, the icon will have a red X on it ( ).

You can also set the selection option from the ribbon. Expand the Select panel's title and select the option(s), as shown in Figure 1–43.

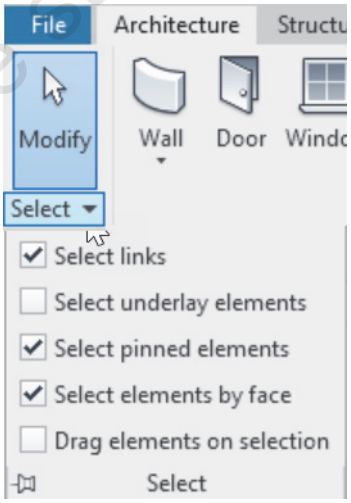

Figure 1–43

Other options in the Status Bar are related to worksets and design options (advanced tools).

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Hint: Shortcut Menus

Shortcut menus help you to work smoothly and efficiently by enabling you to quickly access required commands. These menus provide access to basic viewing commands, recently used commands, and the available browsers, as shown in Figure 1–44. Additional options vary depending on the element or command that you are using.

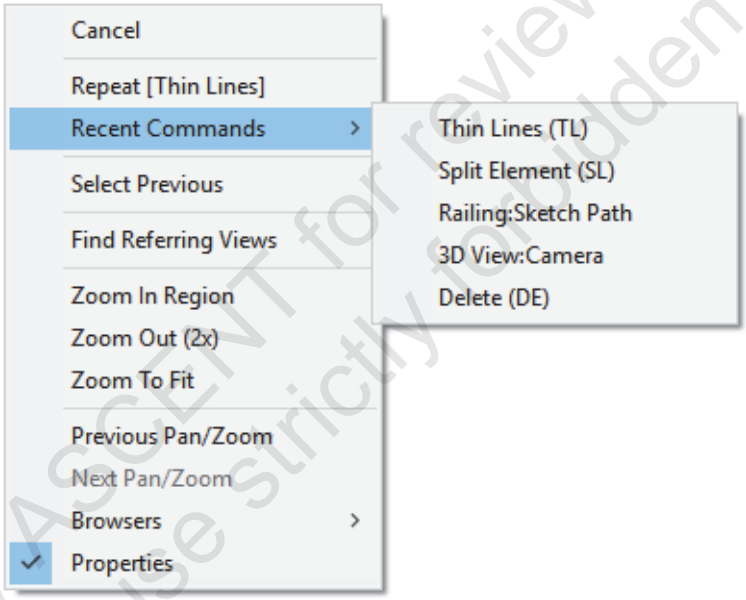

Figure 1–44

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1.3 Opening and Saving Projects

File operations to open existing files, create new files from a template, and save files in Revit are found in the *File* tab, as shown in Figure 1–45.

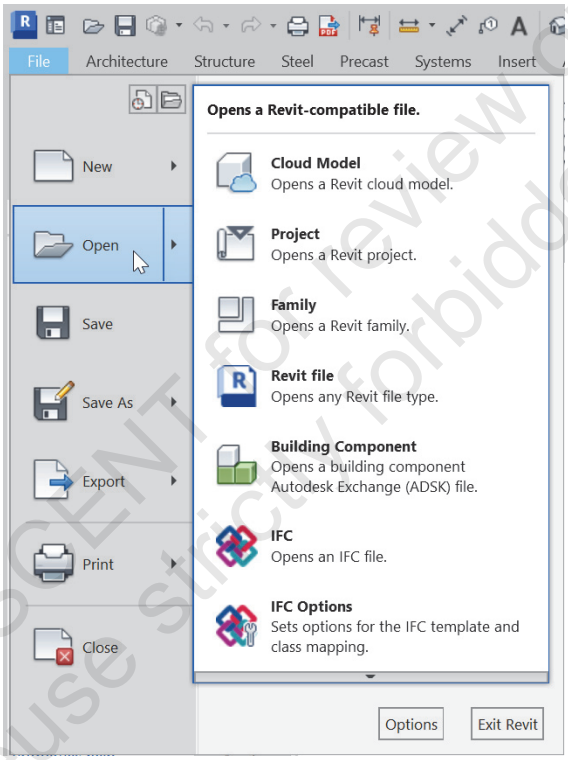

Figure 1–45

There are three main file formats:

- **Project files (.rvt):** These are where you do the majority of your work in the building model by adding elements, creating views, annotating views, and setting up printable sheets. They are initially based on template files.

- **Family files (.rfa):** These are separate components that can be inserted in a project. They include elements that can stand alone (e.g., a table or piece of mechanical equipment) or are items that are hosted in other elements (e.g., a door in a wall or a lighting fixture in a ceiling). Title block and annotation symbol files are special types of family files.

- **Template files (.rte and .rft):** These are the base files for any new project or family. Project templates (**.rte**) hold standard information and settings for creating new project files. The software includes several templates for various types of projects. You can also create custom templates. Family templates (**.rft**) include base information for creating families. Template files are usually saved as a new file.

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Opening Projects

To open an existing project, in the Quick Access Toolbar or *File* tab, click (Open), or press <Ctrl>+<O>. The Open dialog box opens, and you can navigate to the required folder and select a project file. An example of the Open dialog box is shown in Figure 1–46.

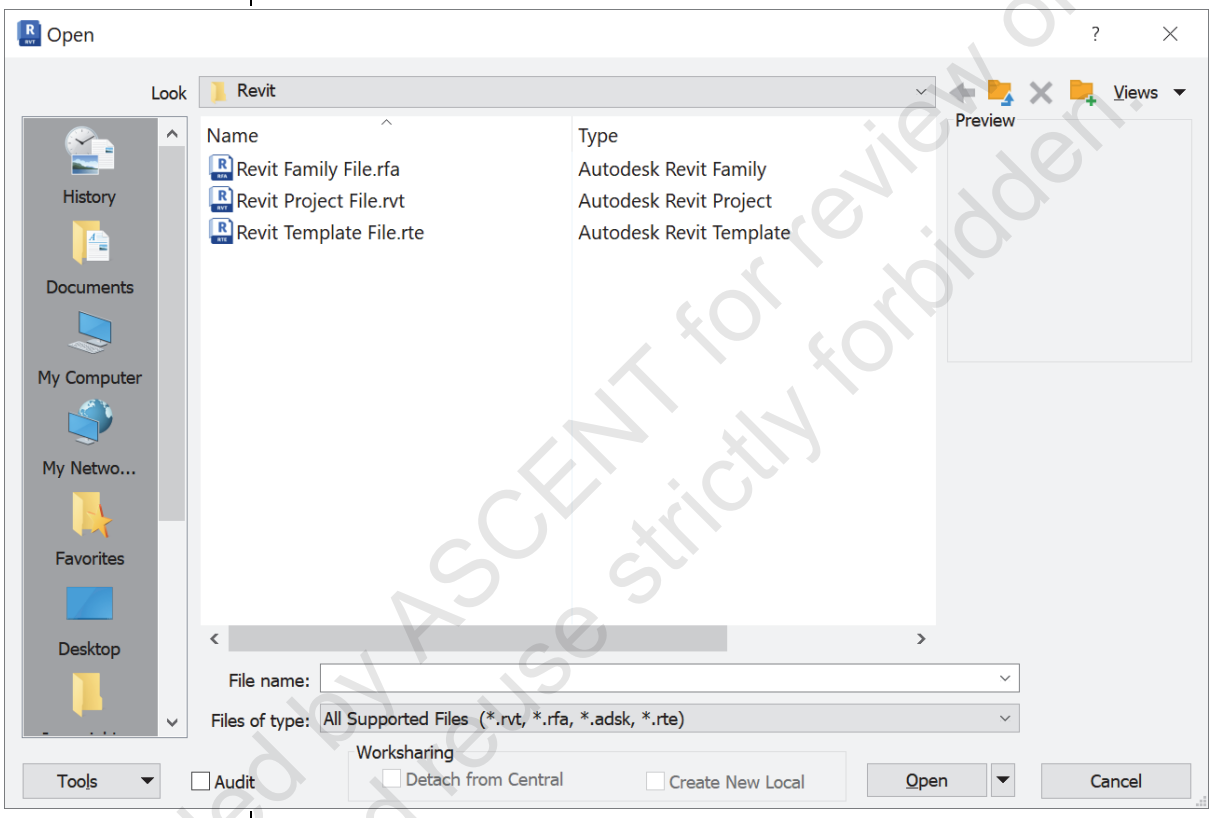

Figure 1–46

- The software release version of the currently selected project displays below the preview. Do not open a drawing that should remain in an earlier version, as you cannot save back to previous versions.

  Note: It is important that everyone working on a project uses the same software version (e.g., 2023) and is on the same updated version (e.g., 2023.1). While your software may be able to open files created in its earlier versions, it will not be able to open files created in versions newer than the one you are using currently. For example, if you are working in Revit 2022, you cannot open a model created in Revit 2023.

- When you open a file created in an earlier version, the Model Upgrade dialog box (shown in Figure 1–47) indicates the release of a file and the release to which it will be upgraded. If needed, you can cancel the upgrade before it completes.

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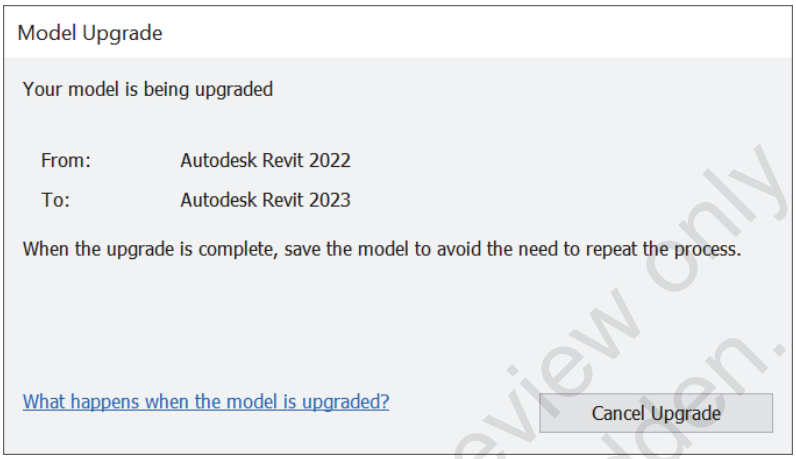

Figure 1–47

Saving Projects

It is important to save your projects frequently. In the Quick Access Toolbar or *File* tab, click (Save), or press <Ctrl>+<S> to save your project. If the project has not yet been saved, the Save As dialog box opens, where you can specify a file location and name.

- To save an existing project with a new name, in the *File* tab, expand (Save As) and click (Project).
- If you have not saved in a certain amount of time, the software will notify you with the Project Not Saved Recently alert box, as shown in Figure 1–48. Select **Save the project**. If you want to set reminder intervals or not save at this time, select one of the other two options shown in Figure 1–48.

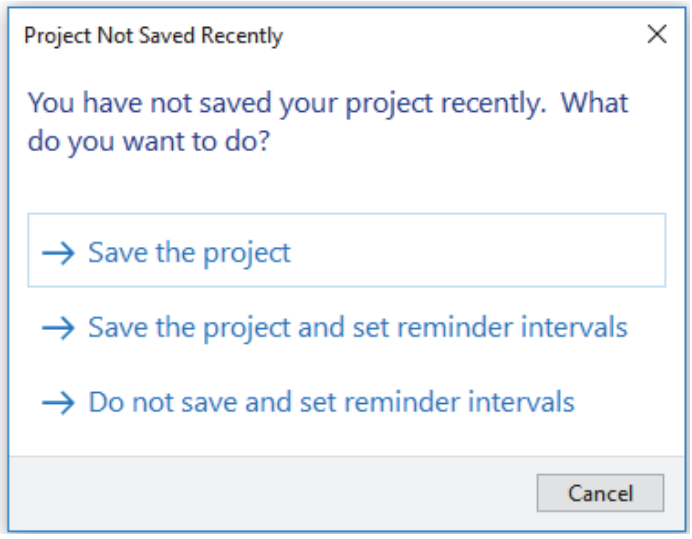

Figure 1–48

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- You can set the *Save Reminder interval* to **15** or **30 minutes**, **One**, **Two**, or **Four hours**, or to have **No reminders** display. In the *File* tab, click **Options** to open the Options dialog box. Select **General** and set the interval, as shown in Figure 1–49.

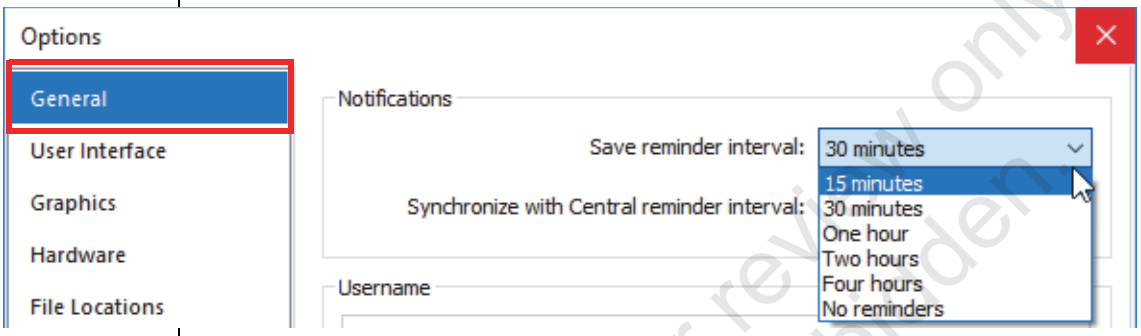

Figure 1–49

Saving Backup Copies

By default, the software saves a backup copy of a project file when you save the project. Backup copies are numbered incrementally (e.g., **My Project.0001.rvt**, **My Project.0002.rvt**, etc.) and are saved in the same folder as the original file. In the Save As dialog box, click **Options...** to control how many backup copies are saved. The default number is three backups. If you exceed this number, the software deletes the oldest backup file.

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1.4 Viewing Commands

Viewing commands are crucial to working efficiently in most drawing and modeling programs and Revit is no exception. Once in a view, you can use the Zoom controls to navigate in it. You can zoom in and out and pan in any view. There are also special tools for viewing in 3D.

Zooming and Panning

Using the Mouse to Zoom and Pan

Use the mouse wheel (shown in Figure 1–50) as the main method of moving around the models.

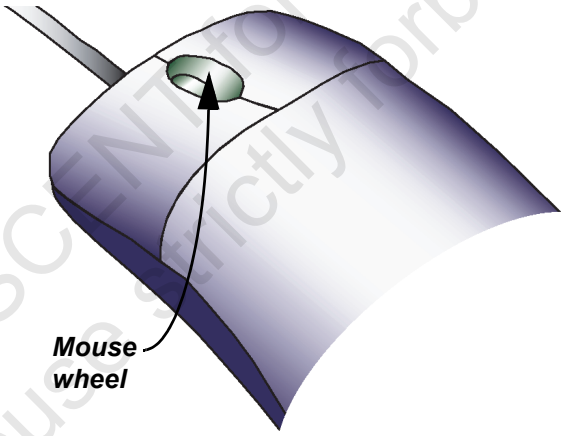

Figure 1–50

- Scroll the wheel on the mouse up to zoom in and down to zoom out.
- Hold the wheel and move the mouse to pan.
- Double-click on the wheel to zoom to the extents of the view.
- In a 3D view, hold <Shift> and the mouse wheel and move the mouse to orbit around the model.

- When you save a model and exit the software, the pan and zoom location of each view is remembered. This is especially important for complex models.

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Zoom Controls

A number of additional zoom methods enable you to control the screen display. **Zoom** and **Pan** can be performed at any time while using other commands.

- You can access the **Zoom** commands in the Navigation Bar in the upper right corner of the view (as shown in Figure 1–51). You can also access them from most shortcut menus and by typing the shortcut commands.


*(2D Wheel) provides cursor-specific access to **Zoom** and **Pan**.*

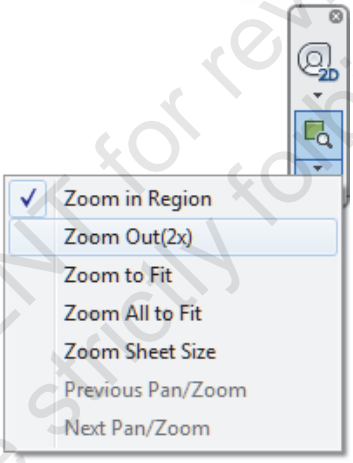

Figure 1–51

Zoom Commands

	**Zoom In Region (ZR)**	Zooms in to a region that you define. Drag the cursor or select two points to define the rectangular area you want to zoom in to. This is the default command.
	**Zoom Out(2x) (ZO)**	Zooms out to half the current magnification around the center of the elements.
	**Zoom to Fit (ZF or ZE)**	Zooms out so that the entire contents of the project only display on the screen in the current view.
	**Zoom All to Fit (ZA)**	Zooms out so that the entire contents of the project display on the screen in all open views.
	**Zoom Sheet Size (ZS)**	Zooms in or out in relation to the sheet size.
N/A	**Previous Pan/Zoom (ZP)**	Steps back one **Zoom** command.
N/A	**Next Pan/Zoom**	Steps forward one **Zoom** command if you have done a **Previous Pan/Zoom**.

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Viewing in 3D

Even if you started a project entirely in plan views, you can quickly create 3D views of the model, as shown in Figure 1–52. There are two types of 3D views: isometric views created by the **Default 3D View** command and perspective and orthographic 3D views created by the **Camera** command.

Figure 1–52

Working in 3D views helps you visualize the project and position some of the elements correctly. You can create and modify elements in both isometric and perspective 3D views, just as you can in plan views.

- Once you have created a 3D view, you can save it and easily return to it.
- Perspective 3D views are visual representations of what the model would look like if you were standing in the model.
- Orthographic 3D views can have a scale applied to them so that the entire model's components are at the same size no matter where the camera is positioned or its distance from the model.

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How To: Create and Save a 3D Isometric View

1. In the Quick Access Toolbar or *View* tab>Create panel, click (Default 3D View). The default 3D southeast isometric view opens, as shown in Figure 1–53.

You can spin the view to a different angle using the mouse wheel or the middle button of a three-button mouse. Hold <Shift> as you press the wheel or middle button and drag the cursor.

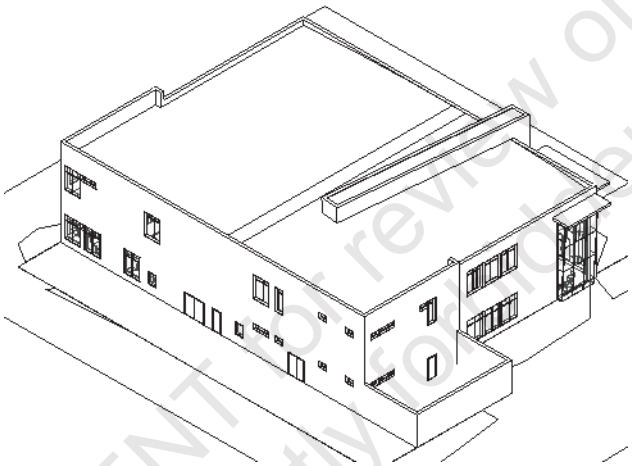

Figure 1–53

2. Modify the view to display the building from other directions.
3. In the Project Browser, slowly click twice on the {3D} view or right-click on the {3D} view and select **Rename...**.
4. The name is placed in a text box with the original name highlighted, as shown in Figure 1–54. Type a new name in the text box, as shown in Figure 1–55.

Figure 1–54

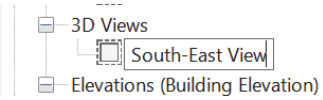

Figure 1–55

All types of views can be renamed.

- When changes to the default 3D view are saved and you start another default 3D view, it displays the southeast isometric view once again. If you modified the default 3D view but did not save it to a new name, the **Default 3D View** command opens the view in the last orientation you specified.

How To: Create a Perspective 3D View

1. Switch to a Floor Plan view.
2. In the Quick Access Toolbar or *View* tab>Create panel, expand (Default 3D View) and click (Camera).
3. Place the camera on the view.
4. Point the camera in the direction in which you want it to shoot by placing the target on the view, as shown in Figure 1–56.

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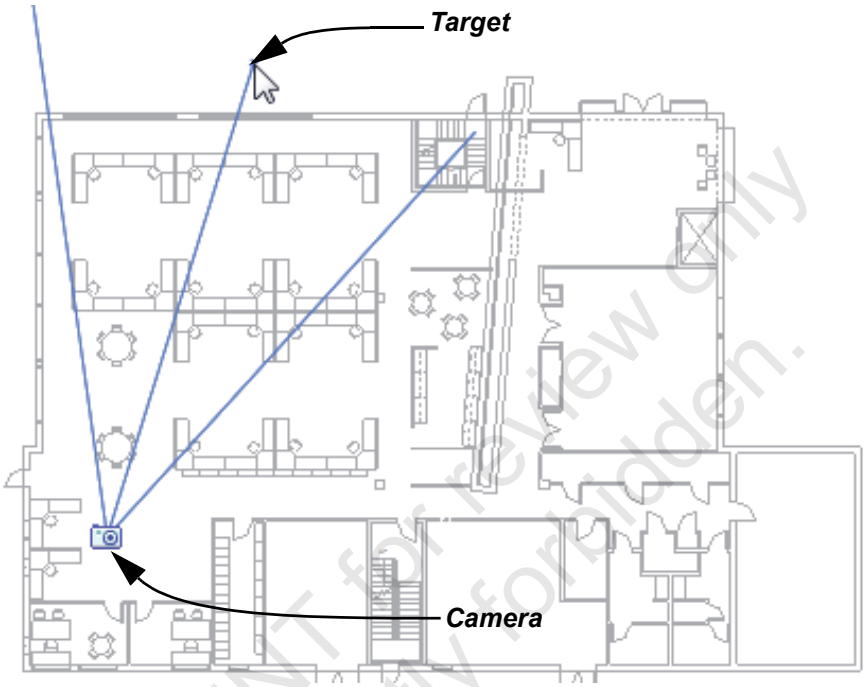

Figure 1–56

A new view is displayed, as shown in Figure 1–57.

Use the round controls to modify the display size of the view and press <Shift> + the mouse wheel to change the view.

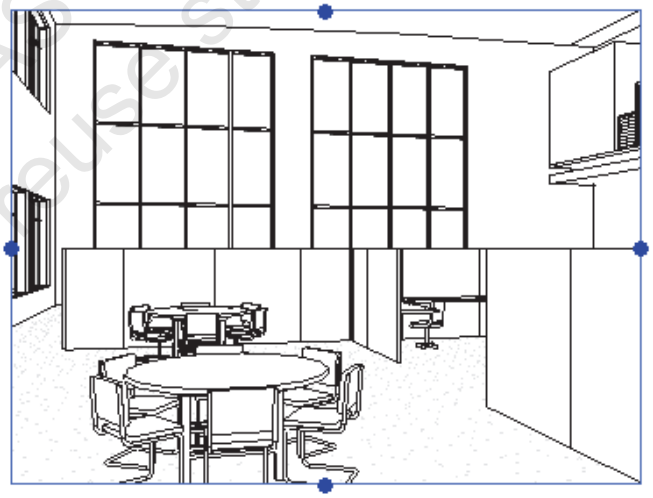

Figure 1–57

How To: Create an Orthographic 3D View

1. Switch to a floor plan view.
2. In the Quick Access Toolbar or *View* tab>Create panel, expand (Default 3D View) and click (Camera).
3. In the Options Bar, uncheck **Perspective** and set the *Scale*, *Offset*, and *From* which level, as shown in Figure 1–58.

Figure 1–58

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4. Place the camera on the view.
5. Point the camera in the direction in which you want it to shoot by placing the target on the view, as shown in Figure 1–59.

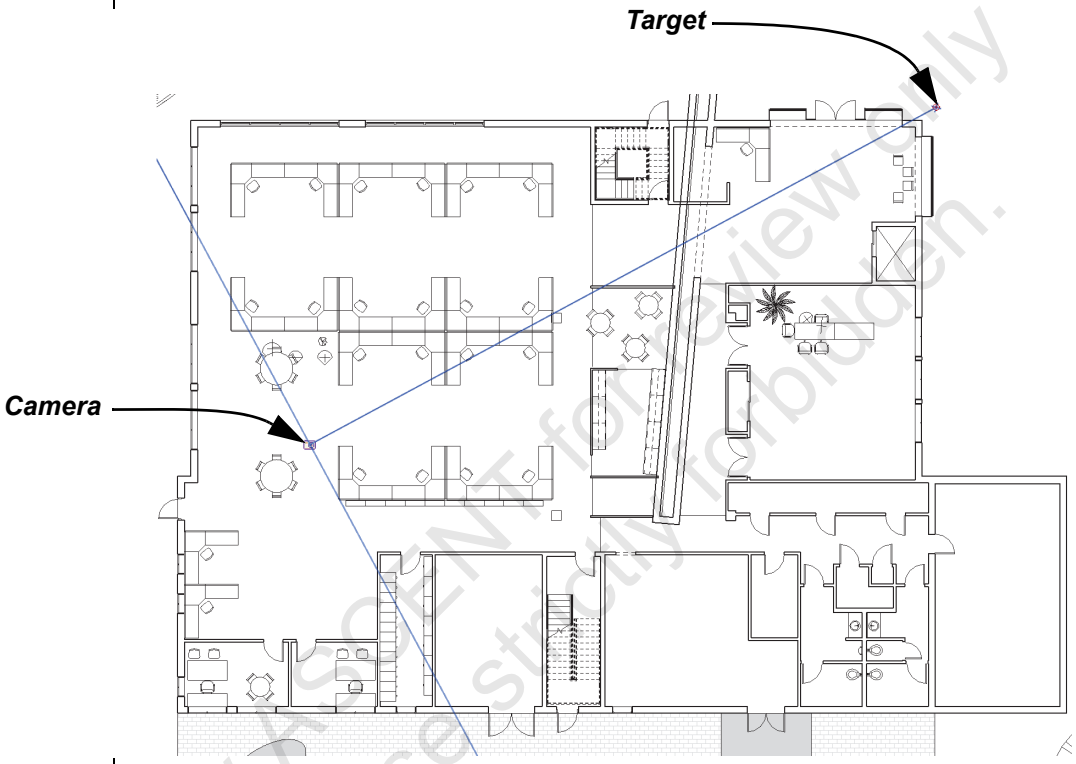

Figure 1–59

- A new view is displayed, as shown in Figure 1–60. If needed, the *Eye Elevation* and *Target Elevation* can be adjusted in Properties.

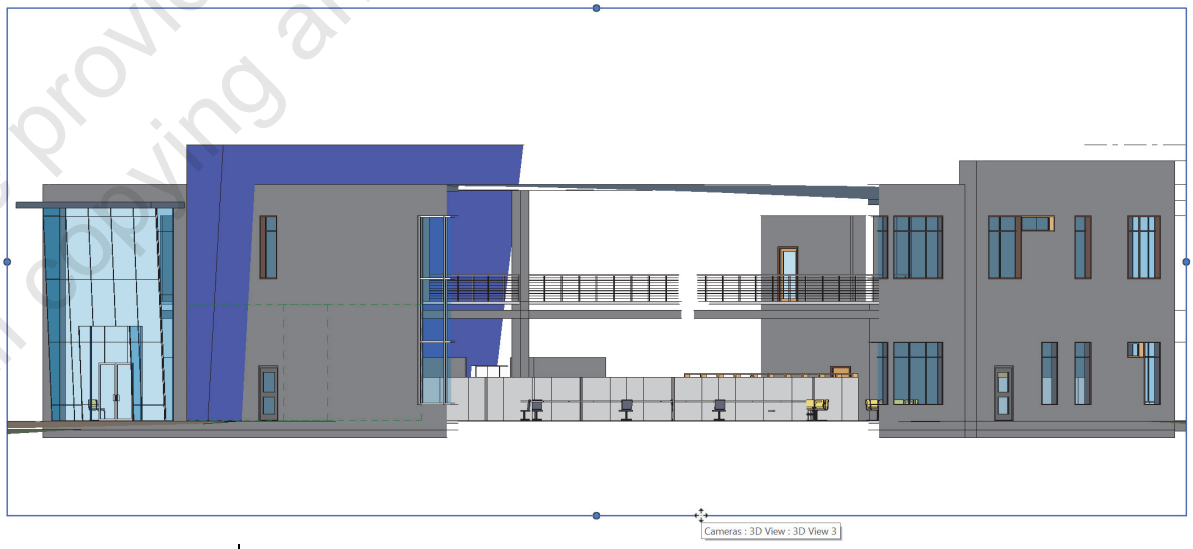

Figure 1–60

6. In Properties, scroll down and adjust the *Eye Elevation* and *Target Elevation* as needed.

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How To: Modify Camera 3D Views

1. In a plan view, select the camera or target icon and drag it within the view to reposition the placement.
2. In Properties, scroll down and adjust the *Eye Elevation* and *Target Elevation* as needed.

- To display the camera and camera controls in a plan view, select the camera's crop boundary in the perspective view, then switch back to the plan view.
    - Alternatively, while in a plan view, you can right-click on the perspective 3D view in the Project Browser and select **Show Camera**, as shown in Figure 1–61. The camera and camera crop boundaries will display.

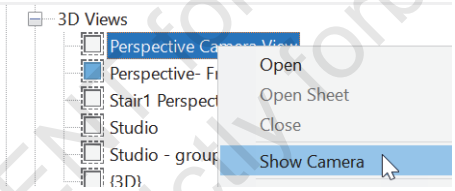

Figure 1–61

- For perspective 3D views, if the view becomes distorted, reset the target so that it is centered in the boundary of the view (called the crop region). In the *Modify* | *Cameras* tab> Camera panel, click (Reset Target).

ViewCube

The ViewCube provides visual clues as to where you are in a 3D view. It helps you move around the model with quick access to specific views (such as top, front, and right), as well as corner and directional views, as shown in Figure 1–62.

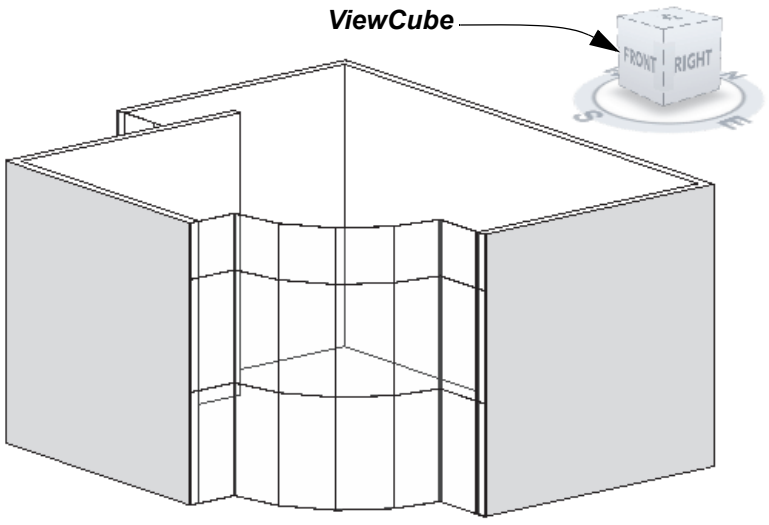

Figure 1–62

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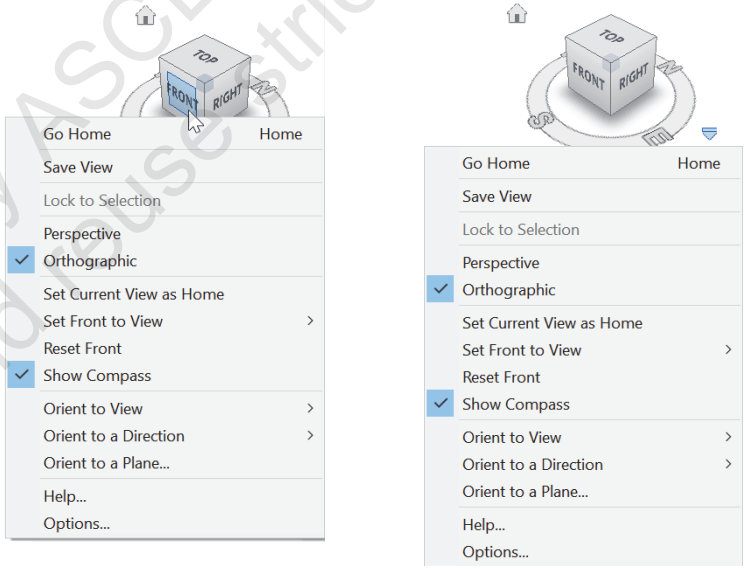
Move the cursor over any face of the ViewCube to highlight it. Once a face is highlighted, you can select it to reorient the model. You can also click and drag on the ViewCube to orbit the box, which rotates the model.

- (Home) displays when you roll the cursor over the ViewCube. Click it to return to the view defined as **Home**. To change the Home view, set the view as you want it, right-click on the ViewCube, and select **Set Current View as Home**.
- The ViewCube is available in isometric and perspective views.

You can switch between Perspective and Isometric mode by right-clicking on the ViewCube (as shown on the left in Figure 1–63) or clicking on (ViewCube contextual menu) to the lower right of the ViewCube (as shown on the right in Figure 1–63) and selecting **Perspective** or **Orthographic**.



Right-click on ViewCube ***Context menu on ViewCube***

Figure 1–63

You can create 3D views that are oriented to a specific view. for more information,

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Visual Styles

Any view can have a visual style applied. The **Visual Style** options found in the View Control Bar (as shown in Figure 1–64), specify the shading of the building model. These options apply to plan, elevation, section, and 3D views.

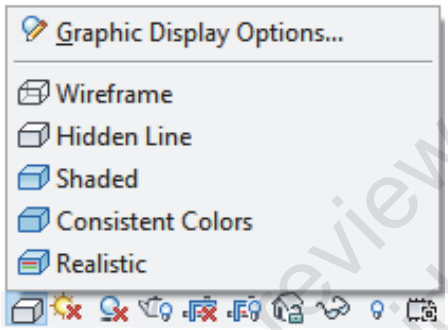

Figure 1–64

- (Wireframe) displays the lines and edges that make up elements, but hides the surfaces. This can be useful when you are dealing with complex intersections.
- (Hidden Line) displays the lines, edges, and surfaces of the elements, but it does not display any colors. This is the most common visual style to use while working on a design.
- (Shaded) and (Consistent Colors) give you a sense of the materials, including transparent glass. An example showing an exterior and interior view using Consistent Colors is shown in Figure 1–65. Landscape components will display as gray outlines of the objects until the Realistic visual style is used.

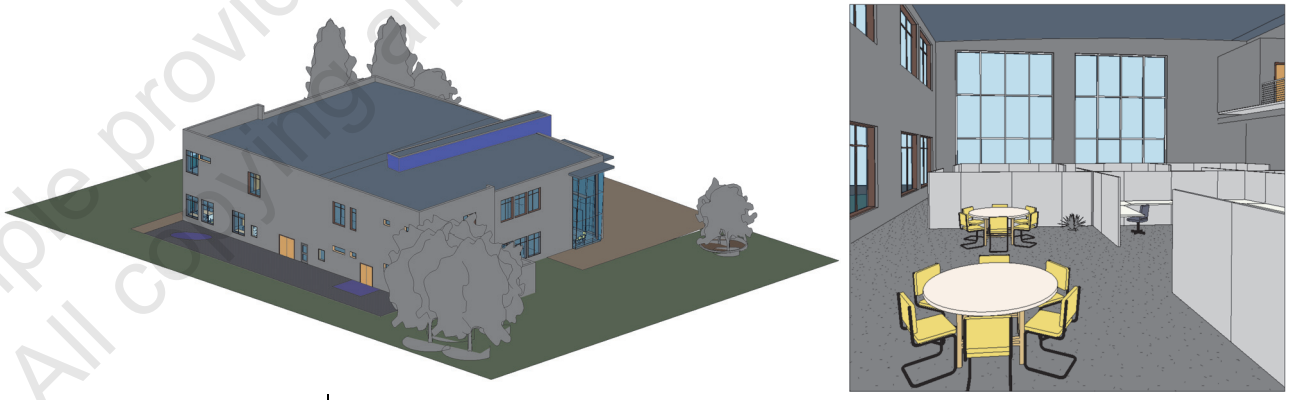

Figure 1–65

- (Realistic) displays what is shown when you render the view, including Rich Photorealistic Content (RPC) components and artificial lights. It takes a lot of computer power to execute this visual style. Therefore, it is better to use the other visual styles most of the time as you are working.

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Practice 1a

Open and Review a Project

Practice Objectives

- Navigate the graphic user interface.
- Manipulate 2D and 3D views by zooming and panning.
- Create 3D isometric and perspective views.
- Set the visual style of a view.

In this practice, you will open a project file and view each of the various areas in the interface. You will investigate elements, commands, and their options. You will also open views through the Project Browser and view the model in 3D, as shown in Figure 1–66.

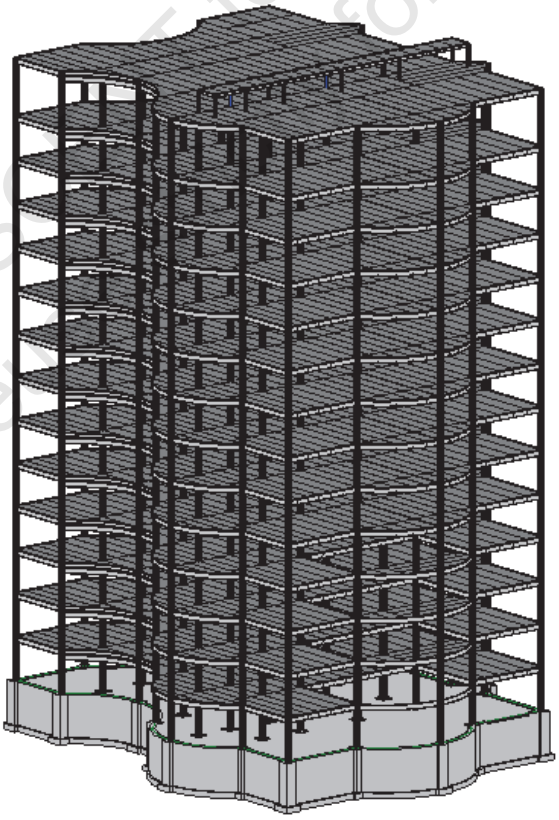

Figure 1–66

- This is a version of the main project you will work on throughout this guide.

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Task 1 - Explore the interface.

1. In the *File* tab, expand (Open) and click (Project).
   - If you are on the Home page, click **Open...** in the *MODELS* area of the sidebar.In the Open dialog box, navigate to the practice files folder and select **Structural-Suite.rvt**.
2. Click **Open**. The 3D view of the building opens in the view window.

If the Project Browser and Properties palette are docked over each other, use the Project Browser tab at the bottom to display it.

3. In the Project Browser, double-click on the **Structural Plans: 00 GROUND FLOOR** view. It opens a plan with the *Visual Style* set to **Wireframe** so that the footings and foundation walls display, although there is a slab over them.
4. In the View Control Bar, change the *Visual Style* to **Hidden Line**. The lines that are hidden in the view display as dashed lines, as shown in Figure 1–67.

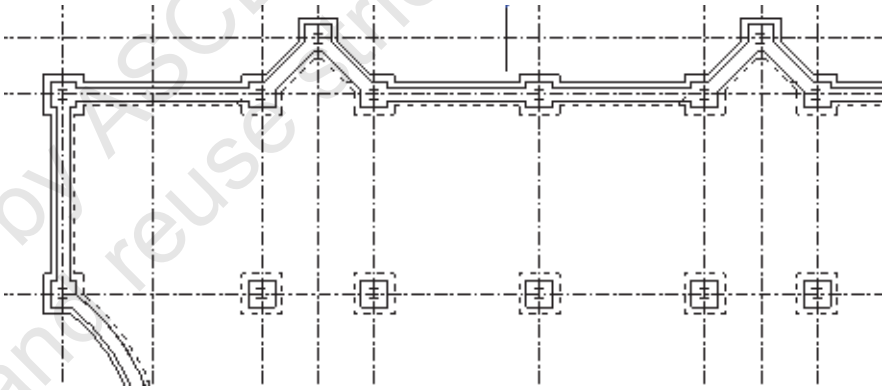

Figure 1–67

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5. In the Project Browser, double-click on the **Structural Plans: 00 T.O. FOOTING** view. The strip footings and spread footings display as continuous lines because they are not obscured by a slab, as shown in Figure 1–68.

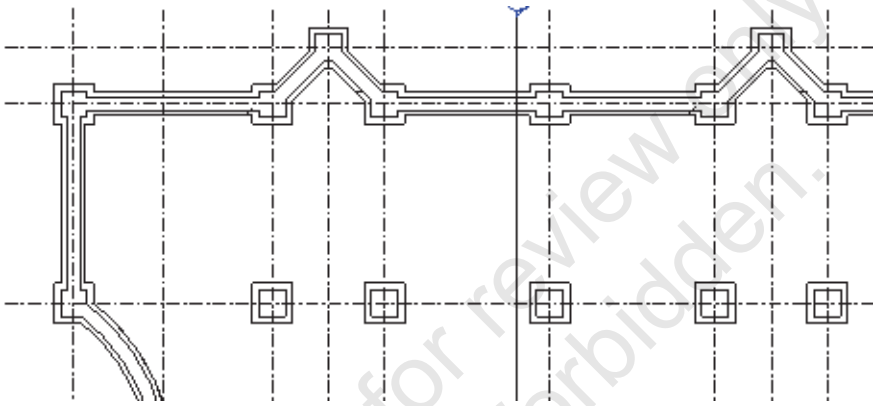

Figure 1–68

6. Zoom in on one corner of the building. The foundation walls are in-filled with the appropriate concrete hatch, as shown in Figure 1–69.

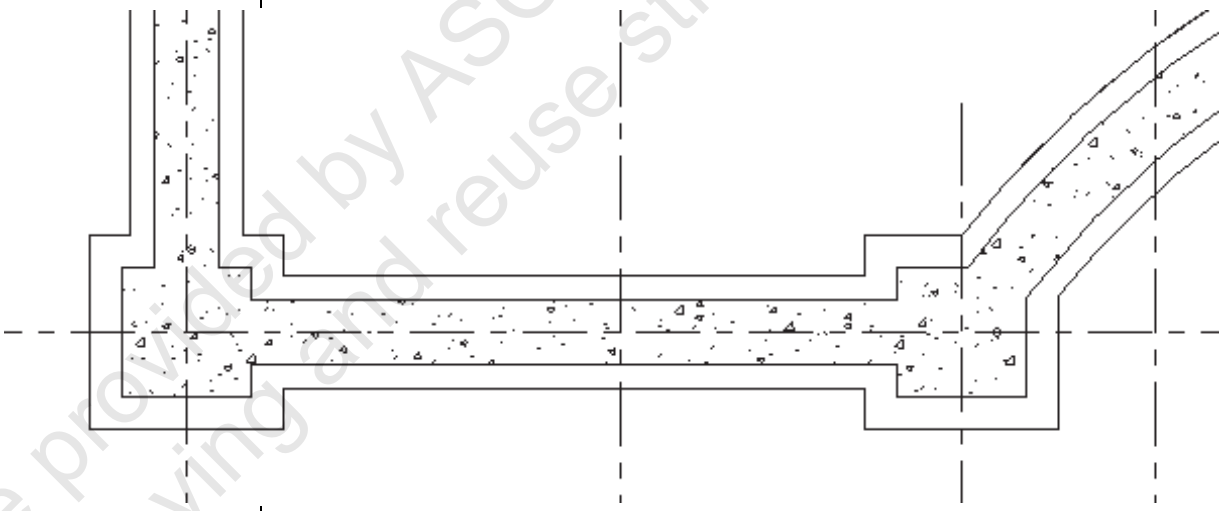

Figure 1–69

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7. Double-click the mouse wheel or type **ZE** to zoom to the extents of the view. (**ZA** zooms to the extents of all of the opened view windows.) Find the section marker that extends vertically along the model, as shown in Figure 1–70.

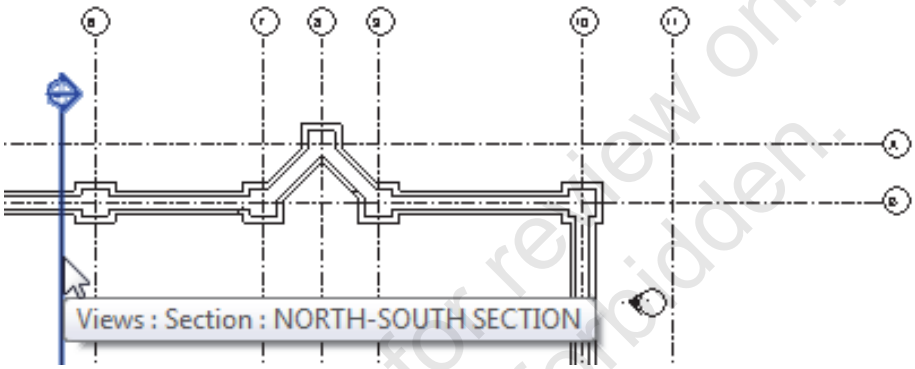

Figure 1–70

8. Double-click on the section head to open the **NORTH-SOUTH SECTION** view.

9. In the Project Browser, navigate to the *Sections (Building Section)* category. The **NORTH-SOUTH SECTION** view name is bold. You can navigate through your model by double-clicking on the element in the Project Browser or by using the graphical view elements in the model.

10. In the section view, zoom in on the area in which the callout has been placed, as shown in Figure 1–71. Double-click on the callout-head to open the **TYPICAL EDGE DETAIL** view.

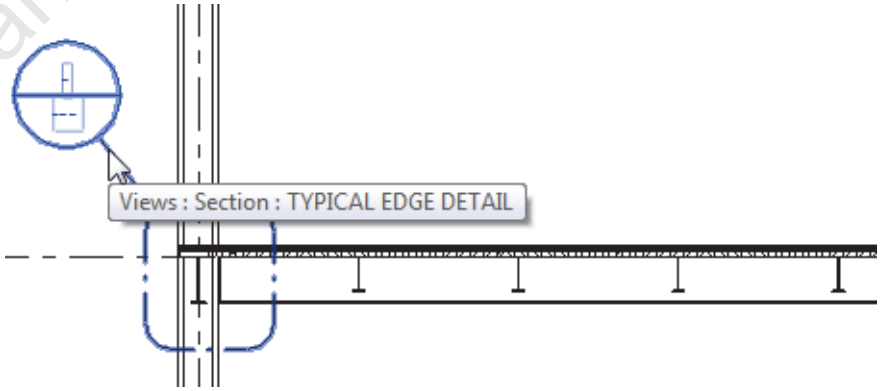

Figure 1–71

11. Toggle on and off  (Thin Lines) to see the different line weights.

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12. In the **TYPICAL EDGE DETAIL** view, select the floor, as shown in Figure 1–72.

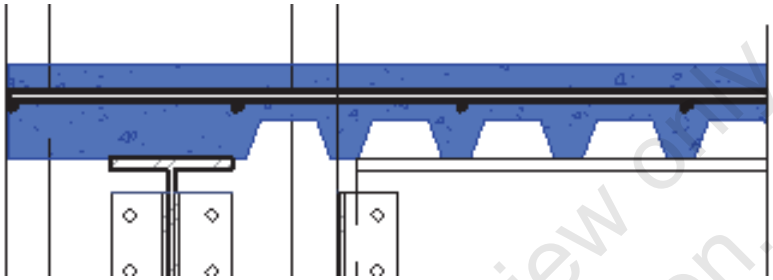

Figure 1–72

13. This is a full 3D floor element. You can edit it using the standard modify tool and the concrete floor-specific tools found in the *Modify* | *Floors* contextual tab, as shown in Figure 1–73.

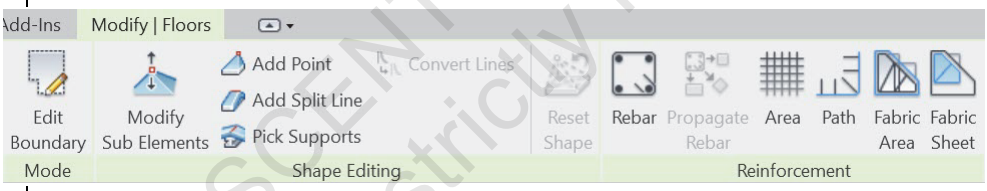

Figure 1–73

14. The Properties palette displays the instance parameters for the element, as shown in Figure 1–74.

Any changes made here are applied to the selected element only.

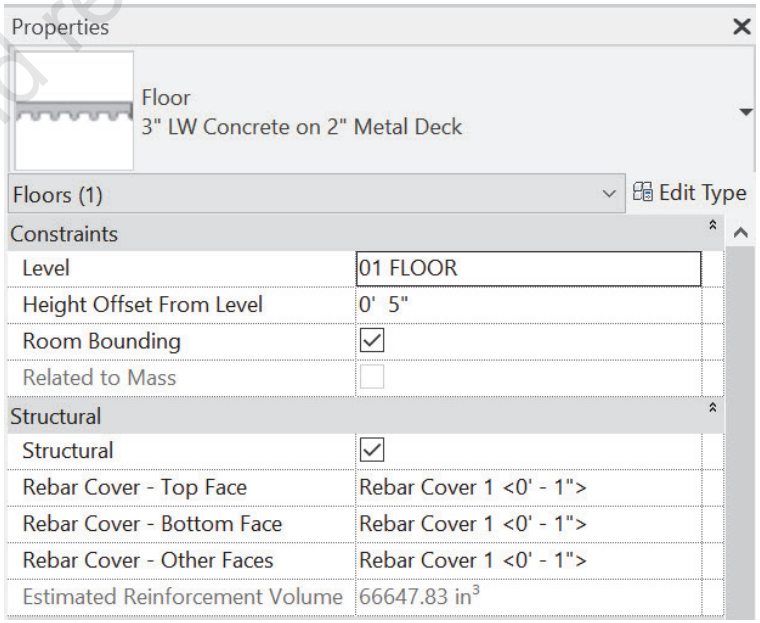

Figure 1–74

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Any changes made to the element here are applied to all of its other instances in the project.

15. In Properties, click (Edit Type) to access the *Type Parameters* in the Type Properties dialog box, as shown in Figure 1–75.

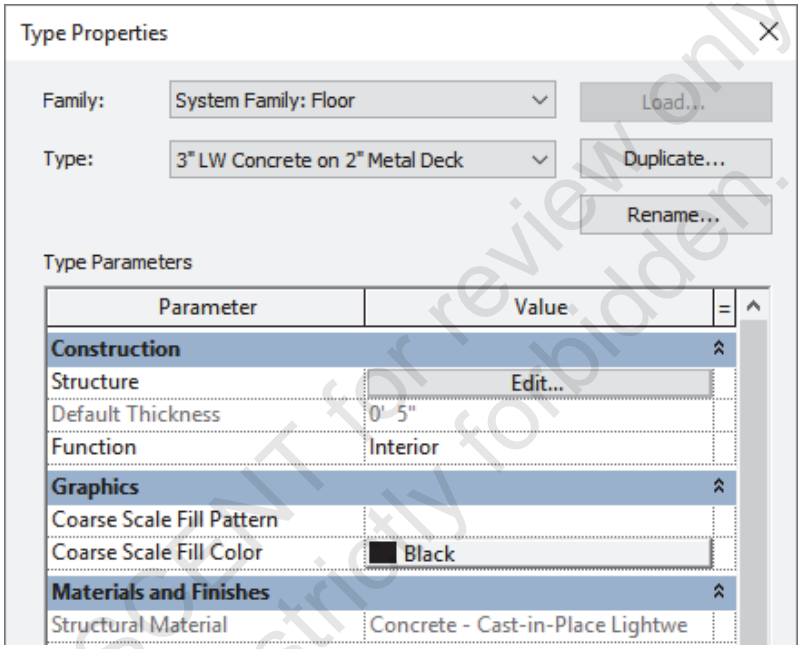

Figure 1–75

16. Click **Cancel** to close the Type Properties dialog box.

17. End the command using one of the following methods:

- In any tab on the ribbon, click (Modify).
- Press <Esc> once or twice to revert to **Modify**.
- Right-click and select **Cancel...** once or twice.
- Start another command.

18. Select one of the bolted connections. This is a detail component (2D element). The *Modify | Detail Items* contextual tab displays the modifying options specific to this element, as shown in Figure 1–76.

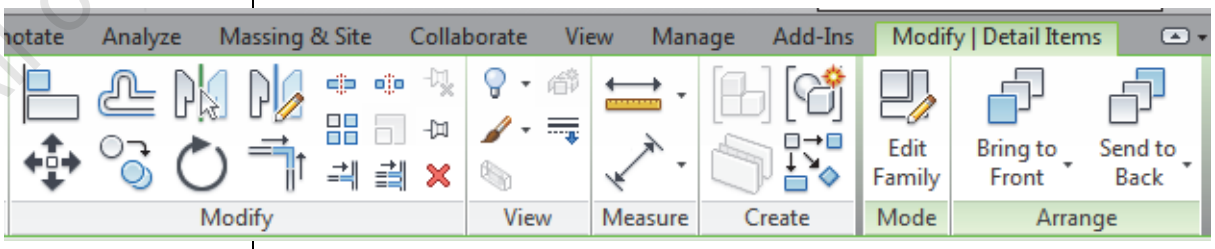

Figure 1–76

19. Click (Modify).

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Task 2 - Work with multiple views and 3D views.

1. At the top of the view, click each tab to switch between the open views.

2. In the *View* tab>Windows panel, click (Tile Views). All of the open views are tiled. Type **ZA** (for Zoom All) to zoom out to the extents of each view, as shown in Figure 1–77.

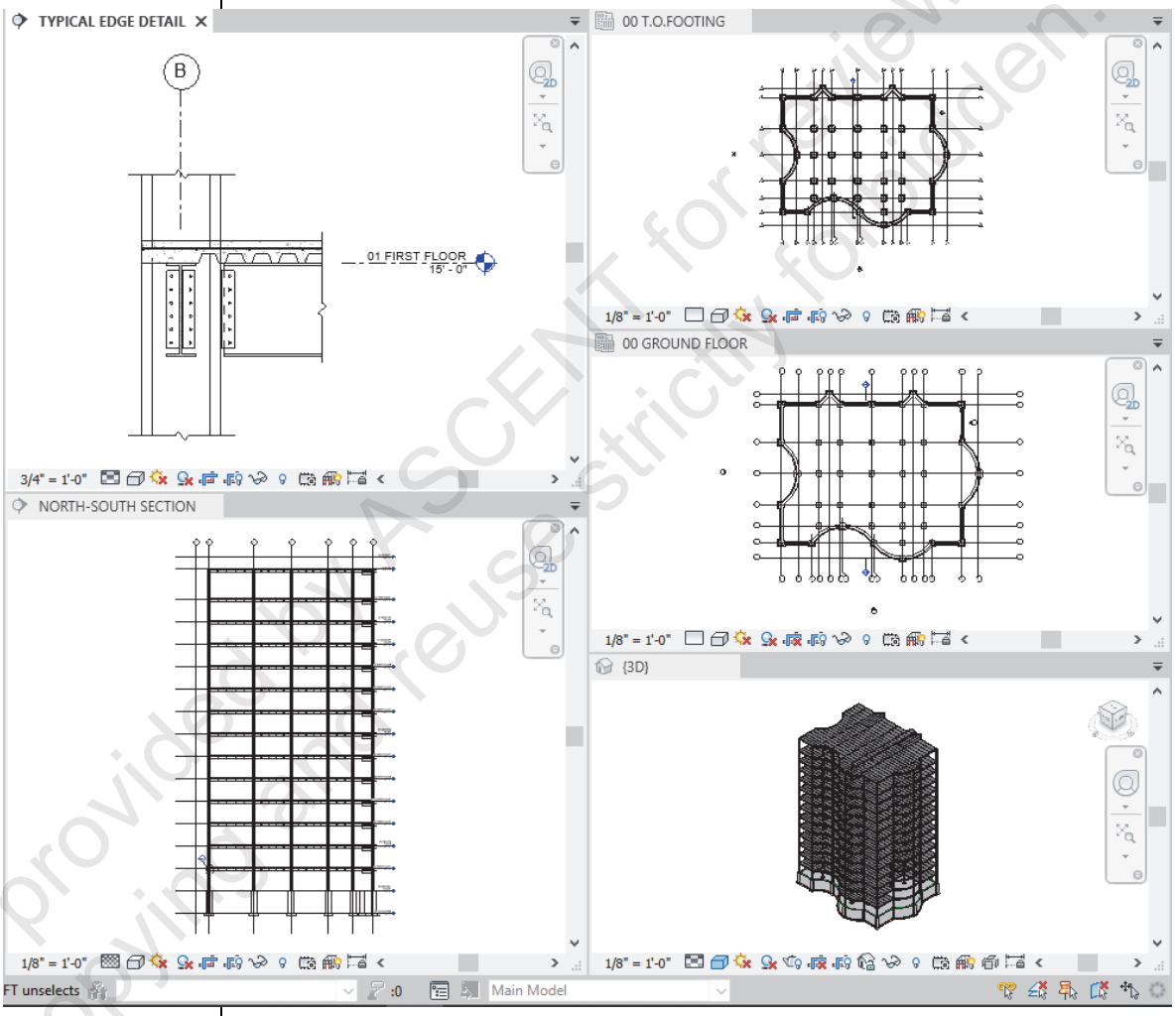

Figure 1–77

3. Click inside the 3D view to make it active.

4. In the *View* tab>Windows panel, click (Tab Views). The views return to the tabs and the 3D view is first in the group.

5. In the Quick Access Toolbar, click (Close Inactive Windows) so that only the current window remains open.

6. Using the mouse wheel, zoom in on the building.

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7. Press and hold <Shift> and then press and hold the wheel on the mouse. Move the mouse to dynamically view the 3D model. You can also navigate in 3D using the ViewCube in the upper-right corner of the view.

8. Expand the *File* tab and click  (Close) to exit the project. Do not save changes.

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Chapter Review Questions

1. When you create a project in Revit, do you work in 3D or 2D?
   a. You work in 2D in plan views and in 3D in non-plan views.
   b. You work in 3D almost all of the time, even when you are using what looks like a flat view.
   c. You work in 2D or 3D depending on how you toggle the 2D/3D control.
   d. You work in 2D in plan and section views and in 3D in isometric views.
2. What is the purpose of the Project Browser?
   a. It enables you to browse through the building project, similar to a walk through.
   b. It is the interface for managing all of the files that are required to create the complete model of the building.
   c. It manages multiple Revit projects as an alternative to using Windows Explorer.
   d. It is used to access and manage the views of the project.
3. Where do you change the visual style?
   a. Ribbon
   b. View Control Bar
   c. Options Bar
   d. Properties Palette
4. What is the difference between Type Properties and Properties?
   a. Properties stores parameters that apply to the selected individual element(s). Type Properties stores parameters that impact every element of the same type in the project.
   b. Properties stores the location parameters of an element. Type Properties stores the size and identity parameters of an element.
   c. Properties only stores parameters of the view. Type Properties stores parameters of model components.

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5. When you start a new project, how do you specify the base information in the new file?
   a. Transfer the base information from an existing project.
   b. Select the right template for the task.
   c. Revit automatically extracts the base information from imported or linked file(s).
6. What is the main difference between a view made using  (Default 3D View) and a view made using  (Camera)?
   a. Use **Default 3D View** for exterior views and **Camera** for interiors.
   b. **Default 3D View** creates a static image and a **Camera** view is live and always updated.
   c. **Default 3D View** is isometric and a **Camera** view is perspective.
   d. **Default 3D View** is used for the overall building and a **Camera** view is used for looking in tight spaces.

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Command Summary

Button	Command	Location
General Tools		
	**Home**	• **Quick Access Toolbar** • **Shortcut:** <Ctrl>+<D>
	**Modify**	• **Ribbon:** All tabs>Select panel • **Shortcut:** MD
	**New**	• ***File* tab** • **Shortcut:** <Ctrl>+<N>
	**Open**	• **Quick Access Toolbar** • ***File* tab** • **Shortcut:** <Ctrl>+<O>
	**Open Documents**	• ***File* tab**
	**Properties**	• **Ribbon:** *Modify* tab>Properties panel • **Shortcut:** PP
	**Recent Documents**	• ***File* tab**
	**Save**	• **Quick Access Toolbar** • ***File* tab** • **Shortcut:** <Ctrl>+<S>
	**Synchronize and Modify Settings**	• **Quick Access Toolbar**
	**Synchronize Now**	• **Quick Access Toolbar:** expand Synchronize and Modify Settings
	**Type Properties**	• **Ribbon:** *Modify* tab>Properties panel • **Properties palette**
Viewing Tools		
	**Camera**	• **Quick Access Toolbar:** expand Default 3D View • **Ribbon:** *View* tab>Create panel> expand Default 3D View
	**Close Inactive Views**	• **Quick Access Toolbar** • **Ribbon:** *View* tab>Windows panel
	**Default 3D View**	• **Quick Access Toolbar** • **Ribbon:** *View* tab>Create panel
	**Home**	• **ViewCube**
N/A	**Next Pan/Zoom**	• **Navigation Bar** • **Shortcut Menu**

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N/A	**Previous Pan/Zoom**	• **Navigation Bar** • **Shortcut Menu** • **Shortcut:** ZP
	**Shadows On/Off**	• **View Control Bar**
	**Show Rendering Dialog/Render**	• **View Control Bar** • **Ribbon:** *View* tab>Graphics panel • **Shortcut:** RR
	**Switch Windows**	• **Quick Access Toolbar** • **Ribbon:** *View* tab>Windows panel
	**Tab Views**	• **Ribbon:** *View* tab>Windows panel • **Shortcut:** TW
	**Tile Views**	• **Ribbon:** *View* tab>Windows panel • **Shortcut:** WT
	**Zoom All to Fit**	• **Navigation Bar** • **Shortcut:** ZA
	**Zoom in Region**	• **Navigation Bar** • **Shortcut Menu** • **Shortcut:** ZR
	**Zoom Out(2x)**	• **Navigation Bar** • **Shortcut Menu** • **Shortcut:** ZO
	**Zoom Sheet Size**	• **Navigation Bar** • **Shortcut:** ZS
	**Zoom to Fit**	• **Navigation Bar** • **Shortcut Menu** • **Shortcut:** ZF, ZE
Visual Styles		
	**Consistent Colors**	• **View Control Bar**
	**Hidden Line**	• **View Control Bar** • **Shortcut:** HL
	**Realistic**	• **View Control Bar**
	**Shaded**	• **View Control Bar** • **Shortcut:** SD
	**Wireframe**	• **View Control Bar** • **Shortcut:** WF

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