Chapter 1

Introduction to Autodesk Revit 2023 for Structure

Learning Objectives

After completing this chapter, you will be able to:

- *Understand the basic concepts and principles of Revit 2023*
- *Understand various terms used in Revit*
- *Describe the parametric behavior of Revit*
- *Start the Revit 2023 program*
- *Understand the interface of Revit*
- *Explain the concept of Worksharing using Revit Server*
- *Understand the linking of Analytical Model to Analysis Software*
- *Access the Revit 2023 Help*

INTRODUCTION TO Autodesk Revit for Structure

Welcome to the realm of Autodesk Revit, a powerful software for structural engineering that provides purpose-built tools for structural design, engineering, and analysis.

Autodesk Revit software provides the Engineers and Designers with tools for structural analysis and design. Revit is a BIM software that helps the users in a project to coordinate the documentation of structural design with other disciplines of engineering. Its integrated parametric modeling technology is used to create the information model of a project and to collect and coordinate information across all its representations. In Autodesk Revit, drawing sheets, 2D views, 3D views, and schedules directly represent the same building information model (BIM). In this software, the physical model is associated with an analytical model. As a result, the model created in Revit is ready to be analyzed in a compatible structural analysis software, such as Autodesk Robot Structural Analysis. Using its parametric change engine, you can modify a design at any stage of its creation. The change in the project is automatically made and represented in all its views resulting in the development of better designs along with an improved coordination. The use of Autodesk Revit provides a competitive advantage and a higher profitability to structural engineers and building industry professionals. Also, in 2023 release, it has become a more complete toolset for the structural engineer and detailer. It now has more automation for your steel connection libraries and many improvements for rebar, including adaptive placement and better visualization of physical and analytical models.

Autodesk Revit AS A BUILDING INFORMATION MODELER

The history of computer aided design and documentation dates back to the early 1980s when architects and engineers began using this technology for documenting their projects. Realizing its advantages, information sharing capabilities were developed especially to share data with other consultants. This led to the development of object-based CAD systems in the early 1990s. Before the development of these systems, objects such as structural walls, beams, columns, and slabs were stored as a non-graphical data with the assigned graphics. These systems arranged the information logically but were unable to optimize its usage in a building project. Realizing the advantages of the solid modeling tools, the mechanical and manufacturing industry professionals began using the information modeling CAD technology. This technology enabled them to extract data based on the relationship between model elements.

In 1997, a group of mechanical CAD technologists began working on a new software for building industry. The Building Information Modeling (BIM) provided an alternative approach to building design, construction, and management. This approach, however, required a suitable technology to implement so as to reap its benefits. In such a situation, the use of parametric technology with the Building Information Modeling approach was envisaged as an ideal combination. They developed a software that was suitable for creating building projects. This led to the development of Autodesk Revit.

Autodesk Revit provides powerful tools for structural design and documentation, in which a digital structural model is created using the parametric elements such as structural walls, beams, columns and so on. All building elements have inherent relationship with one another, which can be tracked, managed, and maintained by the computer.

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BASIC CONCEPTS AND PRINCIPLES

Autodesk Revit enables you to envisage and develop a structural model with actual 3D parametric structural elements. It provides a new approach to the structural design and the implementation process. It replicates the way structural engineers conceive the structure of a building. The 2D CAD platforms, such as AutoCAD, mostly use lines to represent the elements, as shown in Figure 1-1. However, in Autodesk Revit, you can create the structural model of a building project using 3D elements such as structural floors, columns, beams, and so on, as shown in Figure 1-2.

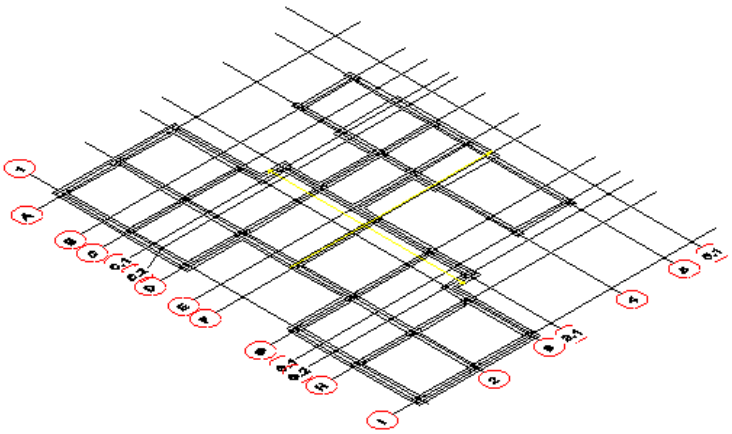

Figure 1-1 *The project created using 2D lines*

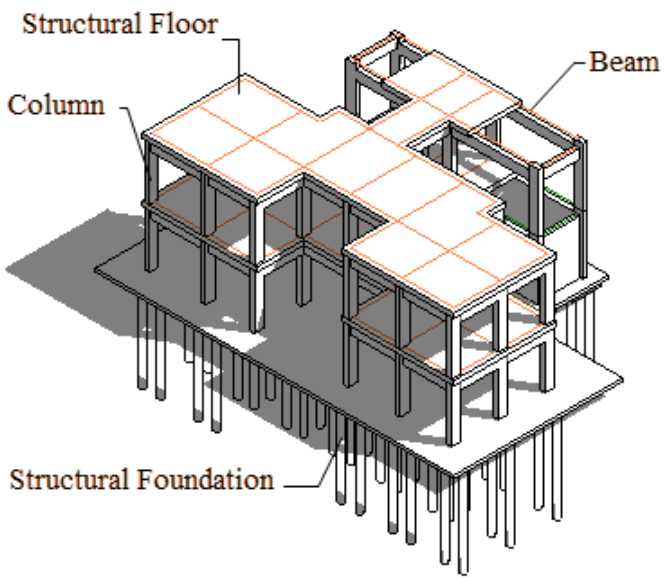

Figure 1-2 *A structural project created using parametric structural elements*

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Using these 3D elements, you can visualize the structural project with respect to its scale, volume, and proportions. This enables you to study design alternatives and develop superior quality design solutions. Autodesk Revit automates routine drafting and coordination tasks and assists in reducing errors in documentation. This in turn saves time, improves the speed of documentation, and lowers the cost for users.

Understanding the Parametric Building Modeling Technology

A project in Autodesk Revit is created using the inbuilt parametric building elements. The term 'parametric' refers to the parameters that relate to various building elements. Some relationships are made by Autodesk Revit itself and others by the user. For example, doors, which have an inherent parametric relationship with the structural walls cannot be created without first creating a host wall. A door always moves with the host wall. Similarly, floors too are parametrically linked to walls. When you move structural walls, the structural floor extents are also modified automatically. Each structural element has inbuilt bidirectional associativity with many other elements in the project.

A building information model is created using different interdependent parametric building elements such as structural walls, beams, columns, structural floors, foundations, and so on. As they are bidirectionally associated elements, any change made in one element is automatically adopted by others. The integrated building information model created contains all data for a project. You can then create project presentation views such as structural plans, sections, elevations, and so on for documentation. As you modify the model while working in certain views, Autodesk Revit's parametric change engine automatically updates other views. This capability is, therefore, the underlying concept in Autodesk Revit.

Autodesk Revit's parametric change engine enables you to modify design elements at any stage of the project development. As changes are made immediately and automatically, it saves the time and effort of coordinating them in all other associated views, which, for most projects, is an inevitable part of the design process. Autodesk Revit's capability to coordinate between various aspects of the building design provides immense flexibility in the design and development process along with an error-free documentation.

Autodesk Revit also provides a variety of in-built parametric element libraries that can be selected and used to create a building model. It also provides you with the flexibility to modify the properties of these elements or to create your own parametric elements, based on the project requirement.

Terms Used in Autodesk Revit for Structure

Before using Autodesk Revit, it is important to understand the basic terms used for creating a building model. Various terms used in Autodesk Revit for Structure such as project, level, category, family, type, and instance are described next.

Autodesk Revit Project

A project in Autodesk Revit is similar to an actual structural project. In an actual project, the entire documentation such as drawings, 3D views, specifications, schedules, cost estimates, and so on are inherently linked and read together. Similarly, in Autodesk Revit, a project not only includes the digital 3D building model but also its parametrically associated documentation.

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Thus, all components such as the building model, its standard views, structural drawings, and schedules combine together to form a complete project. A project file contains all project information such as building elements used in a project, drawing sheets, schedules, cost estimates, 3D views, renderings, and so on. A project file also stores various settings such as environment, lighting, and so on. As data is stored in the same file, so it becomes easier for Autodesk Revit to coordinate the entire database.

Levels in a Building Model

In Autodesk Revit, a building model is divided into various levels. These levels may be understood as infinite horizontal planes that act as hosts for different elements such as roof, floor, ceiling, and so on. The defined levels in a building model can, in most cases, relate to different floor levels, or stories of the building project. Each element that you create belongs to a particular level.

Subdivisions of Elements into Categories and Subcategories

Apart from building elements, Autodesk Revit project also contains other associated elements such as annotations, imported files, links, and so on. These elements have been divided into the following categories:

Model Category : Consists of various structural elements used in creating a building model such as structural walls, structural floors, foundations, beams, braces, and columns.

Annotation Category : Consists of annotations such as dimensions, text notes, tags, symbols, and so on

Datum Category : Consists of datums such as levels, grids, reference planes, and so on

View Category : Consists of interactive project views such as structural floor plans, elevations, sections, 3D views, and renderings

In addition to these four categories, other categories such as **Imported**, **Workset**, **Filter**, and **Revit Categories** can also exist if the project has imported files, enabled worksets, or linked Autodesk Revit projects, respectively.

Families in Autodesk Revit

Another powerful concept in Autodesk Revit is family. A family is described as a set of elements of the same category that can be grouped together based on certain common parameters or characteristics. Elements of the same family may have different properties, but they all have common characteristics. For example, **Concrete-Rectangular-Column** is a concrete column family, but it contains different sizes of columns. Family files have the *.rfa* extension. You can load additional building component families from the libraries provided in Autodesk Revit package.

Families are further divided into certain types. Type or family type, as it is called, is a specific size or style of a family. For example, **Concrete-Rectangular-Column: 12 x 18** is a column type in Imperial system and **M_Concrete-Rectangular-Column: 300 x 450mm** in Metric system. All uses of the same family type in a project have the same properties. Family and family types can also be used to create new families using the **Family Editor**.

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Instances are the actual usage of model elements in a building model or annotations in a drawing sheet. A family type created in a new location is identified as an instance of the family type. All instances of the same family type have the same properties. Therefore, when you modify the properties of a family type, the properties of all its instances also get modified. The family categorization of Revit elements is given below:

Model Category : Column
Family : **Concrete-Rectangular-Column** in Imperial
M_Concrete-Rectangular-Column in Metric
Family type : 12 x 18 (300 x 450mm)
Instance : Particular usage of a family type

The hierarchy of building elements in Autodesk Revit plays an important role in providing the flexibility and ease of managing a change in a building model. Figure 1-3 shows the hierarchy of categories and families in a typical Autodesk Revit project.

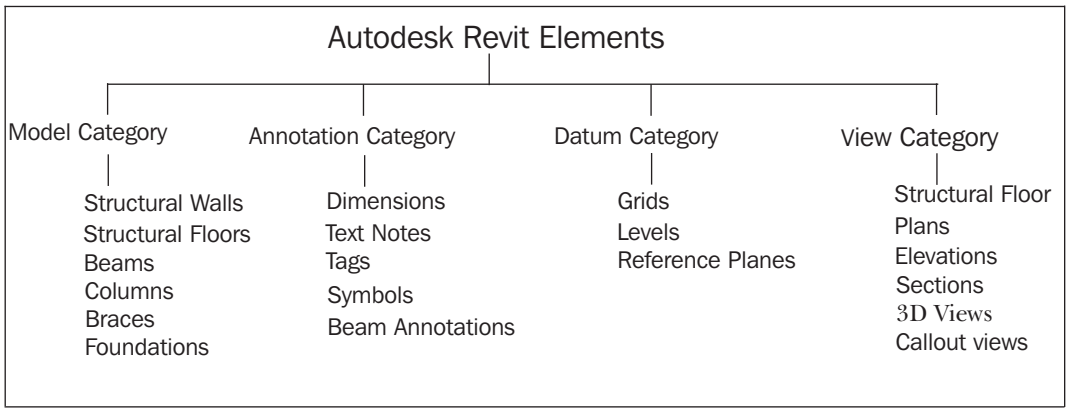

Figure 1-3 *Hierarchy of Autodesk Revit categories and families*

Creating a Structural Model Using Parametric Building Elements

Another classification of categories of elements followed in Autodesk Revit is based on their usage. Autodesk Revit uses five classes of elements: Host, component, annotation, view, and datum. Hosts are the element categories that form the basic structure of a building model and include model elements such as structural walls and floors. Components are the elements that are added to the host elements or act as stand-alone elements such as doors, windows, and foundations. Annotations are the 2D, view-specific elements that add content to the project documentation such as dimensions, tags, text notes, and so on. Views represent various orientations of a building model such as plans, elevations, sections, 3D views, and so on. Datum refers to the reference elements that assist you in creating a building model. The reference elements which include grids, levels, reference planes, and so on.

There is no specific methodology available for creating a building model in Autodesk Revit. It provides you with the flexibility of generating the building geometry based on the project requirement, design complexity, and other factors. However, the following steps describe a

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general procedure that may be followed for creating an architectural building model using the built-in parametric elements provided in Autodesk Revit.

The first step is to define the levels of the structural model based on the story height of the building and then create grids for inserting columns and foundation at the lowest level. Next, add columns, foundation slab, structural wall, and foundations in that level. You can also link the control height of the structural walls and columns to the levels. Next, create framing members and floors using the defined levels. You can add loads to the model and define load conditions and various analytical settings for the model.

After creating the structural analytical model, you will transfer it to Autodesk Robot Structural Analysis software and analyze the structural entities based on the loads applied to it. After performing the analysis and retrieving the design detail of the model, you will import the structural model from the analysis software into Autodesk Revit. Next, you will create drawing sheets with the desired views for its presentation. You can also add reinforcements to the concrete elements in the structural model. Autodesk Revit also provides tools to create rendered 3D views and walkthroughs. Figure 1-4 shows an example of a building elevation with various structural elements.

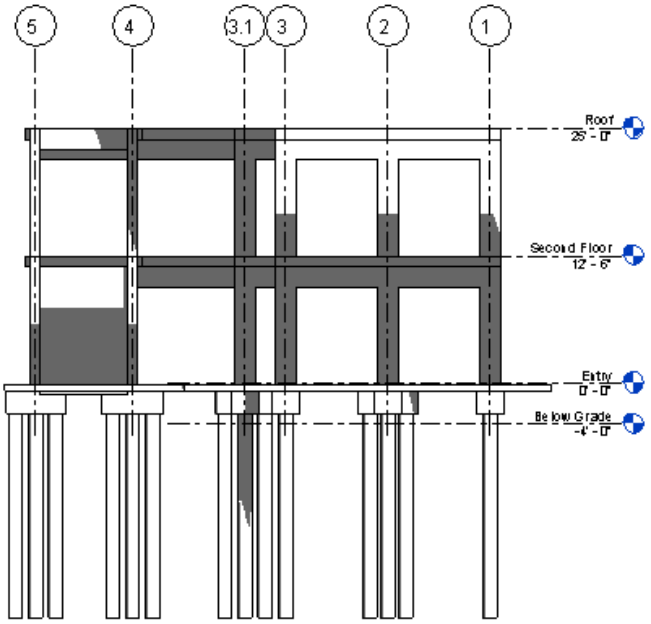

Figure 1-4 *Building section showing building elements and levels*

Visibility/Graphics Overrides, Scale, and Detail Level

Autodesk Revit enables you to control the display and graphic representation of a single element or the element category of various elements in project views by using the visibility and graphics overrides tools. You can select a model category and modify its linetype and detail level. This can also be done for various annotation category elements and imported files. These settings can be done for each project view based on its desired representation. You can also hide an

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element or an element category in a view using the **Hide in view** and **Isolate** tools. You can override the graphic representation of an element or an element category in any view using the **Visibility/ Graphics** tool.

The scale is an important concept in a Revit project. You can set the scale from the available list of standard scales such as 1/16"=1'0", 1/4"=1'0", 1"=1'0", 1/2"=1'0" (for Imperial) and 1:1, 1:2, 1:3, 1:4, 1:5, 1:10 (for Metric). As you set a scale, Autodesk Revit automatically sets the detail level that is appropriate for it. There are three detail levels provided in an Autodesk Revit project: **Coarse**, **Medium**, and **Fine**. You can also set the detail level manually for each project view. Each detail level has an associated linetype and the detail lines associated with it. The details of annotations such as dimensions, tags, and so on, are also defined by the selected scale.

Extracting Project Information

A single integrated building information is used to create and represent a building project. You can extract project information from a building model and create area schemes, schedule, and cost estimates, and then add them to the project presentation.

Autodesk Revit also enables you to export the extracted database to the industry standard Open Database Connectivity (ODBC) compliant relational database tables. The use of the building information model to extract database information eliminates the error-prone method of measuring building spaces individually.

Creating a Structural Drawing Set

After creating the building model, you can easily arrange the project views by plotting them on the drawing sheets. Drawing sheets can also be organized in a project file based on the established CAD standards followed by the firm. In this manner, the project documentation can easily be transformed from the conceptual design stage to the design development stage and finally to the construction document stage. The project view on a drawing sheet is only a graphical representation of the building information model. Therefore, any modification made in it is immediately updated in all the associated project views, thereby keeping the drawing sets updated.

Creating an Unusual Building Geometry

Autodesk Revit also helps you conceptualize a building project in terms of its volume, shape, and proportions before working with actual building elements. This is possible by using the Massing tool, which enables you to create quick 3D models of buildings and conduct volumetric and proportion study on overall masses. It also enables you to visualize and create an unusual building geometry. The same massing model can then be converted into a building model with individual parametric building elements. It provides continuity in the generation of building model right from sketch design to its development.

Flexibility of Creating Special Elements

Autodesk Revit provides a large number of in-built family types of various model elements and annotations. Each parametric element has the associated properties that can be modified based on the project requirement.

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Autodesk Revit also enables you to create the elements that are designed specifically for a particular location. The in-built family editor enables you to create new elements using family templates. This provides you with the flexibility of using in-built elements for creating your own elements. For example, using the furniture template, you can create a reception desk that is suitable for a particular location in the design.

Creating Structural Layouts

Autodesk Revit's structural tools enable you to add structural elements to a building model. An extensive in-built library of structural elements has been provided in Autodesk Revit. You can add structural columns, beams, walls, braces, and so on to the project. Thus, structural consultants can also incorporate their elements in the basic architectural building model and check for inconsistency, if any.

Working on Large Projects

In Autodesk Revit, you can work on large projects by linking different building projects together. For a large project that consists of a number of buildings, you can create individual buildings as separate projects and then link all of them into a single base file. The database recognizes the linked projects and includes them in the project representation of the base file.

For example, while working on a large educational institution campus, you can create separate project files for academic building, administration area, gymnasium, cafeteria, computer center, and so on, and then link them into the base site plan file. In this manner, large projects can be subdivided and worked upon simultaneously.

Working in Large Teams and Coordinating with Consultants

Worksets, in Autodesk Revit, enable the division of the building model into small editable set of elements. The worksets can be assigned to different teams working on the same project and then their work can easily be coordinated in the central file location. The effort required to coordinate, collaborate, and communicate the changes between various worksets is taken care of by computer. Various consultants working on a project can be assigned a workset with a set of editable elements. They can then incorporate their services and modify the associated elements.

For example, a high rise commercial building project can be divided into different worksets with independent teams working on exterior skin, interior walls, building core, toilet details, finishes, and so on. The structural consultants can be assigned the exterior skin and the core workset, in which they can incorporate structural elements. Similarly, the rest of the teams can work independently on different worksets.

STARTING Autodesk Revit 2023



You can start Autodesk Revit by double-clicking on its shortcut icon on the desktop. Alternatively, you can start Autodesk Revit 2023 from the taskbar. To do so, choose the **Start** button; a menu is displayed. Choose **Autodesk > Revit 2023**, as shown in Figure 1-5; the interface

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will be displayed, as shown in Figure 1-6. (For Windows 10)

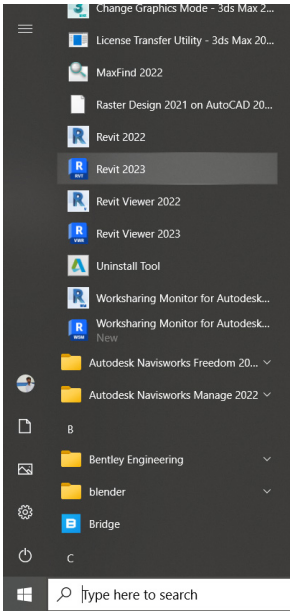

Figure 1-5 *Starting Autodesk Revit 2023 using the taskbar*

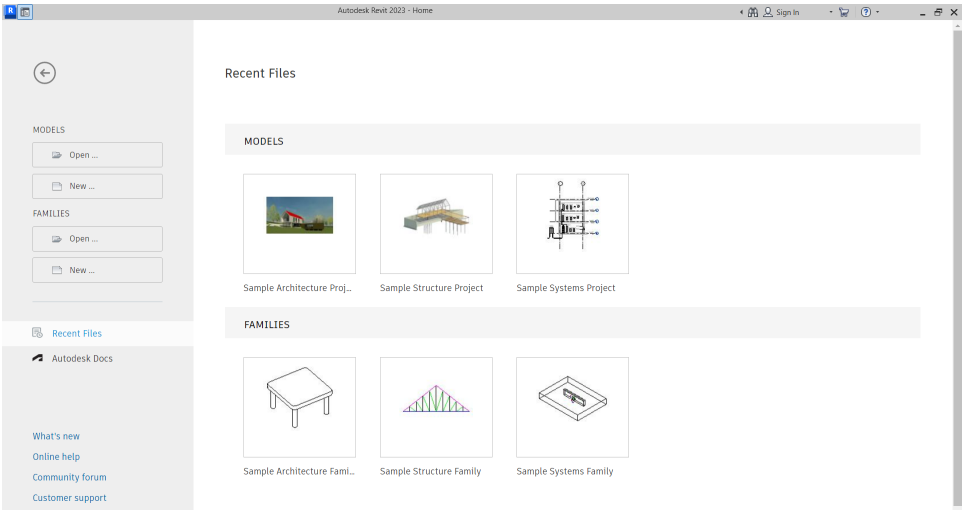

Figure 1-6 *Autodesk Revit 2023 interface*

Note

The path for starting Autodesk Revit depends on the operating system being used.

The interface screen has six sections: **MODELS**, **FAMILIES**, **Autodesk Docs**, **What's new**, **Online help**, and **Community forum**. The options in the **Models** section are used to open an existing model, a new model, and an existing template. The options in the **Families** section

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are used to open a new or an existing family. You can choose the **What's new** option to get information about the new tools and features in Revit 2023.

When you click on the **What's new** option, you are directed to the **Autodesk Revit 2023** page that enlists new and enhanced features in the Revit 2023 software. In the left hand side of the page, under the **What's new in Revit 2023** head, there are different sub-headings such as **Core features**, **Architecture features**, **Systems features(MEP)**, **Structure feature**. You can click any one of the sub-headings to display the related information on the right hand side of the page. Also, you can get more information about Revit 2023 by clicking on the corresponding heads.

In the interface screen of Revit 2023, you can click on the **Online help** option to display the **Autodesk Revit 2023** page for online help. On the right hand side of the page, you can choose the **Essential Skills Videos**, **New Features Videos**, or **User Interface Tour** option to view the videos related to basic, advance concepts, modelling, and new feature in Revit 2023. These videos and their associated information help you to learn about different features and capabilities of the software.

In the interface screen of Revit 2023, you can choose the Community forum to display the Revit Community page. The page displays different links such as **Revit Architecture Forum**, **Revit MEP Forum**, **Revit Structure Forum**, and more. On clicking on any one of the links, you will be directed to a page that will consists of various posts related to the software.

The new interface screen of Autodesk Revit 2023 has been enhanced to provide better experience for navigating through BIM 360 projects. Now, you can access your projects stored in BIM 360 directly from the interface screen of Revit 2023 by using the **Autodesk Docs** option.

To open a new project file, choose the **New** option from the **Models** section. Alternatively, choose **New > Project** from the **File** menu; the **New Project** dialog box will be displayed. In this dialog box, you can select the desired template from the **Template file** drop-down or you can browse the other template files by using the **Browse** button from the **Template File** area. When you choose the **Browse** button, the **Choose Template** dialog box will be displayed. In this dialog box, make sure the **Project** radio button is selected, and then choose the **OK** button; a new project file will open and the interface screen will be activated.

To create a new project template file, choose the **New** option from the **Projects** section; The **New Project** dialog box will be displayed. In this dialog box, select the base template from the **Template file** drop-down list and make sure that the **Project template** radio button is selected. Choose the **OK** button; a new project template file will open with the interface screen.

USER INTERFACE

In Autodesk Revit, the user interface consists of the ribbon, Drawing Area, **Properties** palette, Status Bar, and the **View Control Bar**, as shown in Figure 1-7. In Autodesk Revit, ribbon is an interface from where you can invoke tools. The ribbon, which contains task-based tabs and panels, streamlines the structural workflow and optimizes the project delivery time. In Autodesk Revit, when you select an element in the Drawing area, the ribbon displays a contextual tab that comprises of tools corresponding to the selected element. The interface of Autodesk Revit is similar to the interfaces of many other Microsoft Windows-based programs. The main parts in the Revit interface are discussed next.

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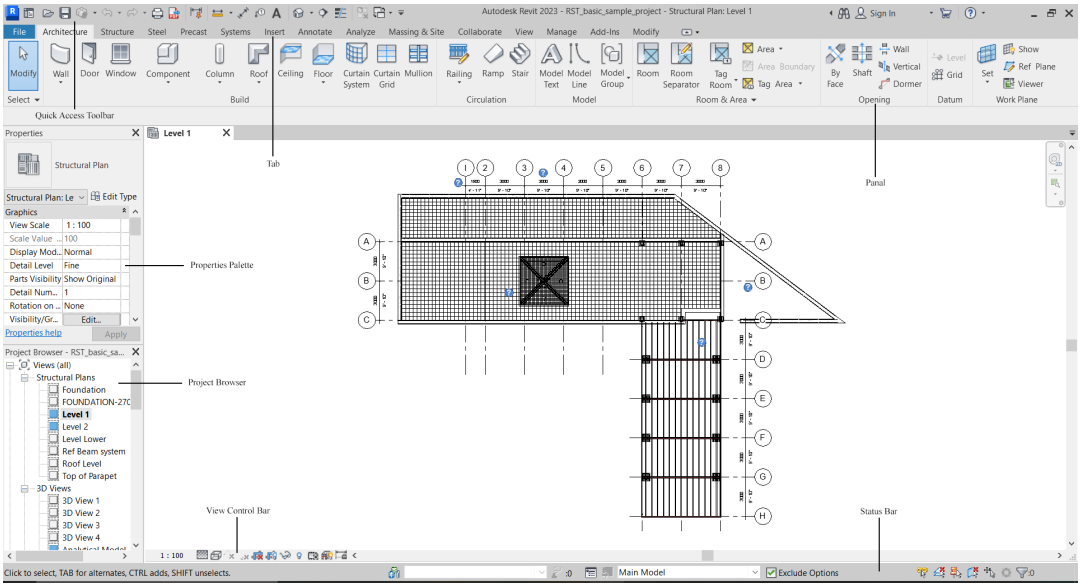

Figure 1-7 *The Autodesk Revit 2023 user interface*

Title Bar

The Title Bar is displayed on the top portion in the user interface, displays the program's logo, name of the current project, and the view opened in the viewing area.

Ribbon

The ribbon, as shown in Figure 1-8, is an interface that is used to invoke tools. When you open a file, the ribbon is displayed at the top in the screen. It comprises task-based tabs and panels, refer to Figure 1-8, which provide all the tools necessary for creating a project. The tabs and panels in the ribbon can be customized according to the need of the user. This can be done by moving the panels and changing the view states of the ribbon (the method of changing the ribbon view state is discussed later in this chapter). The ribbon contains buttons, drop-downs, panels, tabs, and tools. These buttons and the tools can be selected from the corresponding panels.



Figure 1-8 *Different components of a ribbon*

Tip

Tooltips appear when you place the cursor over any of the tool icons in the ribbon. The name of the tool appears in a box helping you in identifying the tool icon.

In the ribbon, you can move a panel and place it anywhere on the screen. To do so, press and hold the left mouse button on the panel label in the ribbon, and then drag the panel to a desired

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place on the screen. Next, use the tools of the moved panel and place the panel back in the ribbon. To do so, place the cursor on the moved panel and choose the **Return Panels to Ribbon** button from the upper right corner of this panel, as shown in Figure 1-9; the panel will return to the ribbon.

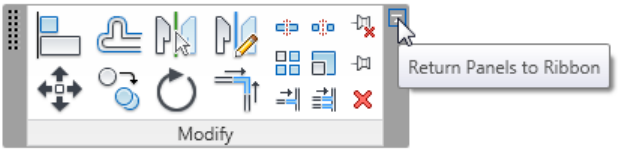

Figure 1-9 *Choosing the* ***Return Panels to Ribbon*** *button*

Changing the View States of the Ribbon

The ribbon can be displayed in three view states by selecting any of the following four options: **Minimize to Tabs**, **Minimize to Panel Titles**, **Minimize to Panel Buttons**, and **Cycle through All**. To use these options, place the cursor over the second arrow on the right of the **Modify** tab in the ribbon, refer to Figure 1-10; the arrow will be highlighted. Next, click on the down arrow; a flyout will be displayed, as shown in Figure 1-10. From this flyout, you can choose the **Minimize to Tabs** option to display the only tabs in the ribbon. If you choose the **Minimize to Panel Titles** option, the ribbon will display the titles of the panels along with the tabs. You can choose the **Minimize to Panel Buttons** option to display panels as buttons in the ribbon along with tabs.

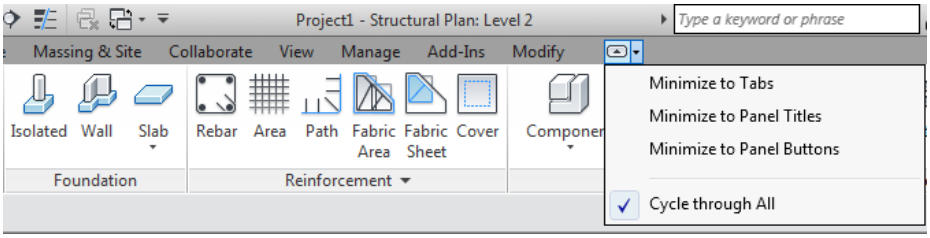

Figure 1-10 *Various options in the flyout for changing the view state of the ribbon*



Note

If the ribbon is changed to a different view state, then on placing the cursor over the first arrow on the right of the ***Modify*** *tab, the* ***Show Full Ribbon*** *tooltip will be displayed. Click on the arrow; the full ribbon will be displayed.*

The table given next describes the tabs in the ribbon and their functions.

Tab	Description
Architecture	Contains tools for creating architectural elements for a project
Structure	Contains tools for creating structural elements in a project
Steel	Contains tools for creating steel structure and their connections details in a project
Precast	Contains tools to create precast assemblies and drawings
Systems	Contains tools for creating mechanical elements in a project

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Insert	Contains tools to insert, link, and manage secondary files such as raster image files, CAD files or PDFs
Annotate	Contains tools for documenting a building model such as adding texts and dimensions
Analyze	Contains tools for energy analysis of the project
Massing & Site	Contains tools for modeling and modifying conceptual mass and site elements
Collaborate	Contains tools for collaborating the project with other team members (internal and external)
View	Contains tools used for managing and modifying the current view and also for switching views
Manage	Contains tools for specifying the project and system parameters and project settings
Add-Ins	Contains all the installed Add- Ins (Plug-Ins)
Modify	Contains tools for editing elements in the model

Contextual Tabs in the Ribbon

These tabs are displayed when you choose certain tools or select elements. They contain a set of tools or buttons that relate only to a particular tool or element.

For example, when you invoke the **Beam** tool, the **Modify | Place Beam** contextual tab is displayed. This tab has the following panels: **Select**, **Properties**, **Clipboard**, **Geometry**, **Modify**, **View**, **Measure**, **Create**, **Mode**, **Draw**, **Multiple**, and **Tag**. The **Select** panel contains the **Modify** tool. The **Properties** panel contains the **Properties** button and the **Type Properties** tool. The **Mode** panel has some necessary tools that are used to load model families or to create the model of a window in a drawing. The other panels, apart from those discussed above, contain the tools that are contextual and are used to edit elements when they are placed in a drawing or selected from a drawing for modification.

Application Frame

The application frame helps you manage projects in Autodesk Revit. It consists of the **File** menu, Quick Access Toolbar, InfoCenter, and Status Bar. These options are discussed next.

File Menu

The **File** menu contains tools that provide access to many common file actions such as **Open**, **Close**, and **Save**. To display this menu, choose **File** menu in the ribbon, refer to Figure 1-11. Alternatively, press ALT+F to display tools in the **File** menu.

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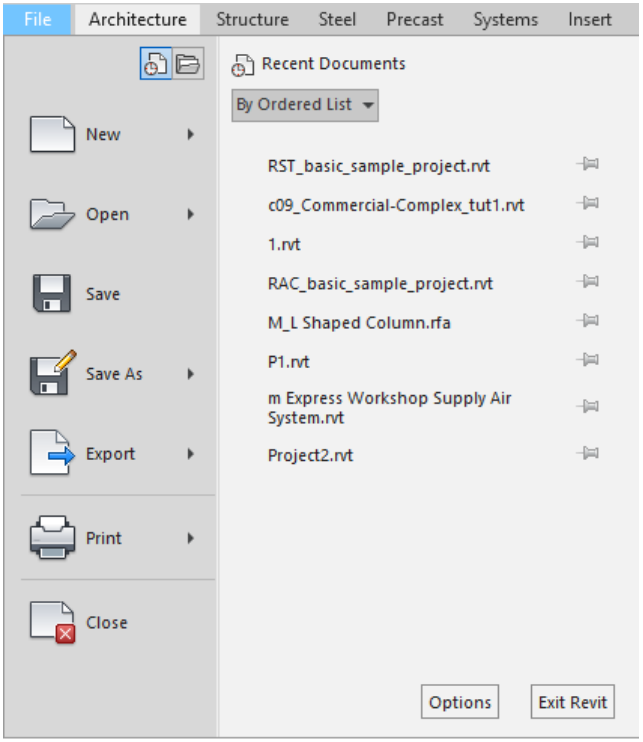

Figure 1-11 *The* ***File*** *menu*

Quick Access Toolbar

The **Quick Access Toolbar**, shown in Figure 1-12, contains the options to undo and redo changes, open and save a file, create a new file, and so on.

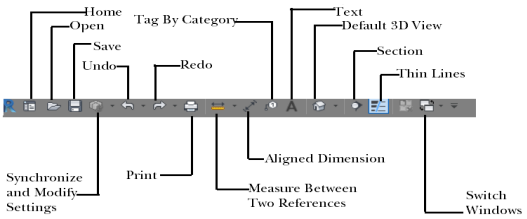

Figure 1-12 *The* ***Quick Access Toolbar***

By default, the **Quick Access Toolbar** contains the options such as **Open**, **Home**, **Save**, **Redo**, **Undo**, and so on. You can customize the display of the **Quick Access Toolbar** by adding more tools and removing the unwanted tools. To add a tool or a button from the panel of the ribbon to the **Quick Access Toolbar**, place the cursor over the button; the button will be highlighted. Next, right-click; a flyout will be displayed. Choose **Add to Quick Access Toolbar** from the flyout displayed; the highlighted button will be added to the **Quick Access Toolbar**. The **Quick Access Toolbar** can be customized to reorder the tools displayed in it. To do so, choose the down arrow next to the **Switch Windows** drop-down, refer to Figure 1-12; a flyout will be displayed.

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Choose the **Customize Quick Access Toolbar** option located at the bottom of the flyout; the **Customize Quick Access Toolbar** dialog box will be displayed. Use various options in this dialog box and choose the **OK** button; the **Customize Quick Access Toolbar** dialog box will close and the tools in the **Quick Access Toolbar** will be reordered.

InfoCenter

You can use **InfoCenter** to search for information related to Revit (Help) to display the **Subscription Center** panel for subscription services and product updates, and to display the **Favorites** panel to access saved topics. Figure 1-13 displays various tools in **InfoCenter**.



*Figure 1-13 The **InfoCenter***

Status Bar

The Status Bar is located at the bottom of the interface screen. When the cursor is placed over an element or a component, the Status Bar displays the name of the family and type of the corresponding element or components. It also displays prompts and messages to help you use the selected tools.

View Control Bar

The **View Control Bar** is located at the lower left corner of the drawing window, as shown in Figure 1-14. It can be used to access various view-related tools. The **Scale** button shows the scale of the current view. You can choose this button to display a flyout that contains standard drawing scales. From this flyout, you can then select the scale for the current view. The **Detail Level** button is used to set the detail level of a view. You can select the required detail level as **Coarse**, **Medium**, and **Fine**. Similarly, the **Visual Style** button enables you to set the display style. The options for setting the display style are: **Wireframe**, **Hidden Line**, **Shaded**, **Consistent Colors**, **Realistic**, and **Raytrace**.

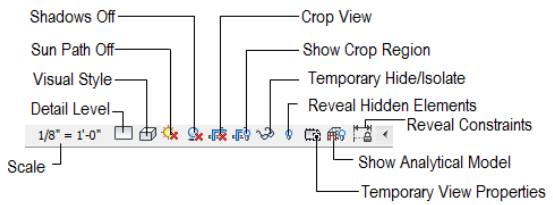

*Figure 1-14 The **View Control Bar***

Options Bar

The **Options Bar** provides information about the common parameters of a component type. It also displays options for creating or editing them. The options displayed in the **Options Bar**

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depend on the type of component being created and selected for editing. Figure 1-15 displays the options in the **Options Bar** to create a structural column.

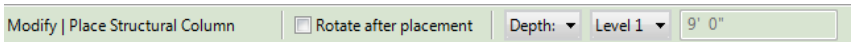

Figure 1-15 *The* ***Options Bar*** *with different options to create a structural column*

Type Selector

The **Type Selector** drop-down list is located in the **Properties** palette for the currently invoked tool. On invoking the **Beam** tool, the properties of the beam will be displayed in the **Properties** palette. In this palette, you can use the **Type Selector** drop-down list to select the required type of the beam. The content in the **Type Selector** drop-down list keep changing, depending upon the current function of the tool or the elements selected. The **Type Selector** drop-down list can also be used to specify the type of the element or component while placing an element or a component in a drawing. You can also use this drop-down list to change the type of a selected element.

Drawing Area

The Drawing Area is the actual modeling area where you can create and view the building model. It covers the major portion of the interface screen. You can draw building components in this area. The position of the pointing device is represented by the cursor. The Drawing Area also has the standard Microsoft Windows functions and buttons such as close, minimize, maximize, scroll bar, and so on. These buttons have the same function as that of the other Microsoft Windows-based programs.

PROJECT BROWSER

The **Project Browser** is located below the ribbon. It displays project views, schedules, sheets, families, and groups in a logical tree-like structure, as shown in Figure 1-16 and helps you open and manage them. To open a view, double-click on the name of the view, or drag and drop the view in the Drawing Area. You can close the **Project Browser** or dock it anywhere in the Drawing Area.

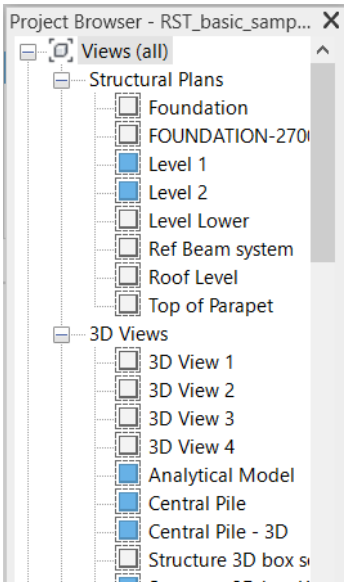

Figure 1-16 *The* ***Project Browser***



Note

If the ***Project Browser*** *is not displayed on the screen, choose the* ***View*** *tab from the ribbon and then select the* ***Project Browser*** *check box from* ***View > Windows > User Interface*** *drop-down.*

The **Project Browser** can be organized to group the views and sheets based on the project requirement. For example, while working on a large project with a number of sheets, you can organize the **Project Browser** to view and access specific sheets.

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Note

*In the **Project Browser**, you can expand or collapse the view listing by selecting the '+' or '-' sign, respectively. The current view in the drawing window is highlighted in bold letters. The default project file has a set of preloaded views.*

Keyboard Accelerators

In Autodesk Revit, accelerator keys have been assigned to some of the frequently used tools. These keys are shortcuts that you can type through the keyboard to invoke the corresponding tool. Accelerator keys corresponding to a tool appear as a tooltip when you move the cursor over the tool.



Tip

*As you become accustomed to use Autodesk Revit, you will find these **Keyboard Accelerators** quite useful because they save the effort of browsing through the menus.*

Properties Palette

The **Properties** palette, as shown in Figure 1-17, is a modeless interface, which displays the type and element properties of various elements and views in a drawing. The **Properties** palette is dockable and resizable, and it supports multiple monitor configurations. The **Properties** palette is displayed in the Revit interface by default and it shows the instance properties of an active view. When you select an element from a drawing, the **Properties** palette displays its instance properties. You can also access the type properties of the selected element from the **Properties** palette. To do so, choose the **Edit Type** button from the palette; the **Type Properties** dialog box will be displayed. In this dialog box, you can change the type properties of the selected element.

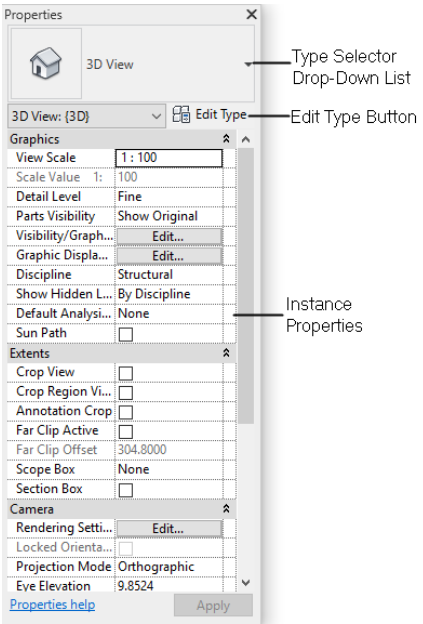

***Figure 1-17** The **Properties** palette*

In the **Properties** palette, you can assign a type to a selected element in a drawing from the **Type Selector** drop-down list. In Revit, you can toggle the display of the **Properties** palette in its interface. Choose the **Properties** button in the **Properties** panel of the **Modify** tab to hide it. Similarly, you can choose the **Properties** button to display the palette if it is not visible in the interface.

DIALOG BOXES

Some Autodesk Revit tools, when invoked, display a dialog box. A dialog box is an interface for accessing, specifying, and modifying the parameters related to that tool. For example, when you choose **Save As > Project** from the **Application Menu**, the **Save As** dialog box is displayed, as shown in Figure 1-18. A dialog box consists of various parts such as dialog label, radio buttons, text or edit boxes, check boxes, slider bars, image box, buttons, and tools, which are similar

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to other windows-based programs. Some dialog boxes contain the [**...**] button, which displays another related dialog box. There are certain buttons such as **OK**, **Cancel**, and **Help**, which appear at the bottom of most of the dialog boxes. The names of the buttons imply their respective functions. The button with a dark border is the default button.

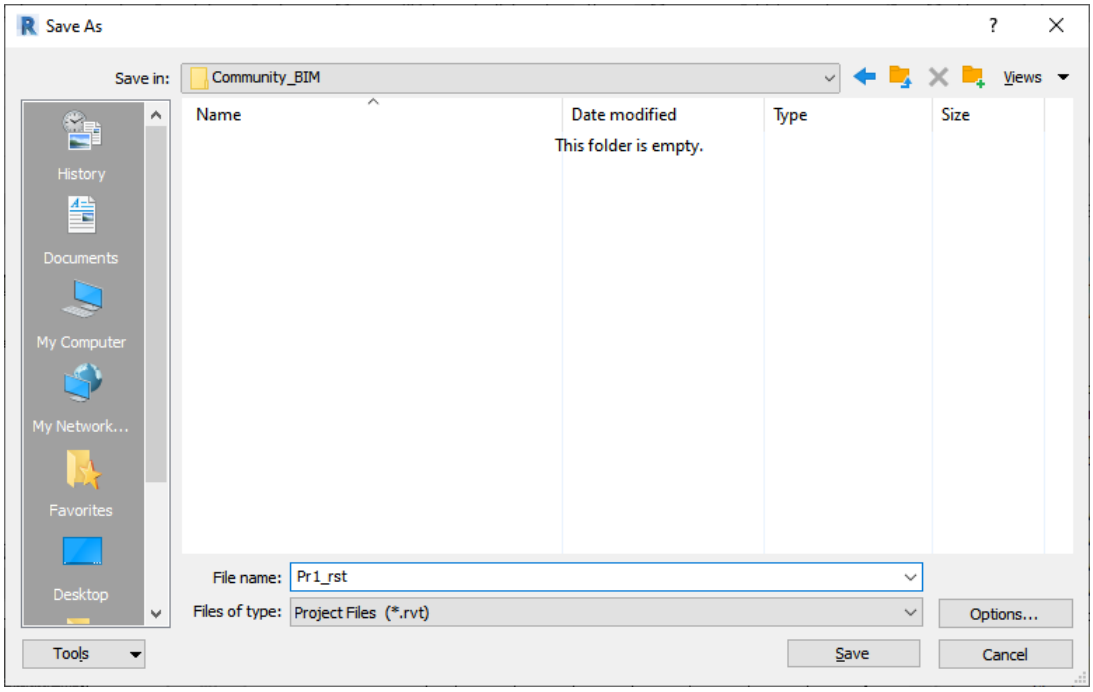

Figure 1-18 *The* ***Save As*** *dialog box*

MULTIPLE DOCUMENT ENVIRONMENT

The multiple document environment feature allows you to open more than one project at a time in a single Autodesk Revit session. This is very useful when you want to work on different projects simultaneously and make changes with reference to each other.

Sometimes, you may need to incorporate certain features from one project into the other. With the help of multiple document environment feature, you can open multiple projects and then use the **Cut**, **Copy** and **Paste** tools from the **Clipboard** panel of the **Modify (type of element)** tab to transfer the required components from one project to another. These editing tools can also be invoked by using the CTRL+C and CTRL+V keyboard shortcuts.

To access the opened projects, click on the **Switch Windows** drop-down arrow in the **Windows** panel of the **View** tab; the options for the names of different opened project files will be displayed, as shown in Figure 1-19. Like other Microsoft Windows-based programs, you can select and view the opened projects using the **Tile Views** tools from the **Windows** panel of the **View** tab. The tile views of a project is shown in Figure 1-20.

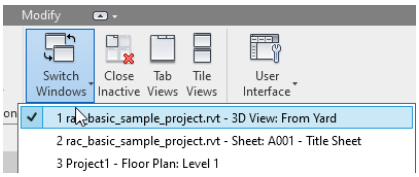

Figure 1-19 *Selecting an option from the* ***Switch Windows*** *drop-down list*

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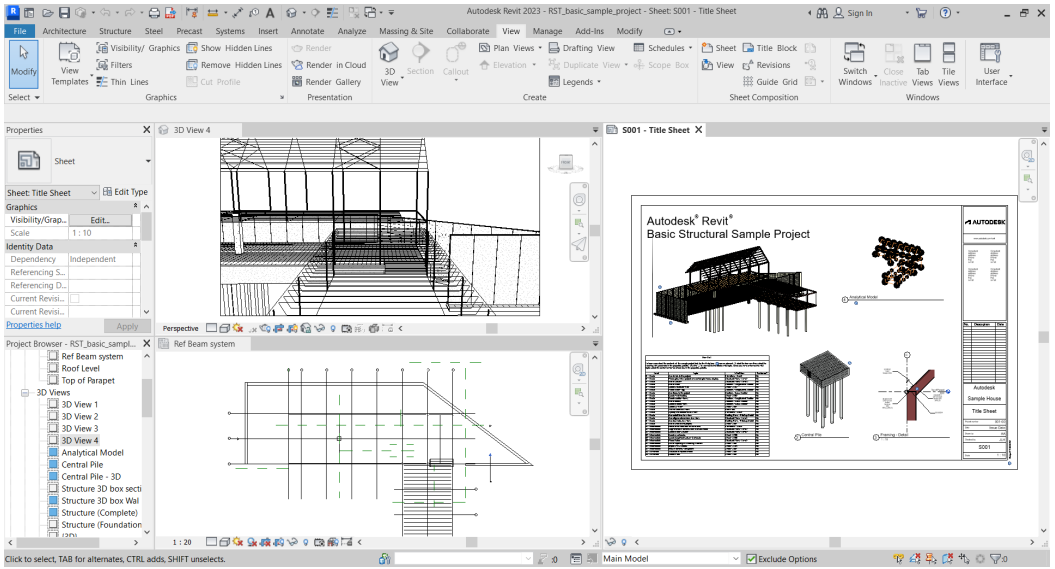

Figure 1-20 *The* ***Tile Views*** *tool for project*

INTEROPERABILITY OF Autodesk Revit

The models or geometries created in Autodesk Revit can be easily exported to AutoCAD and AutoCAD Architecture in the DWG file format. This enables structural engineers to collaborate with Architects.

One of the important aspects of the job of a structural engineer is to collaborate and share information with the rest of the design team including the architect. To facilitate this requirement, Revit follows a wide range of industry standards and supports various CAD file formats such as DWF, DGN, DWG, DGN, IFC, SKP, and SAT. For image files, it supports JPG, TIFF, BMP, PNG, AVI, PAN, IVR, and TGA file formats. Besides these, the formats that are supported by Revit include ODBC, HTML, TXT, XML, XLS, and MDB. Autodesk Revit is compatible with any CAD system hat supports the DWG, DXF, or DGN file format. Revit can import the models and geometries as ACIS solids. This enables engineers to import models from AutoCAD Architecture and AutoCAD MEP (Mechanical, Electrical, and Plumbing) software and to link and import 3D information to Revit. This feature makes Autodesk Revit 2023 an efficient, user-friendly, and compatible software.

BUILDING INFORMATION MODELING AND Autodesk Revit

Building Information Modeling (BIM) is defined as a design technology that involves the creation and use of coordinated, internally consistent, and computable information about a building project in design and construction.

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Using BIM, you can demonstrate the entire life cycle of a building project starting from the process of construction, facility operation, and information about quantities and shared properties of elements. BIM enables the circulation of virtual information model from the design team to contractors and then to the owner, thereby adding changes and their knowledge to update the model at each stage of transfer. The ability to keep information up-to-date and make it available in an integrated digital environment enables the architects, owners, builders, and engineers to have clear vision of the project before the commencement of actual construction. It also enables them to make better and faster decisions to improve the quality and profitability of projects. Autodesk Revit is a specially designed platform based on BIM.

In Revit, the analytical and physical representations of a structural model are created simultaneously. These representations are just different views of a computable building model that contains necessary information for a third-party analysis application. Revit provides a common modeling interface for third-party analysis applications. You can use Revit API to move data directly from the Revit building information model to the analysis software. You can further bring back the analysis while keeping the analysis, design, and documentation synchronized.

Revit's parametric model represents a building as an integrated database of coordinated information. In Revit, change anywhere is change everywhere. A change made in your project at any stage is reflected in the entire project, and also, due to the parametric behavior of elements, the project is updated automatically. Also, the integration of Revit with the available in-built commercial tools such as solar studies, material takeoffs, and so on greatly simplifies the project design and reduces the time consumed by these analyses, thereby enabling faster decision making.

WORKSHARING USING REVIT SERVER

Worksharing is a method of distributing work among people involved in a project, and accomplishing it within the stipulated period of time. In worksharing, each person involved in the project is assigned a task that has to be accomplished through proper planning and by coordinating with the other members of the team.

In a large scale building project, worksharing helps in finishing a project in time and meeting the quality requirements that are set during the process. Generally, in a large scale building project, worksharing is based on the specialization of work. The professionals such as structural engineers, architects, interior architects, and MEP engineers are involved in their respective fields to accomplish the project. So, the distribution of work at the primary stage is made on the basis of the area of specialization. Each professional has his own set of work to perform for the accomplishment of the project. Therefore, worksharing is an important process that is required to be implemented efficiently to complete the project in time.

In Autodesk Revit, you can apply server-based worksharing with the help of Revit Server, which is a server application. Revit Server uses a central server and multiple local servers for collaborating across a Wide Area Network (WAN). The central server hosts the central model of a workshared project and remains accessible to all team members over the Wide Area Network. Similarly, the local server is accessible to all team members in a Local Area Network (LAN). The local server hosts a local updated copy of the central model. In the Worksharing environment, the team

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members are not aware of the local server as it is transparent in their daily operations. Refer to Figure 1-21 for the network model of Revit Server.

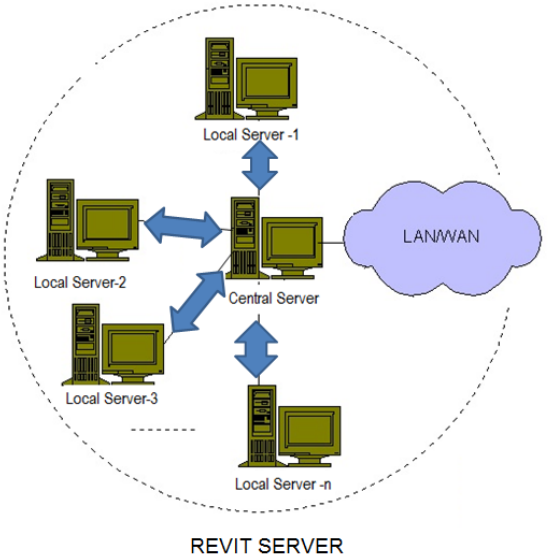

Figure 1-21 *The Network Model of Revit Server*

In Worksharing environment, a team member starts working on the local model of the central model. The local model will be saved in the computer of the team member. As the team member works, the local server requests updated information from the central model on the central server, using available network capacity to transfer the data over the WAN. The updated version of the model is stored on the local server, so the updates are readily available when a team member requests them.

AUTODESK CONSTRUCTION CLOUD

Autodesk Construction Cloud™ is used as a cloud-based construction management and collaboration solution developed by Autodesk. Autodesk Construction Cloud solution connects building data, project work flows, and project teams throughout the entire building life cycle, from design to operations. Autodesk Construction Cloud is built on an integrated platform and common data environment that will empower general contractors, specialty trades, designers and owners to drive better business outcomes. Using the Autodesk Construction Cloud solution, project teams will now have a comprehensive construction management platform in which all data will be located centrally. As such, it will simplify collaboration, predict project changes, and will provide guidance that will be driven by data for improvement of the organization. The Autodesk Construction Cloud offers three main products namely Autodesk Build, Autodesk Quantity, and Autodesk BIM Collaborate. As part of the unified Autodesk Construction Cloud, every product is reinforced by Autodesk Docs, Insights, and Administration.

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Autodesk Docs cloud platform supports the common data environment for every product of Autodesk Construction Cloud. It provides the users with uninterrupted navigation of data across the project teams and throughout the project workflow. Autodesk Docs is a single, cloud-based platform for streamlining document management in a project by storing and managing all project documents and data from design through construction in a single platform.

Insights platform is used to deliver analytical report from the data collected and analyzed from the project. It is also used to export that data to the user with the application of artificial intelligence to identify and mitigate risk.

Administration platform is used for administration of data in a project for better practices.

LINKING ANALYTICAL MODEL FOR ANALYSIS

In Autodesk Revit, the physical model represents the physical layout that consists of structural walls, beams, columns, footings, and so on. The analytical model is created along with the physical model. The analytical model is the engineering description of a structural physical model.

The following elements have analytical model associated with them: Structural Columns, Structural Framing elements (such as beams and braces), Structural Floors, Structural Footings, and Structural Walls. The analytical model is a 3D model that is used for structural analysis. In this model, you can add loads and material properties that are required for analysis. To analyze the analytical model, transfer it into a third-party analysis software. You can link the analytical model via application programming interface (API) to several leading industry applications for building analysis, such as ADAPT-Builder, RISA 3D, Fastrack, ROBOT Millennium, Sofistik, and others. After the analysis has been performed, the results of the analysis are returned to the building model (physical and analytical) in Revit. The results that are returned to Revit, dynamically update the building model and the documentation associated with it.

Autodesk Revit HELP

Autodesk Revit 2023 helps you to easily understand the tools and methods used in a project. In Autodesk Revit 2023, you can access online help documentation as well as local (offline) help documentation.

To access the help feature, click on the **Help** down arrow on the right of the **InfoCenter**; a flyout with various help options will be displayed. The options to access the help are discussed next.

Using the Revit 2023 Help

To access the local Revit 2023 help, choose the **Help** tool from **InfoCenter**; the **Autodesk Revit 2023** page will be displayed, as shown in Figure 1-22. You can also display the **Autodesk Revit 2023** page by pressing the F1 key. In this page, different areas such as **Learn about Revit**, **Resources**, and others are displayed. You can click on the required link from these areas to get the related information. In the **Learn about Revit** area, various help options related to Autodesk Revit are available. You can click on the required option to display the help page corresponding

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to the option. The **Resources** area contains various learning resources. You can click on the desired option in this area to get the information related to it.

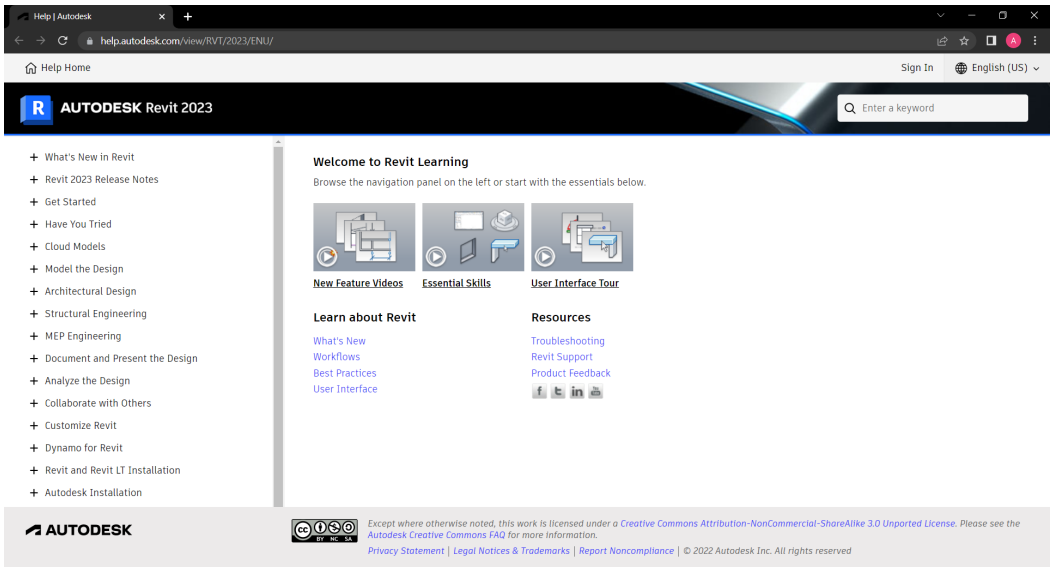

Figure 1-22 *The local* ***Revit Help*** *page*

Self-Evaluation Test

Answer the following questions and then compare them to those given at the end of this chapter:

1. You cannot add template file under the **Projects** head. (T/F)

2. You can create analytical model in Revit. (T/F)

3. Worksharing method is used only to hide elements in Revit. (T/F)

4. You can work on four detail levels in Revit. (T/F)

5. Elements of the same family may have different properties. (T/F)

Answers to Self-Evaluation Test

1. T, **2.** T, **3.** F, **4.** F, **5.** T

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