Chapter 1

Building Information Modeling

Before you start a design, you need to understand how Revit® Structure manages information.

Each building project contains a complete description of the building model and all of the information needed to represent it in both 2D and 3D views, and in schedules. This information is stored in a single database. All views of your building model, whether plan, section, sheet, or schedule, use the same database.

Bidirectional associativity is the ability of the building modeler to coordinate changes made in any view back to the database and out to all other views. This method of working is known as building information modeling.

Objective

After completing this chapter, you will be able to:

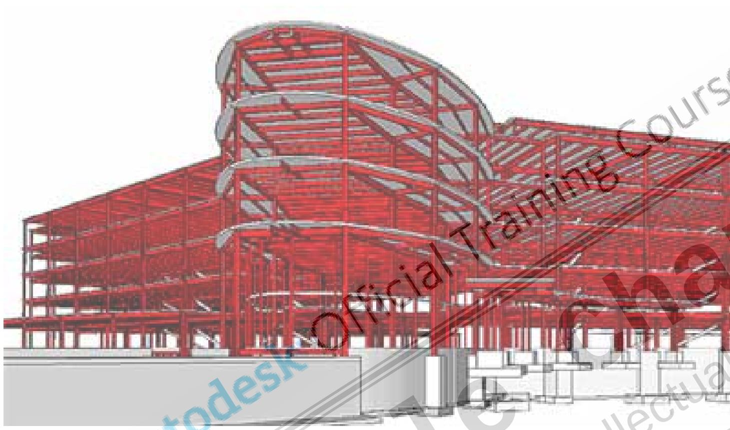
- Describe building information modeling.

Lesson: Building Information Modeling

Overview

This lesson describes building information modeling.

Applying building information modeling results in better drawings, shorter timelines, and improved productivity. It also helps the professionals in the building industry to design, construct, and operate buildings at a lower cost.



Objectives

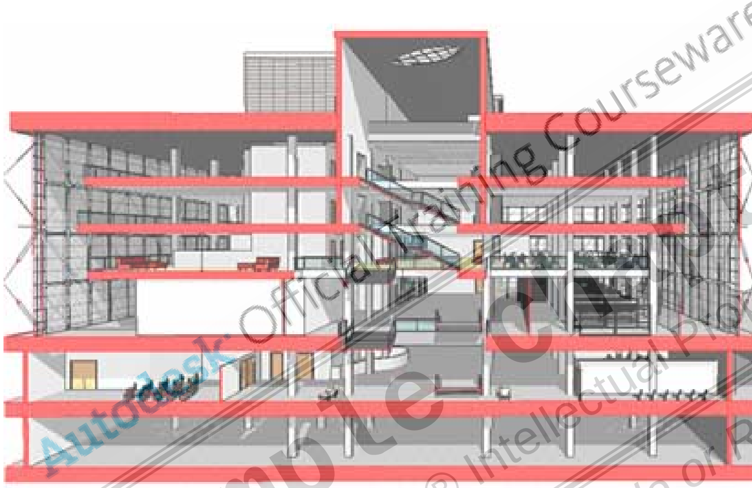
After completing this lesson, you will be able to:

- Describe building information modeling.
- Describe bidirectional associativity.

About Building Information Modeling

The building industry traditionally illustrated structural projects with manually created drawings. Information was added to these illustrations by using notes and specifications. With the advent of CAD technology, this process was automated. However, the output of manual drafting, graphics CAD systems, and object-oriented CAD systems remained the same: a graphic abstraction of an intended structural design.

The development of building information modeling methodology has turned this relationship around. The software applications that use this methodology capture information about a building and then present the information as 2D and 3D illustrations, schedules, or in any other required format.



Definition of Building Information Modeling

Building information modeling is a building design and documentation methodology. It enables you to create and manage information about a structural project. The information about the structural project is stored in a single database, which ensures that the information is consistent and up-to-date.

Building information modeling is used for the coordination of design information across all representations of a building project.

> The 3D model views, 2D drawing sheets, sections and plans, informational schedules, and take-offs are coordinated because they are all elements of the same underlying structural model.

Revit Structure and Building Information Modeling

Traditional drafting and CAD software represent the geometry of a design by using stylized symbols from designated views. Some examples of these views are plans, elevations, and sections. These views are essentially independent of one another; therefore, the changes that you make to a design in one view are not automatically displayed in other views.

A building modeler software application represents the design as a series of intelligent objects and elements such as walls, windows, and views. These objects and elements have parametric attributes. The information about these objects and elements is stored in a common project database. You can extract any number of different views of the data from this database to produce plans, elevations, sections, and schedules, as required, for construction documentation.

The Revit Structure platform is a structural design and documentation system that supports the design, structural drawings, and schedules required for a structural project. In a structural model created with Revit Structure, every drawing sheet, 2D and 3D view, and schedule is a representation of the information stored in a single underlying structural model database.

Database Information Tailored to the User

In building information modeler software, the building information is stored in a digital database instead of in a presentation format such as a drawing file or a spreadsheet. The building information modeler presents information from the database for editing and review in display formats that are appropriate for and familiar to the user. Some examples of these display formats are a 2D elevation or a 3D rendering.

Managing Change with Building Information Modeling

Building information modeling solutions manage iterative changes in a structural model throughout the design, construction, and operation phases. A change to any part of the database is replicated in all associated parts.

Maintaining an internally consistent representation of the building as a database improves drawing coordination and reduces the number of errors in the documents. You can invest the time that you would otherwise spend manually checking and coordinating documents in making the structural project better. As a result, the building documents are of higher quality, and the costs of changes and coordination are also reduced.

Capturing and Reusing Information

Building information modeling solutions capture and preserve information for reuse by additional industry-specific applications. Data is captured once, as close as possible to its point of origin, and stored so that it is available and can be presented whenever required. For example, consider personal financial management software that captures information from your checkbook register as you write checks and make deposits. It stores and manages that information for a variety of purposes, such as to prepare your income tax return and to create a statement of your net worth. Building information modeling reuses data in a similar manner.

Improved Quality

You can evaluate and make changes to a structural project at any time during the design or documentation process without burdening the design team with difficult and time-consuming coordination tasks. Manual coordination and checks are minimized, and the design team has more time to design and solve structural problems.

Greater Productivity

You can concurrently design and document a building. Design thinking is captured at the point of creation and is embedded in the documentation as the work progresses. All deliverables for the design team, such as schedules, color-filled diagrams, and drawings, are created dynamically while work is being done on the design. When you make a change, the consequences of that change are reflected throughout the project. This enables the design team to deliver better work faster, producing key project deliverables, such as visualizations and regulatory approval documents, in less time and with less effort.

Lower Cost

Design teams can accomplish more with fewer people. A smaller design team means lower costs and fewer chances for miscommunication. A computer coordinates the documents; therefore, it costs less to coordinate the changes in construction administration.

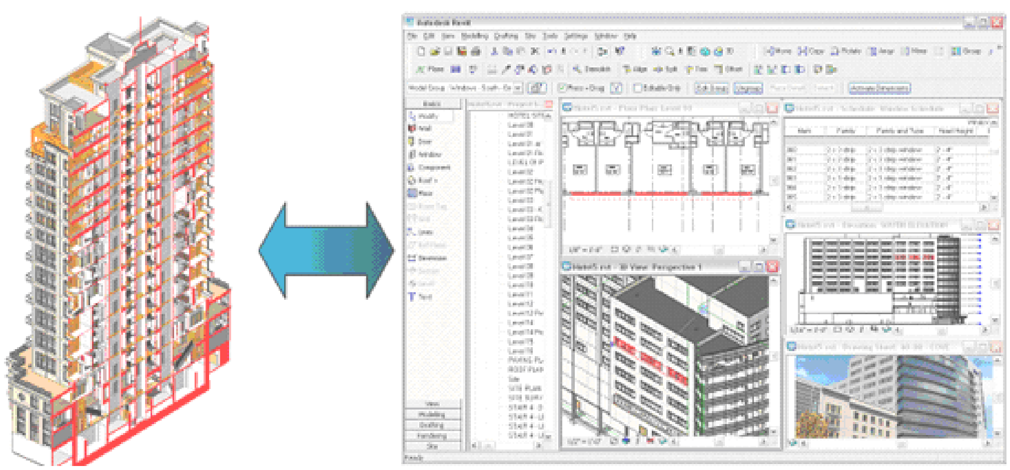
Changes that are made late in the design process to reduce construction costs can be difficult, inefficient, and expensive. With building information modeling, cost information is available early in the design phase and such changes are less likely. In construction, less time and money is spent in process and administration because the document quality and construction planning are better.

Example of Building Information Modeling

During the design of a building, if there is any change in the load conditions on a floor area, you need to modify the design parameters of the relevant beams. The modifications can include an increase in the depth of the beam and a change in its profile. The change in the profile of the beam results in a change in the geometric parameters of that beam in a 3D view. This change is also reflected in plan and section views. Therefore, building information modeling ensures an effective interaction between the design and its representation.

About Bidirectional Associativity

A key feature of Revit Structure is bidirectional associativity, which ensures that changes to any part of the design are immediately reflected in all the associated parts.



Definition of Bidirectional Associativity

Bidirectional associativity is the ability of the building information modeler to coordinate the changes made in any view with the database and other views. Bidirectional associativity is automatically applied to every component, view, and annotation. For example, a change in the height of a floor is reflected in all other elements such as walls, columns, stairs, and ramps associated with that floor.

Definition of Parametric Relationships

The term parametric refers to the relationships between the elements of a structural model. These relationships enable the software to coordinate and manage the changes made to the structural model. The relationships are created either automatically by the software or defined by the user. The characteristics that define these relationships are called parameters; therefore, the operation of the software is called parametric. It is these parametric relationships that deliver fundamental coordination and productivity benefits provided by the building information modeling methodology.

Updating the Database

A fundamental characteristic of a building information modeling software is the ability to coordinate changes and maintain consistency. You do not have to intervene to update drawings or links. When you change something, the bidirectional associativity feature of the software immediately determines the elements that are affected by the change and replicates that change in other affected elements.

When you work in drawing and schedule views, the software collects information about the building project and coordinates this information across all other representations of the project. The parametric change engine automatically coordinates the changes that you make to different elements such as model views, drawing sheets, schedules, sections, or plans.

Examples of Bidirectional Associativity

- You attach a wall to a roof. This design intent is captured in the wall and roof components. You now change the pitch of the roof above the wall. The geometry of the wall is instantly modified to reflect the change.
- You sketch a rough layout of gridlines, and then enter the dimension values to refine the design.
- As you make changes to parametric design elements, they are reflected in all the appropriate directions.
- If you edit a dimension, you change the underlying geometry of the object associated with that dimension.

Examples of Parametric Relationships

- You specify that a vertical brace ends at a specified distance from the end of a beam. If you move the end of the beam, the brace retains its relationship with the endpoint of the beam.
- You have equally spaced members of a beam system across a floor span. If the floor span changes, the spacing between the beams changes to maintain the equal spacing relationship.
- You have joined the edge of a floor to an exterior wall. When you move the exterior wall, the floor remains connected.

Chapter Summary

In this chapter, you learned how to use building information modeling and bidirectional associativity to create projects.

Having completed this chapter, you can:

- Describe building information modeling.