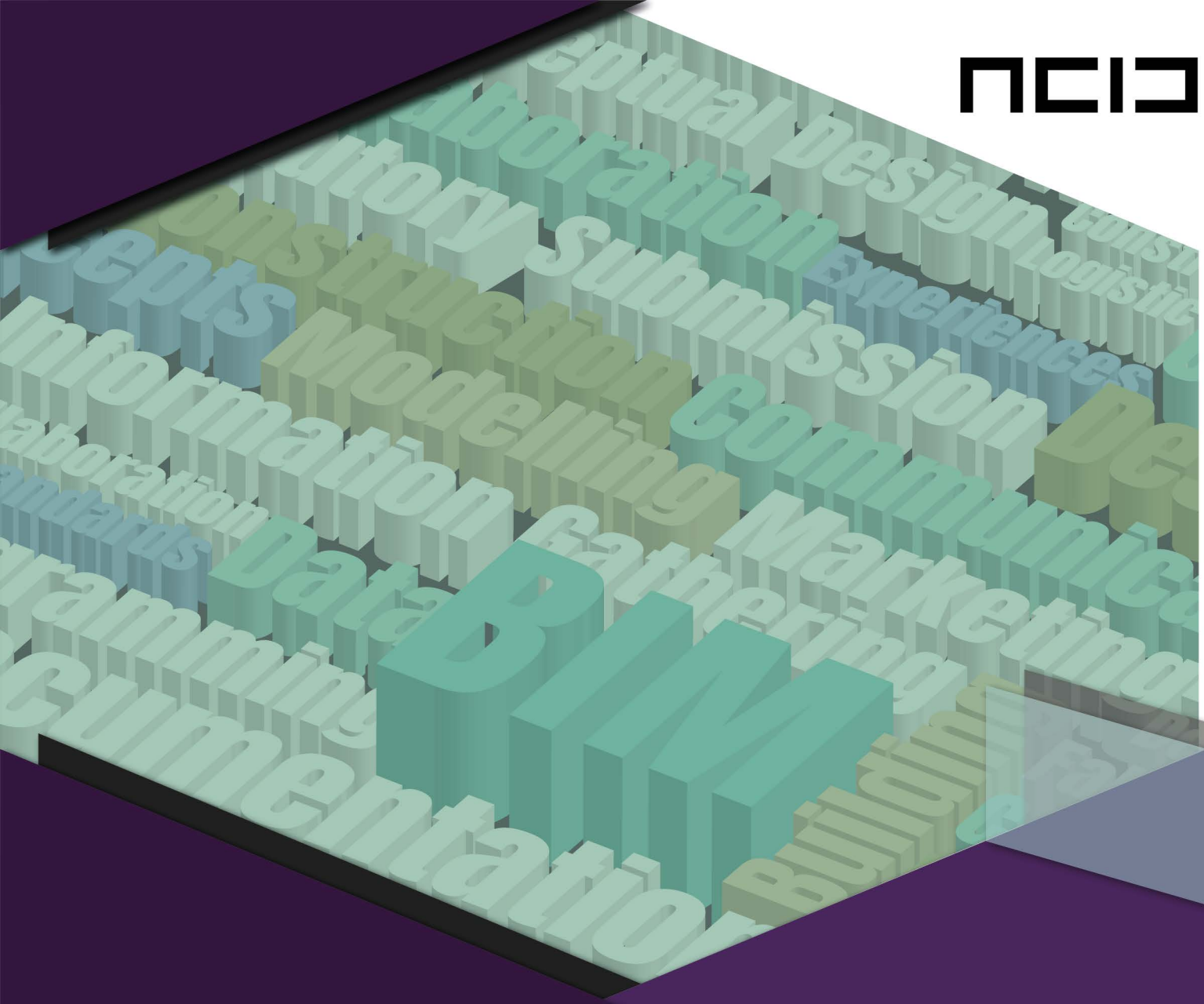


BUILDING INFORMATION MODELLING

Training Materials

CEI, CEII - MEP (Revit)

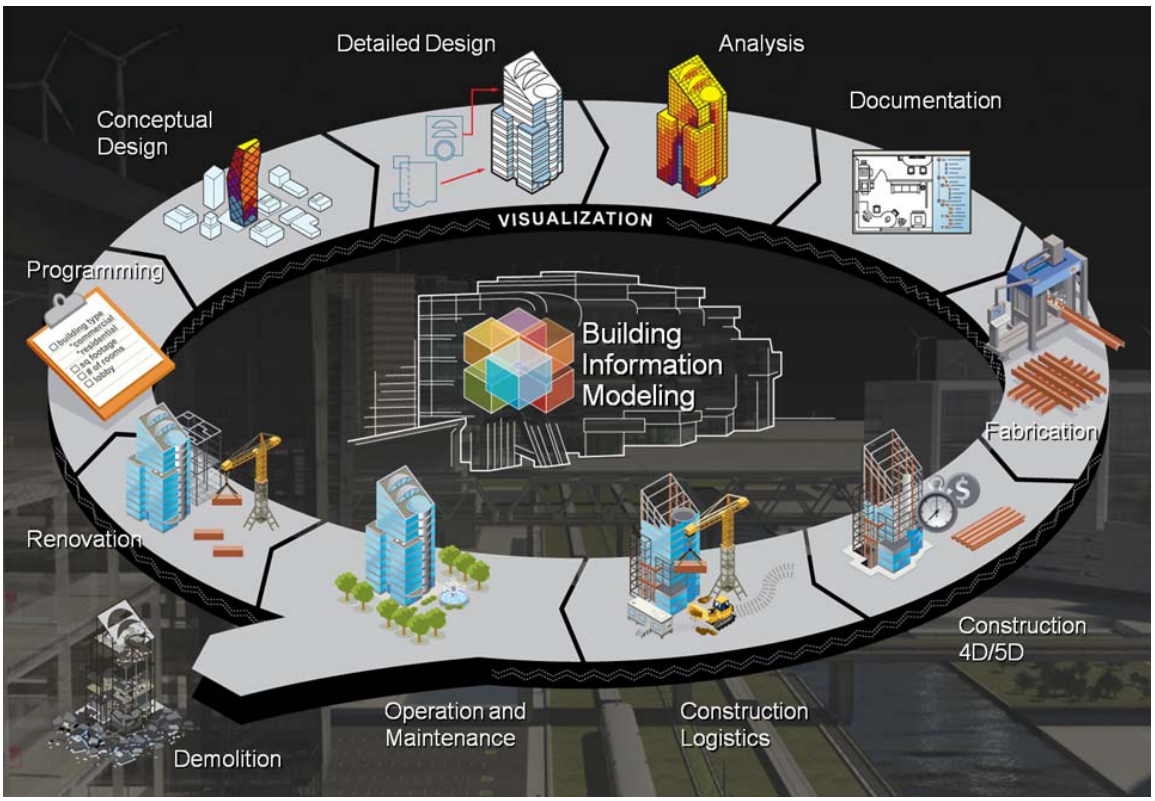
Advanced Construction Information Development Ltd.

Table of Contents

CHAPTER 1. INTRODUCTION OF BIM

1.1 WHAT IS BUILDING INFORMATION MODELING (BIM)?

Building Information Modeling (BIM) is an information-rich, model-centric process with the power to transform project delivery and add value across the lifecycle of infrastructure assets.

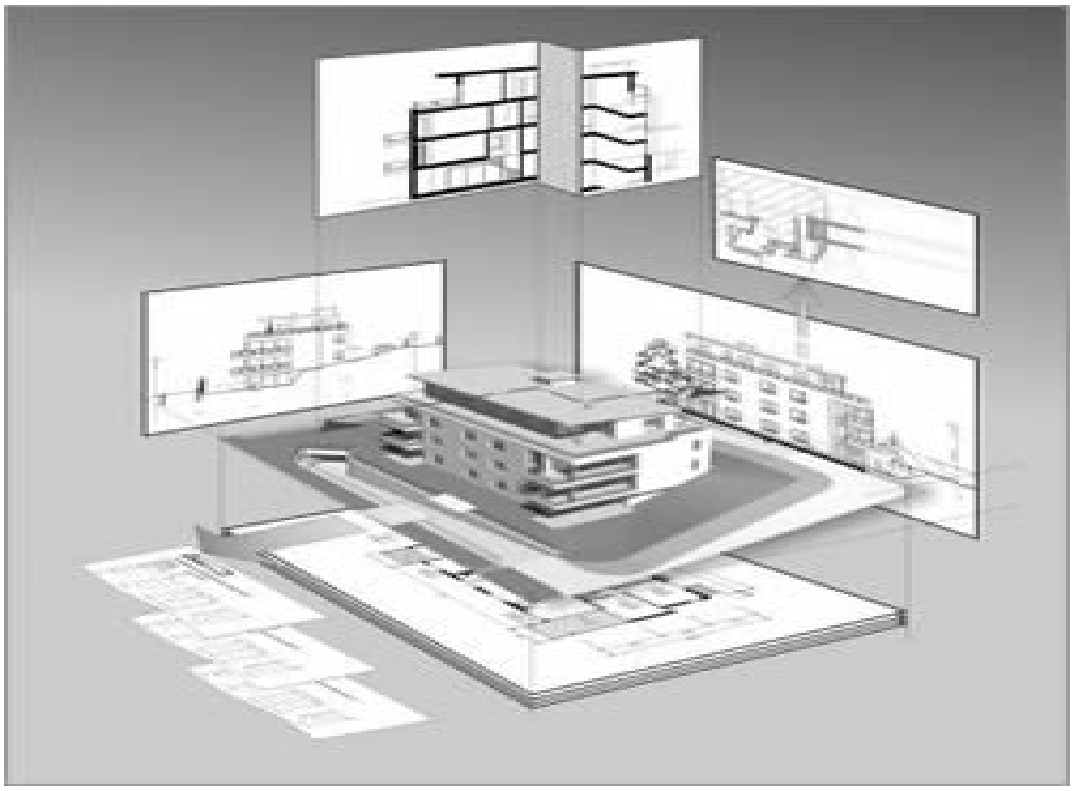


As BIM is adopted by more and more companies in the construction industry, its usefulness has expanded beyond the original design phase activities. This course positions BIM in the context of all phases of construction illustrating how to maximize BIM as a tool for the entire construction team. We will see how BIM fits into the construction workflow. It introduces the BIM philosophy in design, bidding, construction, commissioning, delivery, and as-built stages of construction.

Use of BIM goes beyond the planning and design phase of the project, extending throughout the whole building life cycle, supporting processes including cost management, construction management, project management, facility operation and demolition.

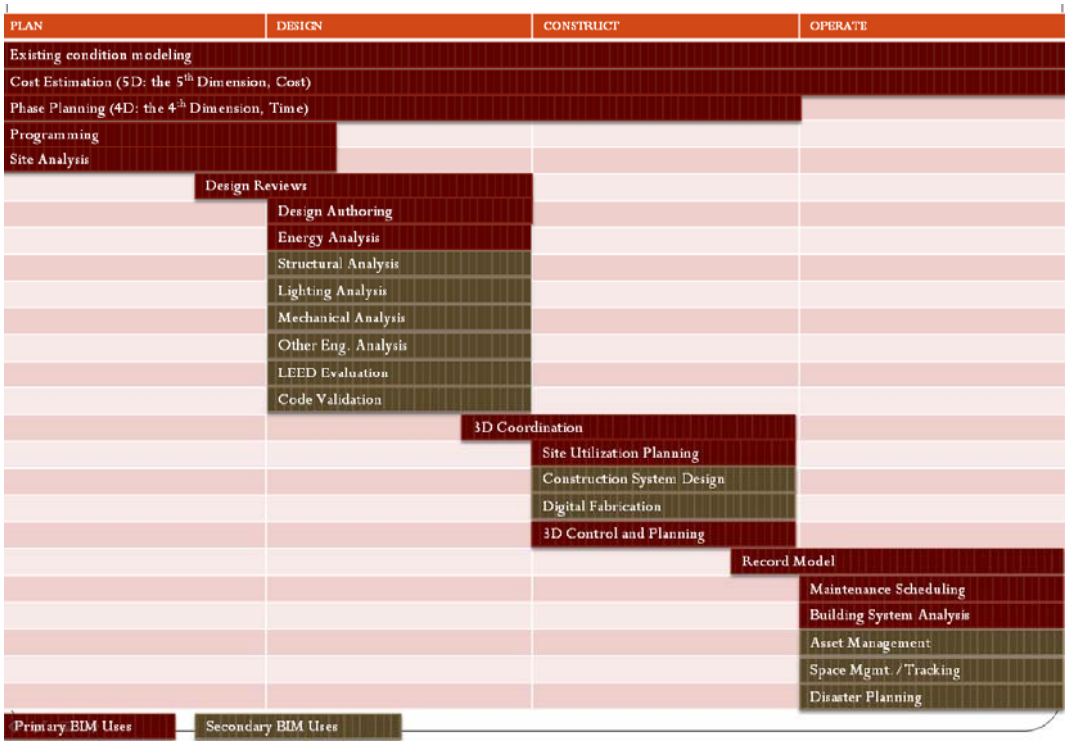
In traditional architectural design and documentation procedures, drawings are the result of carefully reasoned thought and design. Whether we are an architect, an interior designer or a draftsman, we spend a lot of our time looking at plans, sections, and elevations. A process of draw, erase, and redraw eventually leads to the desired result, which then must be replicated in all appropriate drawings, like sections and elevations. Each drawing conveys only a small abstracted part of the whole and can easily get out of sync.

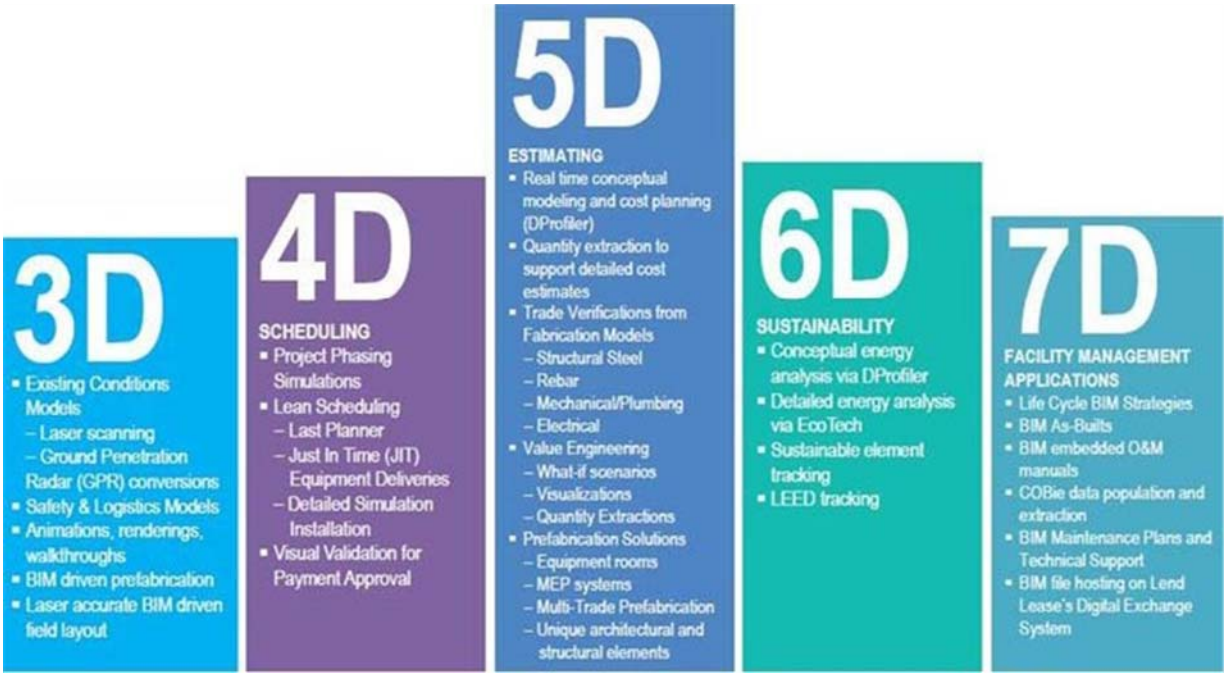
Revit is one of common used BIM system in AEC field. In contrast, the BIM/Revit workflow, all modifications are performed directly in the model, in any view that is convenient to the task at hand. Revit views are live representations of the model displayed through the prism of conventional architectural drawing types like plans, sections, and elevations. Work that we do and plan is immediately reflected in elevation section and vice versa. Revit makes it easy to keep all our changes coordinated with a firsthand look at what it is one of the most fundamental benefits of building information modeling, the fully coordinated building model. As shown in below figure, we can here different 3D views and a floor plan, an elevation, and even a schedule.



1.2 BIM APPLICATIONS

The BIM uses throughout the planning, designing, construction and operation stages of building life cycle.





BIM is not a 3D model

Basic Elements

1st D (data)

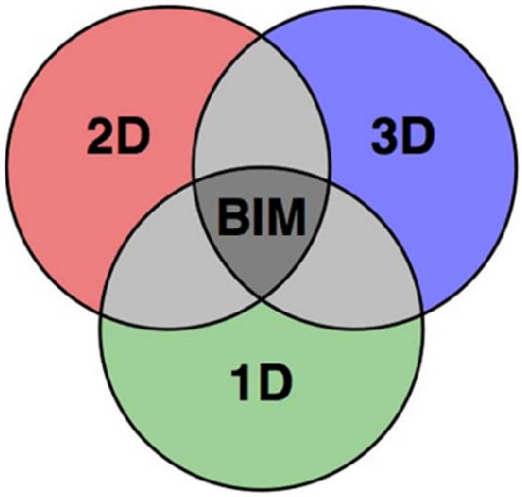
– The text, the equation, the parametric, the hyperlink

2nd D (drawing)

– Circles, Lines to represent the conceptual / relationship between difference components

3rd D (models)

– From subtractive to additive modelling to digital



The models created for BIM are not just 3D geometry; they are data-rich objects which are:

Intelligent

Parametric engines help define relationships between objects and keep changes consistent and coordinated.

Visual

Enable better analysis, simulation and communication

Putting big data in context

BIM helps to collect, analyze, and aggregate the huge amounts of data necessary to connect designs to the context of the surrounding environment.

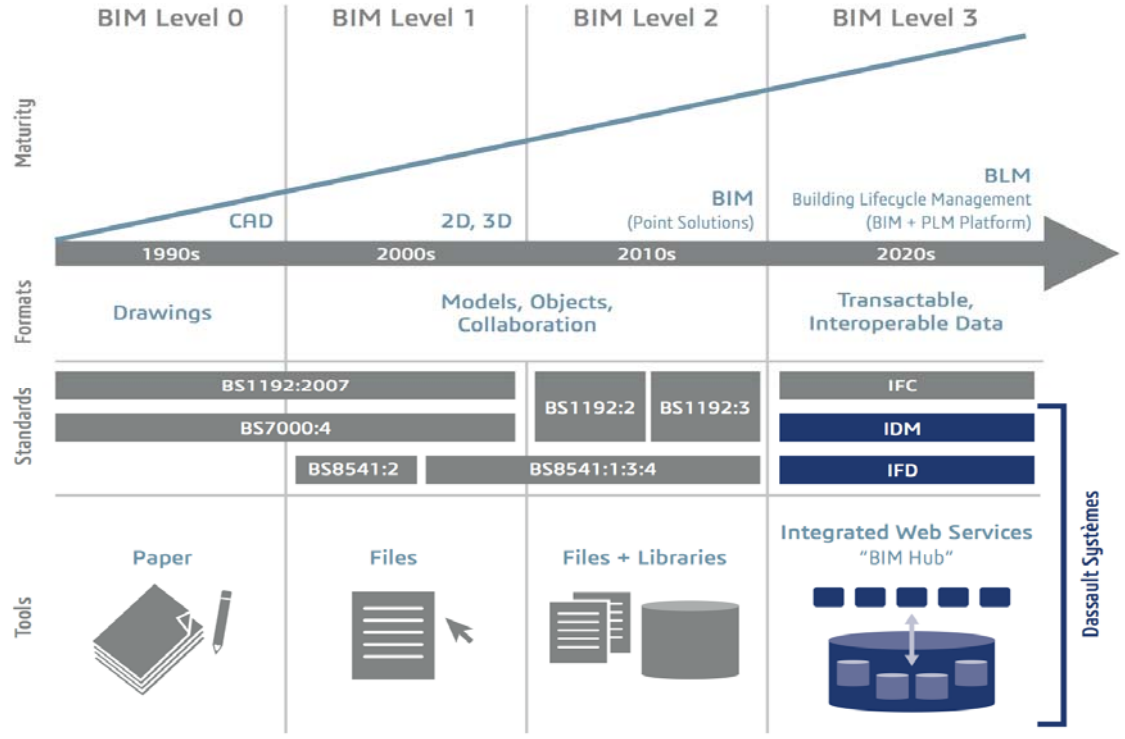
Collaboration

The AEC industry is moving toward integration of disciplines. The collaborative mode will become a standard approach. Only advanced data-sharing technology will enable effective communication.

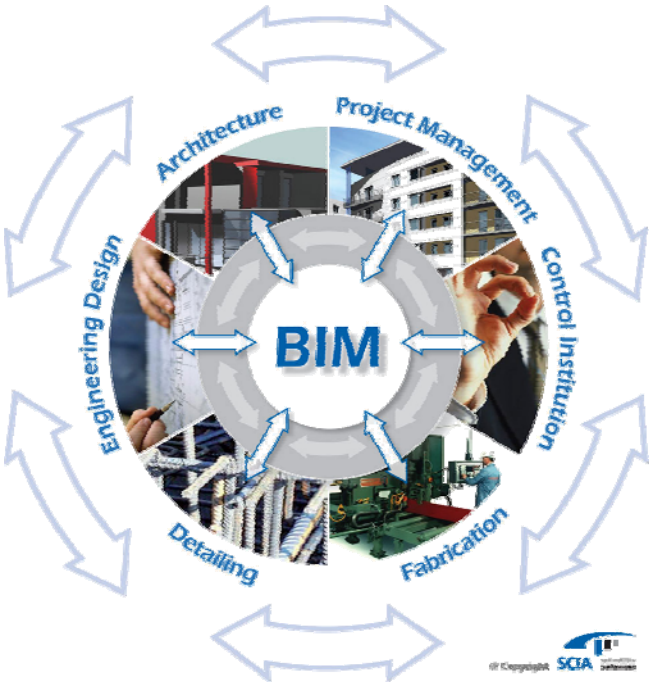
1.3 NEW WORKFLOW

BIM is an approach not a technology. It does require suitable technology to be implemented effectively. The use of BIM is only 20% technology, but 80% management restructuring.

Building Information Workflow: Model ➤ Modeling ➤ Management



The BIM Maturity Model by Mark Bew and Mervyn Richards adapted to reflect BLM's relationship to Level 3.

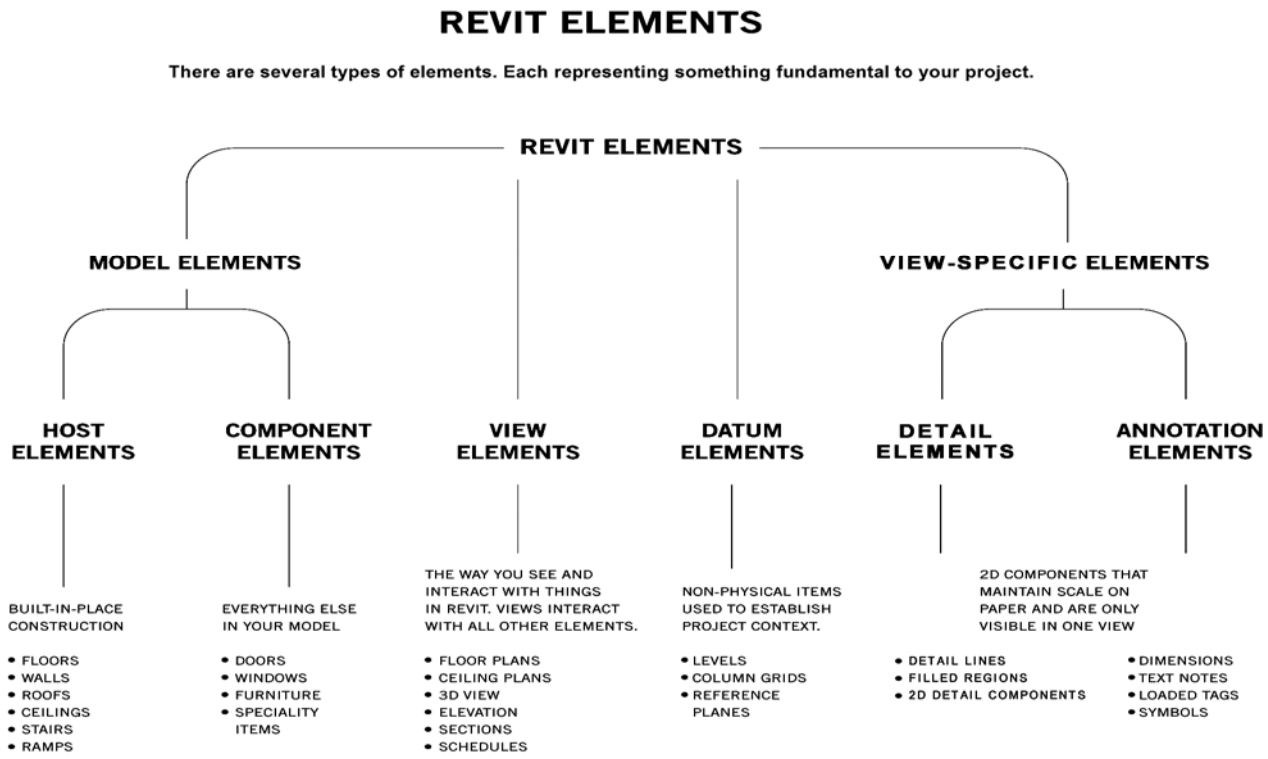


CHAPTER 2. UNDERSTANDING REVIT ELEMENTS

2.1 ABOUT REVIT FAMILY

All Revit elements are Familis. *Families* are components you use to build your model, such as walls, windows, stairs, doors, etc. Each family can have multiple *types*, such as different size, materials, parameter variables, etc. Any change to a type is updated in every instance throughout the project. For example, when you change the window height of one of your window type, all the windows with the same window type are updated instantly.

Revit Element Hierarchy can be shown as follows:

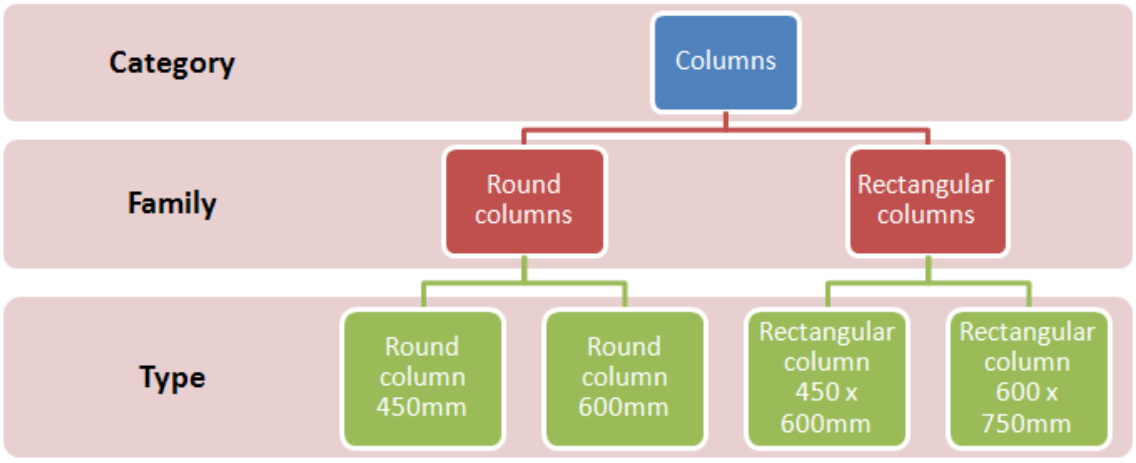


Revit classifies elements by *categories*, *families*, *types*, and *instances*.
Category: A Category controls the organization, visibility, graphical representations, and scheduling options of Families within the Project.

Family: A Family is a grouping of 2D and/or 3D information that serves to represent a discrete building or documentation element in the Project. It defines parametric, graphical, and documentation requirements.

Type: A Type is a specific representation in a Family defined by distinct parametric, graphical, and

Instance: An Instance is an individual representation of a Type in the Project defined by unique parametric, graphical, and documentation characteristics which makes it unique from other Instances in the Project.



2.2 System Family and Loadable Family

There is a list of predefined families that are shipped with Revit software. However, you can also download or create your own family as follows:

System Families

System families are created inside a project. They contain family types that you use to create basic building elements in your building models

Revit includes many system families

- Ceilings
- Curtain Systems
- Curtain Wall Mullions
- Ducts
- Flex Ducts
- Flex Pipes
- Floors
- Fluids (an MEP family)
- Model Text
- Pipes
- Railings
- Ramps
- Repeating Detail
- Roofs
- Site (Pad)
- Stairs
- Structural Foundations
- Structural Loads
- Structural Rebar
- Walls

Loadable families

Standard component families can be created and edited in the family editor. Loadable families include diffusers, dampers, valves, tags, and so on. They are saved in separate files in ".rfa" files.

Some of standard loadable families for MEP

- Casework
- Columns
- Curtain Panel by Pattern
- Curtain Wall Panels
- Electrical
- Entourage
- Furniture
- Furniture System
- Lighting
- Mass
- Mechanical
- Openings
- Planting
- Plumbing
- Railings
- Site
- Specialty Equipment
- Sustainable Design

2.3 ABOUT MEP COMPONENTS

2.3.1 About System

Systems represent the transfer of information between families. Creating systems in MEP project is a key step in automatically generating routing, sizing duct/pipe, and performing engineering calculations and analysis in the design. When a system be created, a logical relationship is created between related elements in a project. For example, a supply air system might include duct, fitting diffusers and mechanical equipment. Element s with connectors, such as air terminals and equipment are assigned a system classification.

Without systems, ducts and pipes act only as connections between two points. Systems are needed to generate the bigger picture and allow you to manage the elements on a building-wide level. Systems enable you to build more than just a three-dimensional model; they enable the engineering to be included in the model as well.

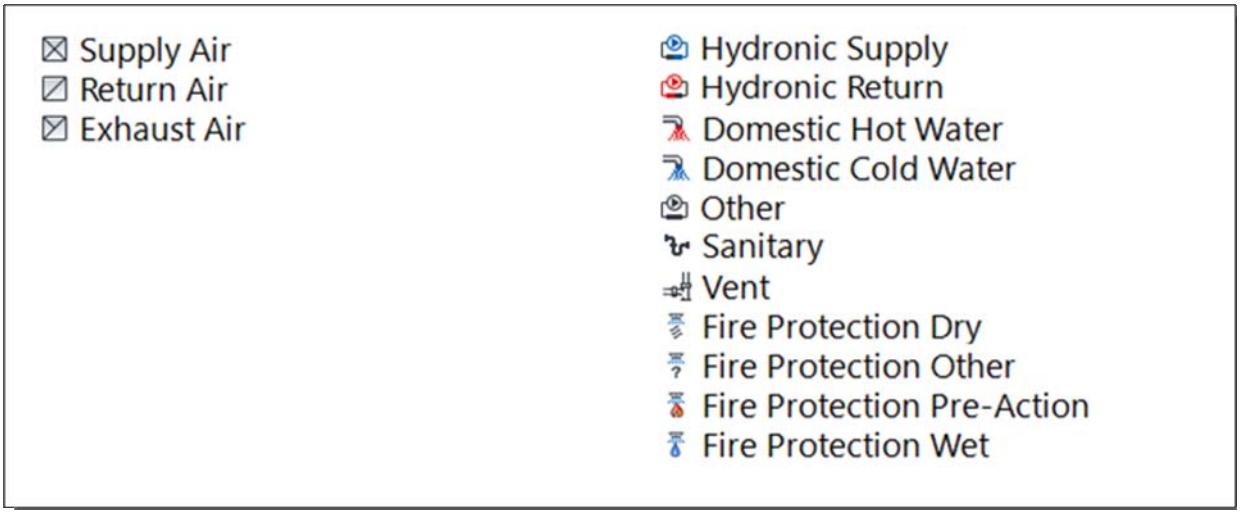
Systems are also useful in the documentation of a model. Because the systems link elements, and their engineering data, across the entire model, tags and other properties can be managed quickly and accurately. One example of this is using a pipe tag that includes not only the size but also the system abbreviation and, if needed, flow rate, velocity, or friction loss within the dust/pipe.

2.3.2 System Classification

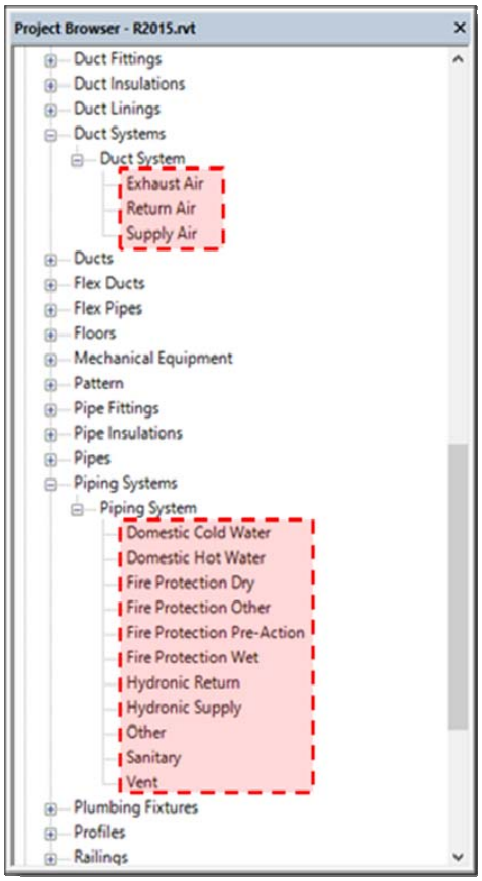
System classification are parameter that decided which type of connectors the system can connect into.

Types of system classification are pre-defined in Revit.

Duct System classification (3 types) Pipe System classification (11 types)



- The system classification is hard coded in Revit MEP.
- It is not allowed to create or delete any system classifications.
- It is not allowed to change the system classification of duct/piping systems.
- In each project, it should have at least one duct system for each for the 3 Duct System classifications, and one piping system for each of the 11 Piping System classifications.

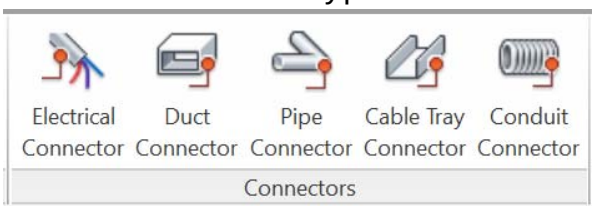


2.3.3 About Connectors

One of the primary differences in creating content for Revit MEP and other Revit content is the concept of connectors. All Revit MEP content will need to have connectors added to it for it to be useful.

MEP For BS engineers, all MEP components require connectors to behave with intelligence. Components created without connectors cannot participate in a system topology. Connectors are primarily logical entities that allow calculating loads within a project. Revit maintains information about loads associated with the spaces in a project. As devices and equipment are placed in spaces, Revit keeps track of the loads based on load type: HVAC, Lighting, Power, Other. The loads associated with the spaces can be viewed in the instance properties for each space, and displayed in schedules.

There are five basic types of connectors that can be added to a MEP family



Duct connectors are associated with ductwork, duct fittings, and other elements that are part of the air handling systems.

Electrical connectors are used for any type of electrical connections, including power, telephone, alarm systems, and others.

Pipe connectors are used for piping, pipe fittings, and other components that are meant for transmitting fluids.

Cable tray connectors are used for cable tray, cable tray fittings, and other components that are meant for wiring.

Conduit connectors are used for conduit, conduit fittings, and other components that are meant for wiring. A conduit connector can be an individual connector or a surface connector. The individual connector is used for connecting only one conduit. The surface connector is used for connecting more than one conduit to a surface.

CHAPTER 3. GETTING STARTED

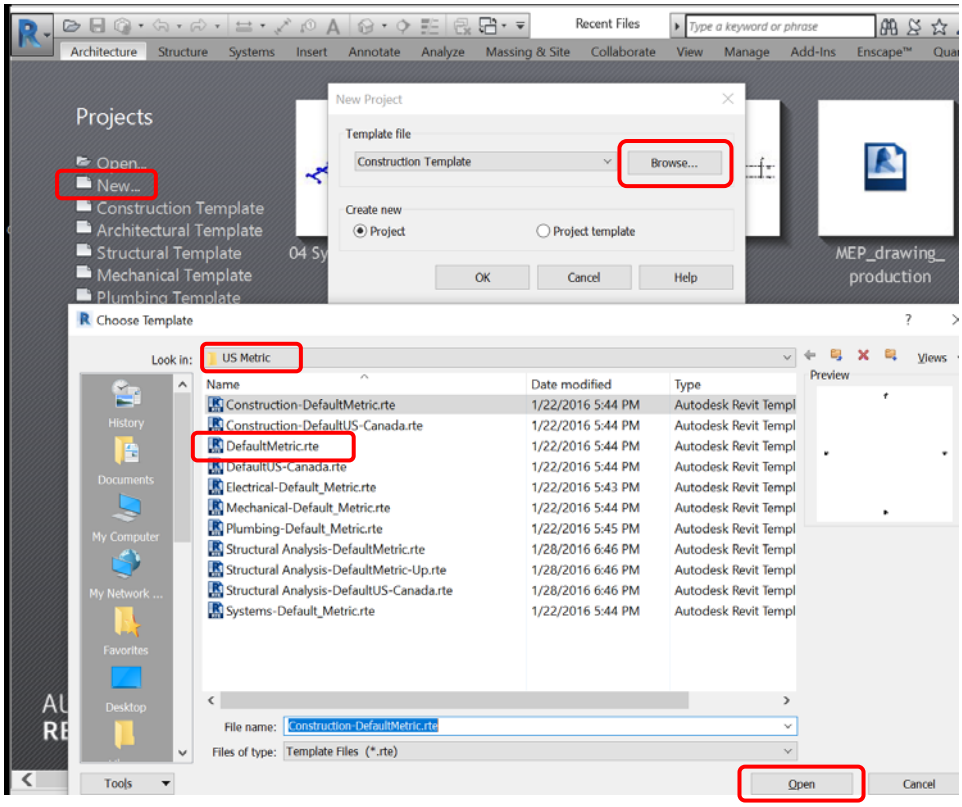
3.1 START A PROJECT

Unlike any other WINDOWS application or a CAD application, Revit does not use the term called 'FILE'. Instead, it uses 'PROJECT'.

The project contains all the information related to the building design, from concept to completion. By using a single project file, Revit makes it easier to alter the design and have changes reflected in all associated views (plan views, elevation views, section views, schedules and so on). Having only ONE project file also makes it easier to manage the project (Although, increases the file size.)

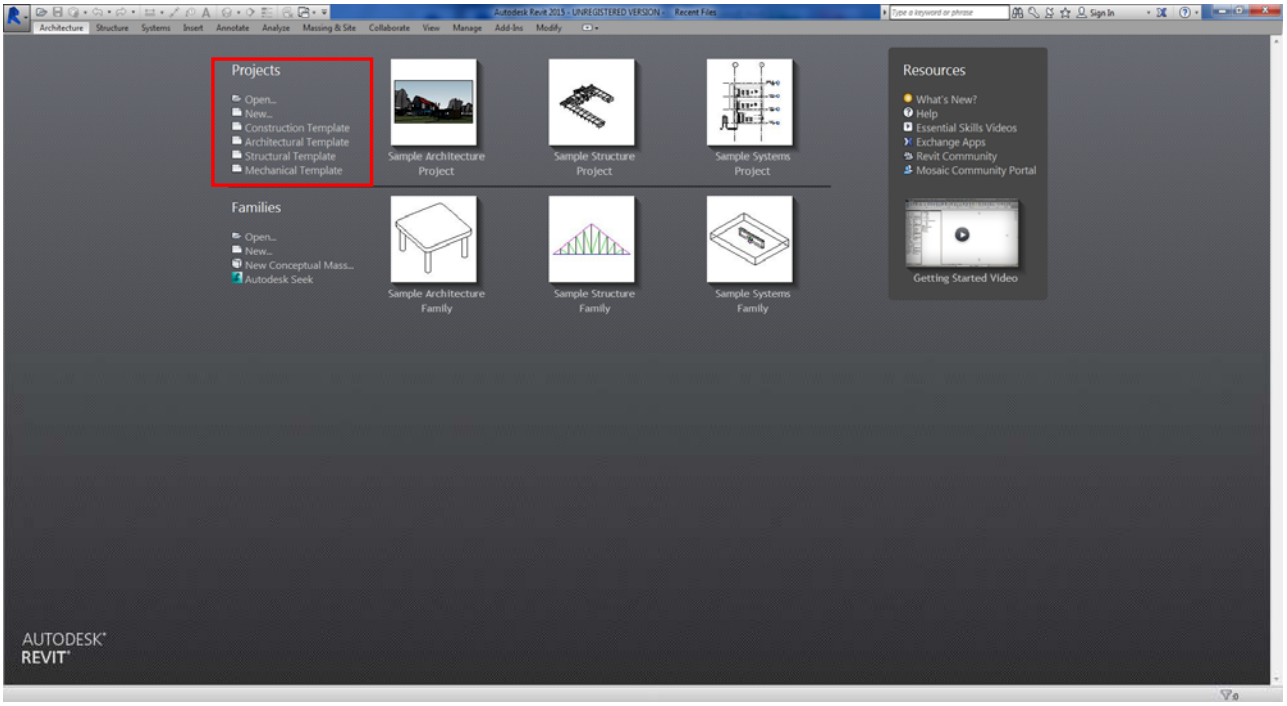
3.1.1 Creating a new project

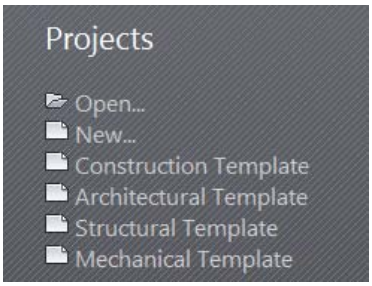
1. Click on "New" and you can click the default "Architectural Template".
2. In the New Project dialog, under Template File, browse to a template file (*.rte).
3. Normally, we work with metric units, so choose the template from US Metric.
4. Revit includes a default template called "DefaultMetric.rte", which contains several default settings to help you begin the design process immediately.
5. Select "Mechanical –Default_Metric.rte" if you want to start a BSE project.
6. You can also create your own template with the desired settings and standards.



3.2 USER INTERFACE

When you will open the software for the first time, it may look like this:





It is important to understand the names mentioned below from the interface as it will be referred in the following chapters as well as in the HELP menu of the software or in other resources related to Revit.

Tips:

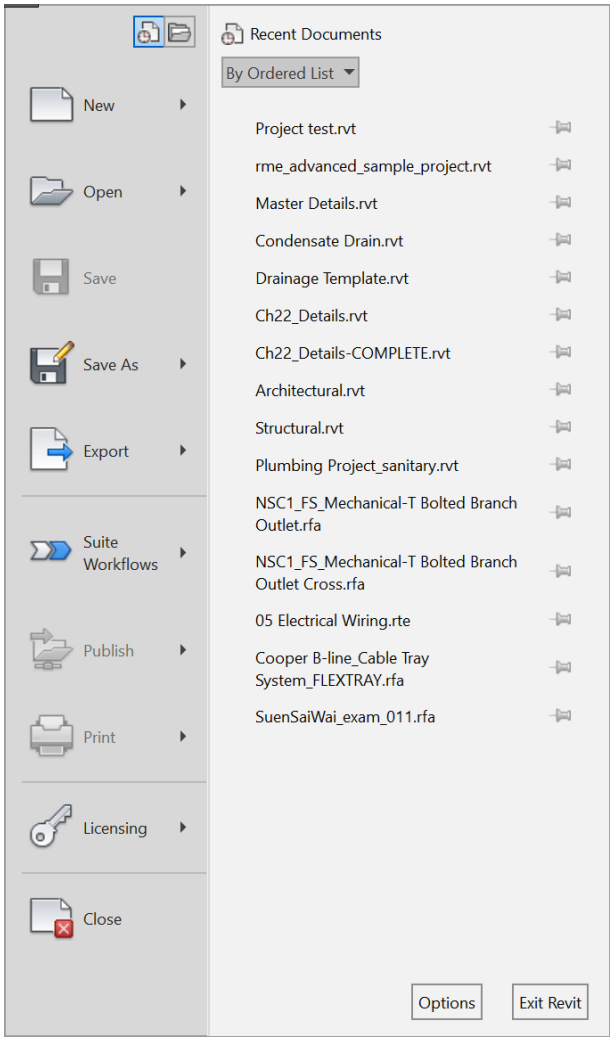
Please note… Unlike AUTOCAD or other CAD applications, REVIT does not use COMMAND ROMPT.

Instead, the interface is made of a ribbon with tools & menus.

3.2.1 Application Menu

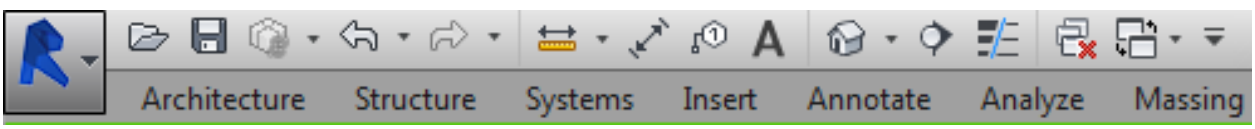
Click  to open the application menu

As a shortcut, to click the main buttons in the application menu (on the left) to perform the default operation.



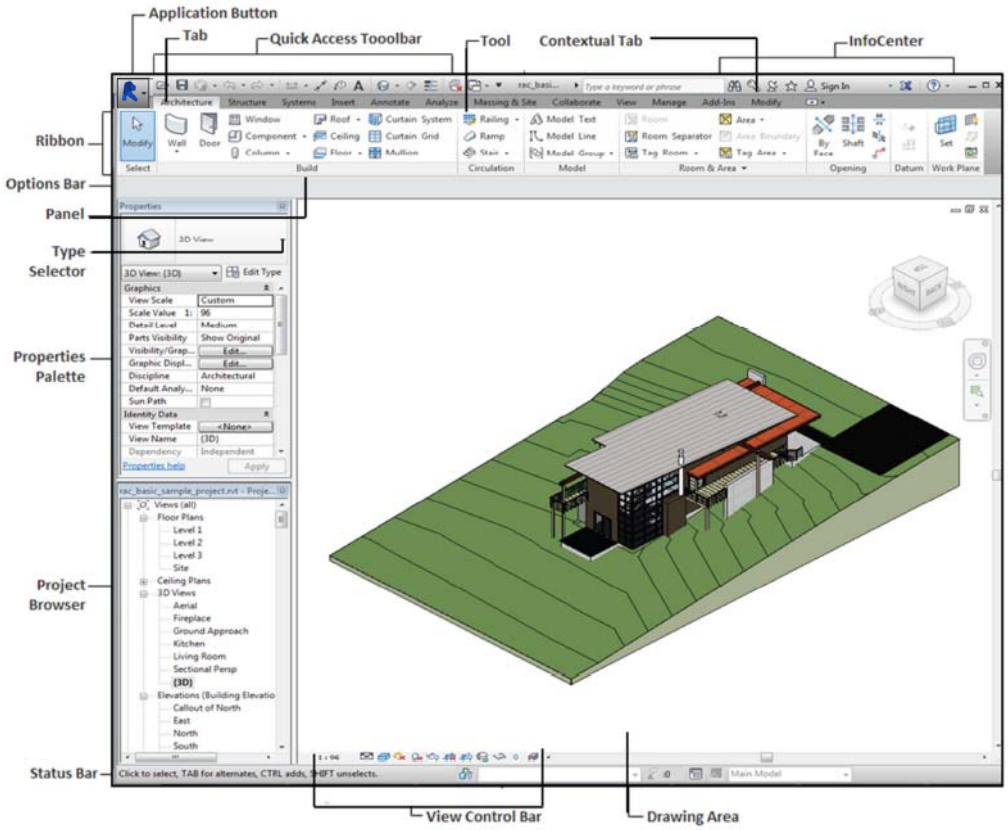
3.2.2 Quick Access Toolbar

The Quick Access toolbar contains a set of default tools. You can customize this toolbar to display the tools that you use most often.



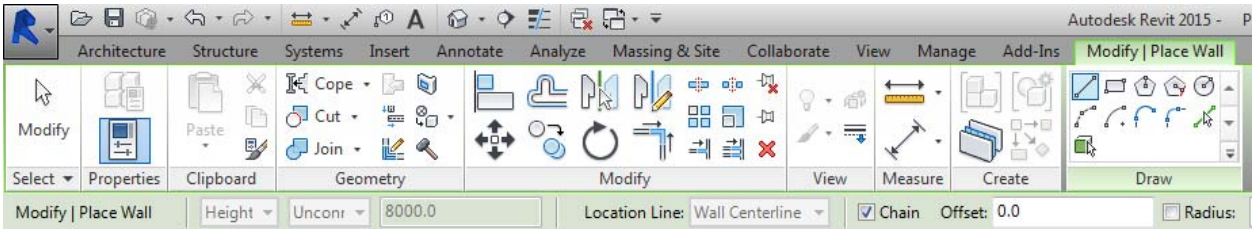
3.2.3 Ribbon

The ribbon displays automatically when you create a new file or open an existing file. It comprises of tabs and panels (see the image above). Tabs are classified by functionality of our model. You may find all panels and tools required for annotation/notes such as Text, Dimension, etc in 'Annotate' tab. Similarly, all tools required for modifying a model are arranges in 'Modify' tab.



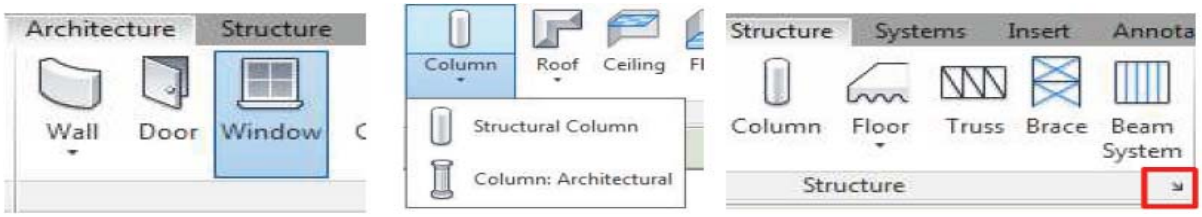
As we resize the window, we may notice that tools in the ribbon automatically adjust their size to fit the available space. This feature allows all buttons to be visible for most screen sizes.

1. Button: Clicking on a button will get you started with the tool;
2. Drop-down button: contains a drop-down arrow that displays additional tools;
3. Settings button: invokes a frequently used tool and displays a menu that contains additional settings.

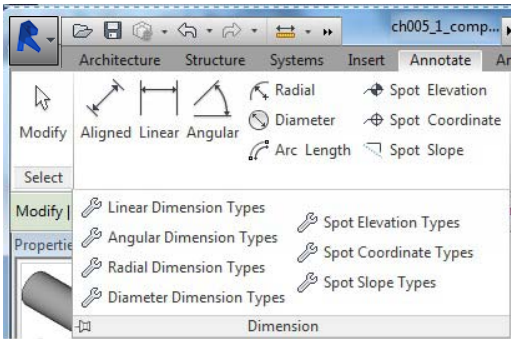


3.2.4 Expanded panels

An arrow next to a panel title indicates that we can expand the panel to display related tools and controls.



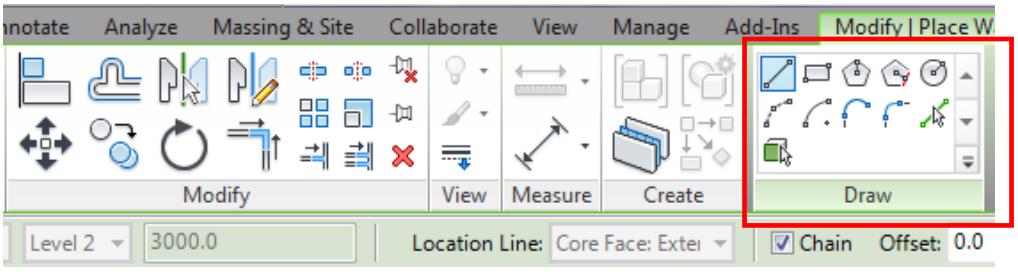
By default, an expanded panel closes automatically when we click outside the panel. To keep a panel expanded while its ribbon tab is displayed, click the push pin icon in the bottom-left corner of the expanded panel.



Some panels allow us to open a dialog to define related settings. A dialog-launcher arrow on the bottom of a panel opens a dialog.

3.2.5 Contextual Ribbon Tab

When you use certain tools or select elements, a contextual ribbon tab appears. This contains set of tools that relate only to the context of that tool or element. For example, when you click the Wall tool, the Place Wall contextual tab displays, showing a few panels:

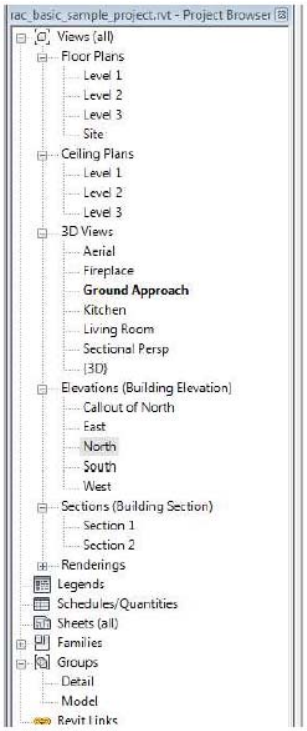


We can specify whether a contextual tab automatically comes into focus or the current tab stays in focus. We can also specify which ribbon tab displays when we exit a tool or clear a selection.

3.2.6 Project Browser

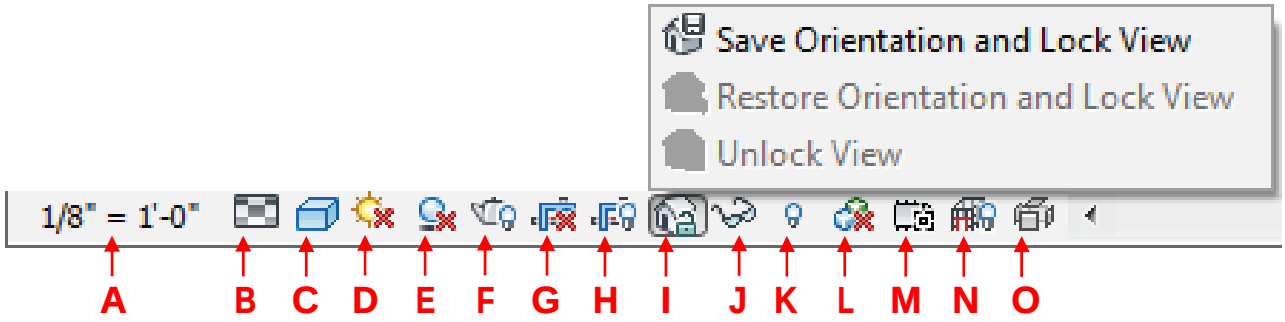
The project browser is one of the most important and frequently used parts of the interface. It is used for navigating between different views inside the project. The project browser shows a logical sequence for all views, schedules, sheets, families, groups, linked Revit models, and other parts of the current project. As you expand and collapse each branch, sub-views are displayed.

- To go to a particular view, double click its name in the project browser. The active view name displays in **bold** letters.
- You can also right click on the view name and click rename.
- To delete a view, right click on the view name and click delete.
- To show the Project Browser, click View tab ➢ User Interface panel, and select the Project Browser check box.



3.2.7 View Control Bar

View Control Bar is located at the bottom of the Revit window above the status bar.



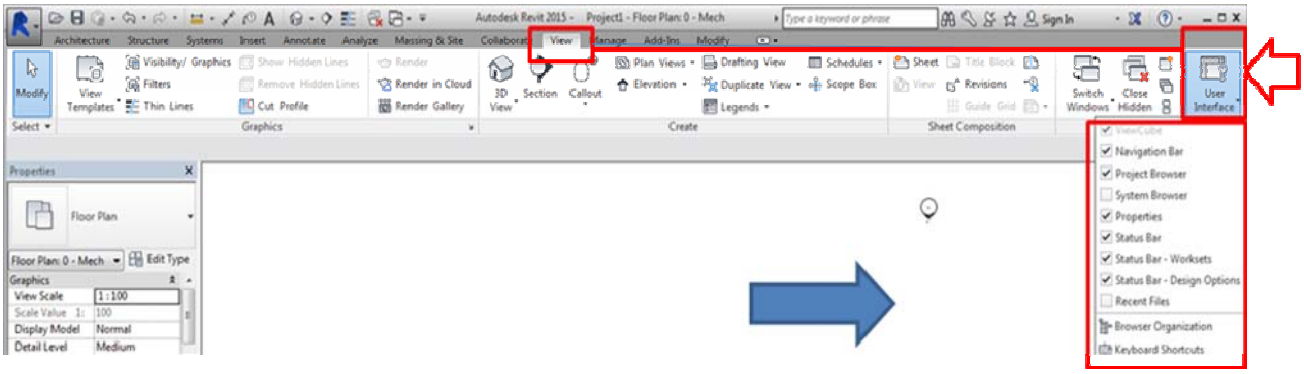
It provides quick access to functions that affect the drawing area, including the View scale, Detail level, Model graphics style, shadows on/off, crop region on/off, crop boundaries, etc. We shall study them in detail further in our later chapters.

A. View Scale
B. Detail Level
C. Visual Styles
D. Sun Path Toggle
E. Shadows Toggle
F. Show Rendering Dialog
G. Crop View Toggle
H. Show/Hide Crop Region
I. Temp Hide/Isolate
J. Reveal Hidden Elements
K. 3D View Lock
L. Worksharing Display
M. Temp View Properties
N. Analytical Model Toggle
O. Highlight Displacement Sets

3.2.8 Palette On/Off

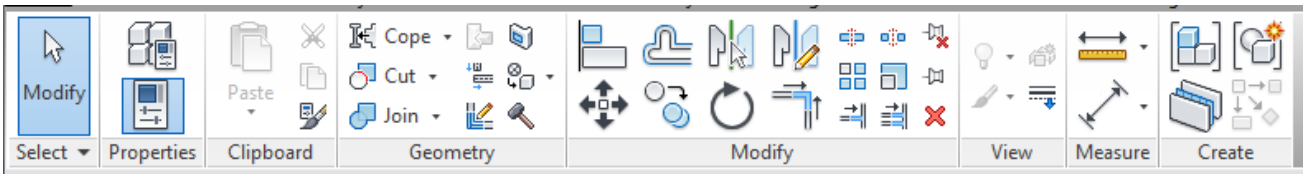
If we subsequently close any palette, we can reopen it by

- Click View tab ➤Windows panel ➤User Interface drop-down



3.2.9 Basic Tools

Modify Tools (Move, Copy, Align, Offset, Mirror, Rotate)



Move: Select the object, click  ; or M+V

Copy: Select the object, click  ; or C+O

Align: Click  , select the reference element, select one or more elements to align with the reference element; or A+L.

Offset: Select the object, click  , input the amount of offset, select the object, and click at the side you want; or O+F.

Mirror: Select the object, click  , and select the mirror plane; or M+M.

Rotate: Select the object, click  , and input the angel; or R+O.

3.2.10 Useful Shortcuts

1. Zoom In/Out: Directly use wheel on your mouse.
2. Temporary Hidden Objects: Select objects. Type "HH" on keyboard.
3. Show temporary hidden objects: Type "HR" on keyboard.
4. Rotate view. Hold "Shift" button and wheel of your mouse.
5. Hidden Object: Select objects, right click-➤Hide in View.
6. Set objects visibility/Override: Type "VV/VG" on your keyboard.
7. Tile views: Type "WT" on your keyboard.

MV ~ Move
RO ~ Rotate
CO ~ Copy
AR ~ Array
MM ~ Mirror

AL ~ Align
SL ~ Split
TR ~ Trim
OF ~ Offset

MD ~ Modify

VP ~ View Properties
PR ~ Element Properties

T<Spacebar> ~ Thin Line

VV ~ Visibility Graphics...
VG ~ Visibility Graphics...

DI ~ Dimension

WF ~ Wireframe
HL ~ Hidden Line
SD ~ Shading with edges

[Ctrl] + Z ~ Undo
[Delete] ~ Delete Object

WT ~ Tile
WC ~ Cascade

RP ~ Ref Plane

DL ~ Detail Line

TX ~ Text
GR ~ Grid
LL ~ Level

CM ~ Component Load

SA ~ Select All Instances

ZZ ~ Zoom to Region
ZA ~ Zoom All to Fit
ZF ~ Zoom to Fit
ZV ~ Zoom Out (2x)

UN ~ Project Units
MS ~ Mechanical Setting
ES ~ Electrical Setting

RR ~ Rendering

Object Snaps
SO ~ Snaps Off
SC ~ Centers
SM ~ Midpoints
SI ~ Intersections
SP ~ Perpendicular
SN ~ Neatest
SE ~ Endpoints
SQ ~ Quadrants
ST ~ Tangents
SX ~ Points

WA ~ Wall
WN ~ Windows
DR ~ Doors
PI ~ Pipe
PF ~ Pipe Fitting
PA ~ Pipe Accessory
PX ~ Pipe Fixture
DT ~ Duct
DF ~ Duct Fitting
DA ~ Duct Accessory
LF ~ Light Fixture
SK ~ Sprinkler

CHAPTER 4. LEVEL AND GRID

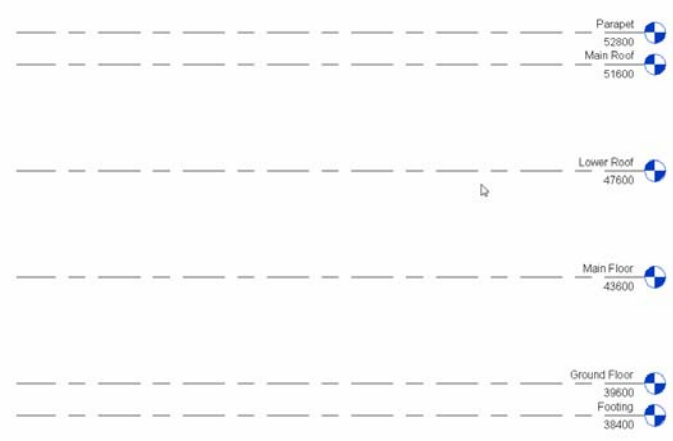
4.1 CREATING / MODIFYING LEVELS

Go to Project Browser and double click on the section/elevation view to add levels.

1. Click Architecture tab ➢ Datum panel ➢ Level. (Keyboard shortcut 'LL')
2. Place the cursor in the drawing area and click.

Note: As you place the cursor to create a level, if the cursor aligns to an existing level line, a temporary vertical dimension displays near the cursor.

3. Draw level lines by moving the cursor horizontally.
4. Click when the level line is of correct length.



You can also use Ctrl+C of an existing level, Ctrl+V and entering level height to create a new level.

These two methods are faster and simple way to create new level lines.

To change the elevation of the level line:

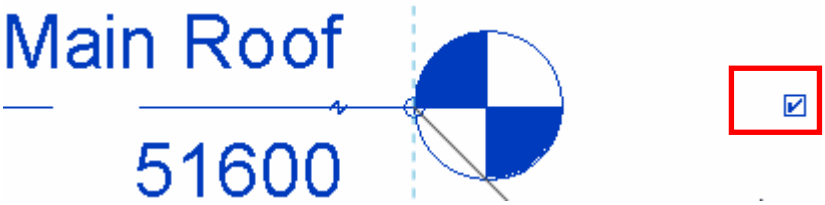
Click on the existing level line ➢ Click on the elevation of the level displayed in blue color below the name ➢ Write a new elevation value for the Level. The position of the level will change according to the new dimension.

To rename the level:

Click on the existing level line ➤ Click on the name of the level displayed in blue ➤ Write a new name for the Level. If you rename the level, the associated name for the floor plan and the reflected ceiling plan update as well. Thus, you can also use the Project Browser to rename the level, if desired. Click on the name of floor plan/ceiling plan displayed in project browser ➤ Right click and select rename ➤ Write a new name for the floor plan. Corresponding level name will also change.

To switch visibility of level symbols:

It is possible to have level symbols on both ends or either of the end of the level line. To control the visibility of these symbols, select the level line ➤ click on the Box besides the level symbol. Check to see the symbol and uncheck to hide it.



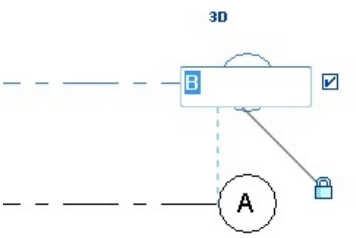
4.2 Creating/Modifying Grids

Use the Grid tool to place structural grid lines in the building design. You can then add columns/structural components along the column grid lines.

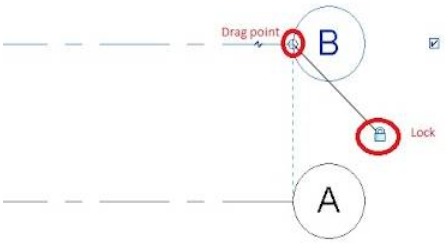
Adding Grids:

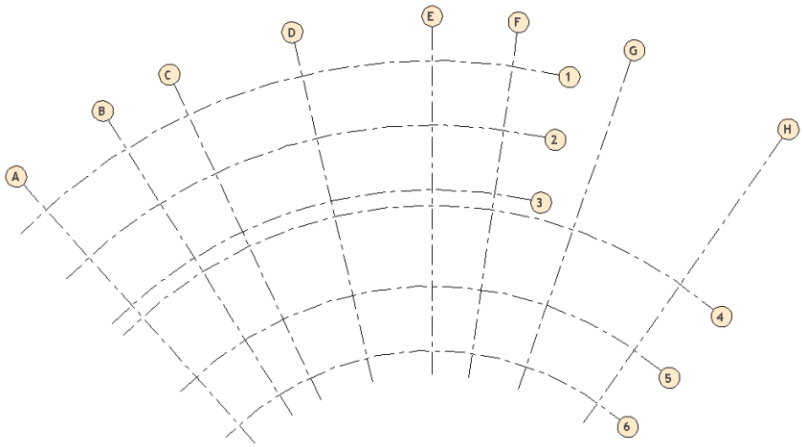
1. Open Plan view and Click Architecture tab ➤ Datum panel ➤ Grid. (Keyboard Shortcut **'GR'**)
2. Click Place Grid tab ➤ Draw panel, and select a sketch option.
3. Go to the drawing area and draw the grid line from its starting point to its end point.

Revit automatically numbers each grid. To change the grid number, click the number, enter the new value, and press ENTER. You can use letters for grid line values. If you change the first grid number to a letter, all subsequent grid lines update appropriately.



As you draw grid lines, the heads and tails of the lines can align to one another. If grid lines are aligned and you select a line, a lock appears to indicate the alignment. If you drag the blue drag point of any one grid line, other aligned grid lines will also move with it. If you wish to drag only one of the grid line than click on the lock again to unlock it and then drag again.

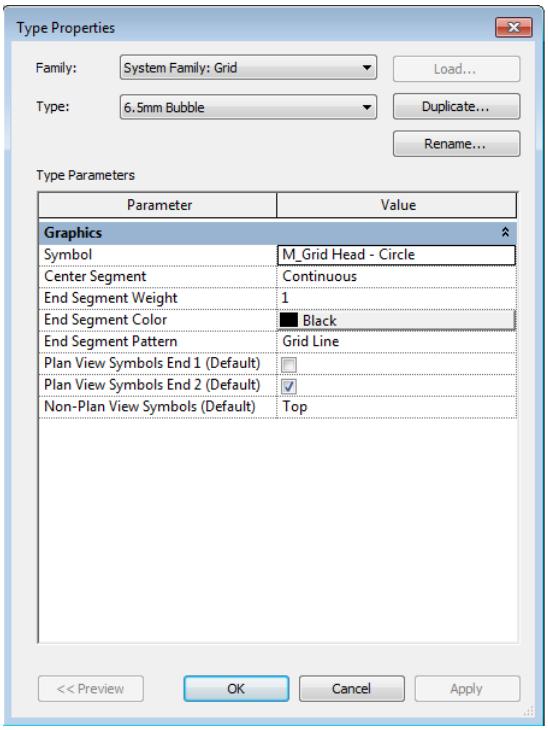




Customizing GRID Lines:

You can customize grid types in the following ways:

- Change the **line color, weight, and pattern** of the entire grid line:
  Input the desired properties in Type properties of the GRID ➤ end segment weight / color/ pattern.
- Hide center segment of grid lines to create a gap, displaying only the end segments in views:
  Go to Type Properties of GRID ➤ center segment ➤ input None.
- Display the center segment of the grid line using a different line color, weight, and pattern:
  Go to Type Properties of GRID ➤ center segment ➤ input Custom. Center segment weight/ color/ pattern titles appears. Input the required data.



- To change the design, fonts and shape of the Grid Symbol, a new family of Grid Head needs to be created. It cannot be changed from the properties.

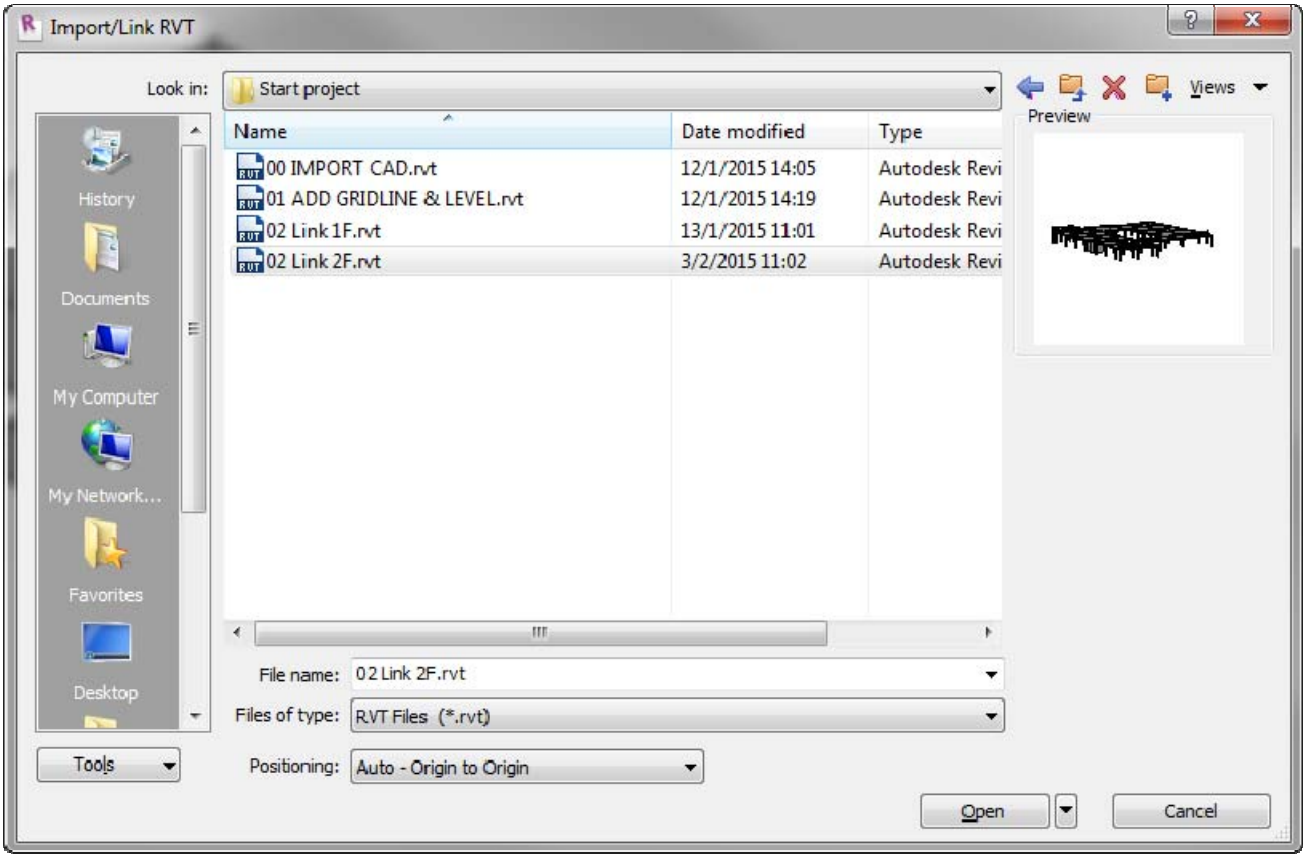
CHAPTER 5. LINK PROJECT

5.1 ABOUT LINKING MODELS

Linking models is primarily intended for linking separate part of buildings, such as Architecture, Structure, and MEP models.

5.2 LINK A MODEL INTO CURRENT PROJECT

- Click Insert tab ➢ Link panel ➢ (Link Revit).
- In the Import/Link RVT dialog, select the model to link.



Select “02 Link 2F.rvt”, choose “Auto - origin to origin” as positioning method. Click open and model will link into current project. Check if the coordinate is correct. After linked the model into project, manual place it to the correct position by using move, align tools.

The three automatic options are more commonly used, and each has a specific function:

Auto – Center To Center This option links the model from its center point to the center point of your project. The center point is determined by the location of the model objects within the file.

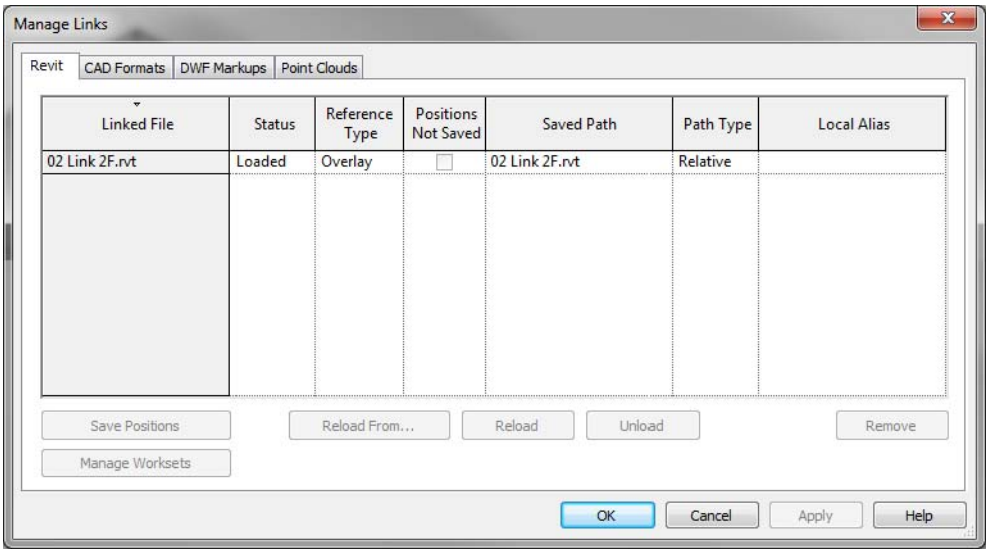
Auto – Origin To Origin This is the best option to use unless a shared coordinate system is required. The origin of the linked model will not change if the model changes size or shape, or even if building geometry is moved or rotated, so you will be able to stay coordinated with the building when major position changes occur.

Auto – By Shared Coordinates This option should be used when a project requires that common location coordinates be used. This is most commonly used on projects that have multiple buildings because it enables you to keep the relationship between buildings coordinated. If you link in a project that is using shared coordinates, you can use the same coordinates for your model.

5.2.1 Link Property

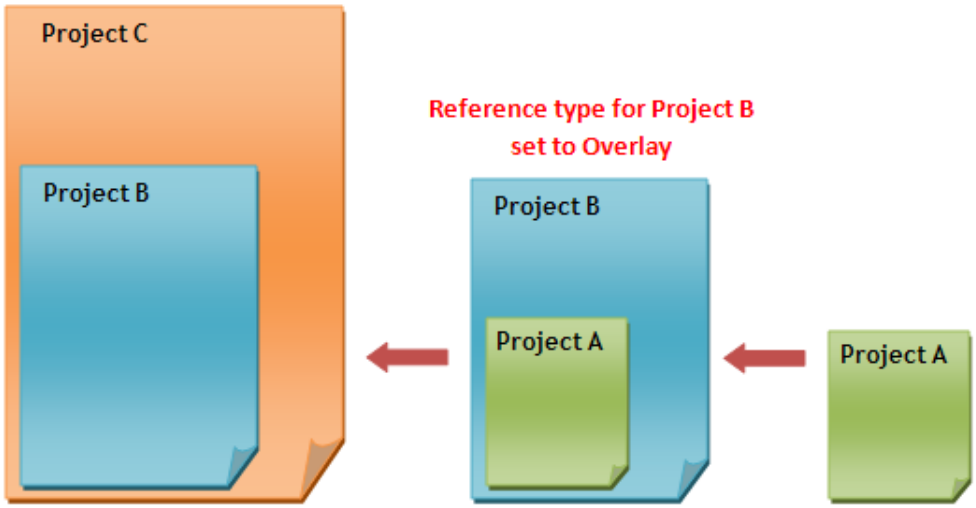
Manage ➤ Mange Links

After creating a link to a CAD format, DWF markup, or Revit model, you have several options for controlling those links. In this dialog, all link/import files are shown, the linkage property can be modified here.

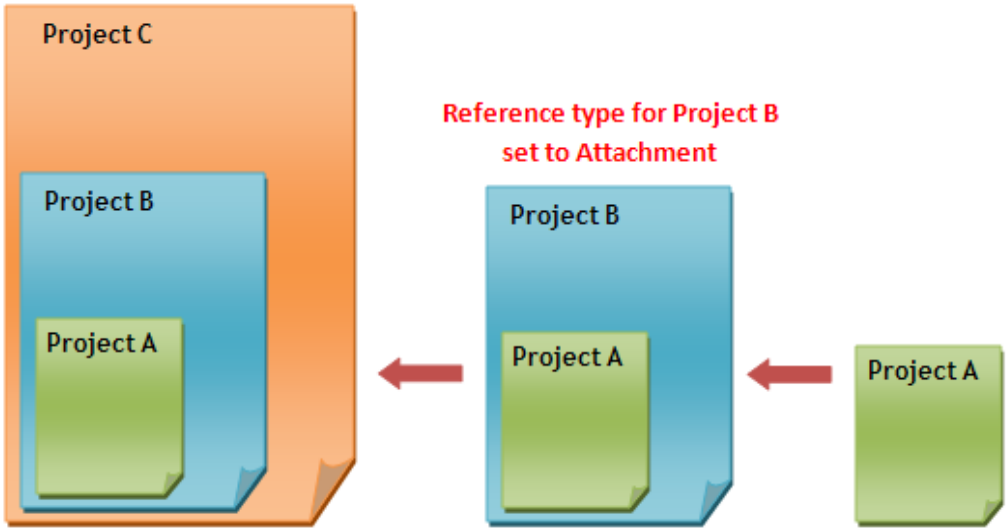


5.2.2 Reference Type

Reference Type has two types: Overlay and Attachment.
When you import a model that contains linked models, the nested links display according to the Reference Type setting in their parent model.
The following image shows that Project A is linked into Project B (so Project B is the parent link for Project A). The Reference Type setting for Project B is Overlay, therefore when Project B is imported into Project C, Project A does not display.



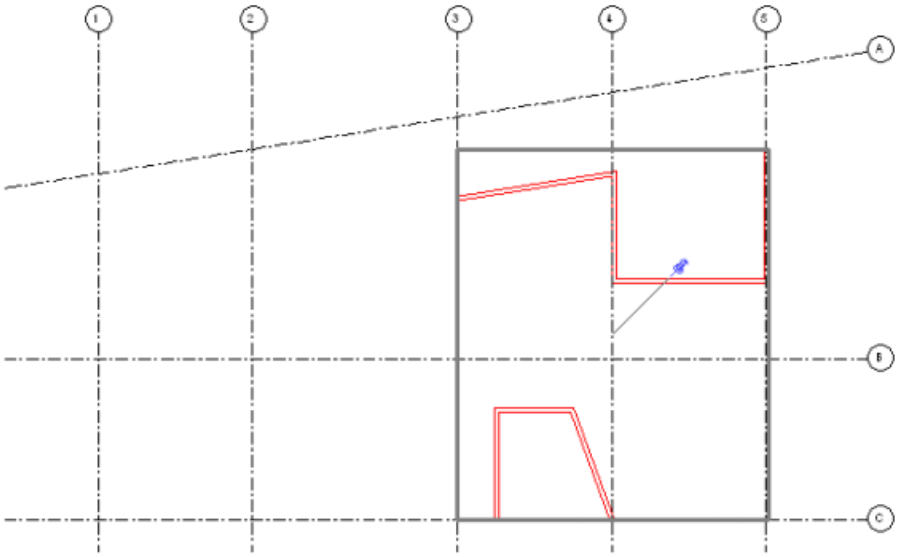
If you change the Reference Type setting for Project B to Attachment, when you import Project B into Project C, the nested link (Project A) displays.



5.3 ABOUT LINKING CAD

Main functions to used linking CAD files as follows:

- the details or elevations drawings, which created by AutoCAD, are linked into the project and place them on sheets. These drawings can then be included in the set of construction documents that Revit generates.
- To link AutoCAD drawings from other disciplines to a project to use them as underlay for your project views.



Linking CAD could maintain a connection between an AutoCAD file and a Revit project. Revit maintains a link to that file. Whenever the project open, Revit retrieves the current, saved version of the linked CAD and displays it in the project. Any changes to the linked file are displayed in the project.

When you link (or import) an AutoCAD file to a project, you can do the following:

- Query objects in the file.
- Hide or delete selected layers in the file.
- Preserve or discard graphic overrides for linked files.
- Make global changes to the graphic display of layers.
- Make view-specific changes to the graphic display of layers.

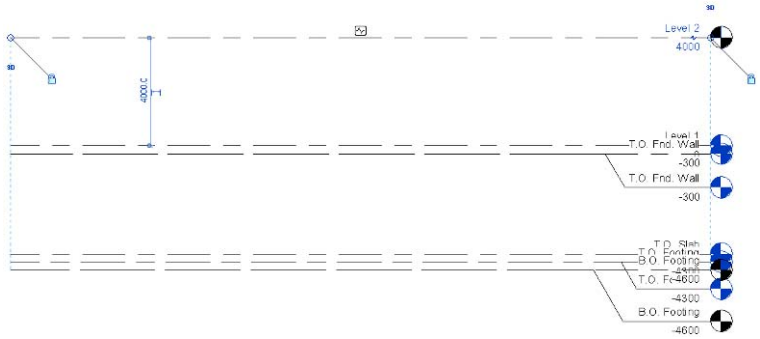
When you link a file to a project, you can control whether the linked file is visible only in the current view, or in all views. As a 2D drawing, the linked file is displayed only in relevant 2D Revit drawings, such as floor plans. In a 3D view, the linked file is displayed as flat, 2D shapes.

CHAPTER 6. COPY/MONITOR MODELS

When multiple teams collaborate on a project, effectively monitoring and coordinating work can help to reduce mistakes and expensive rework. Use the Copy/Monitor tool to ensure that design changes are communicated across teams.

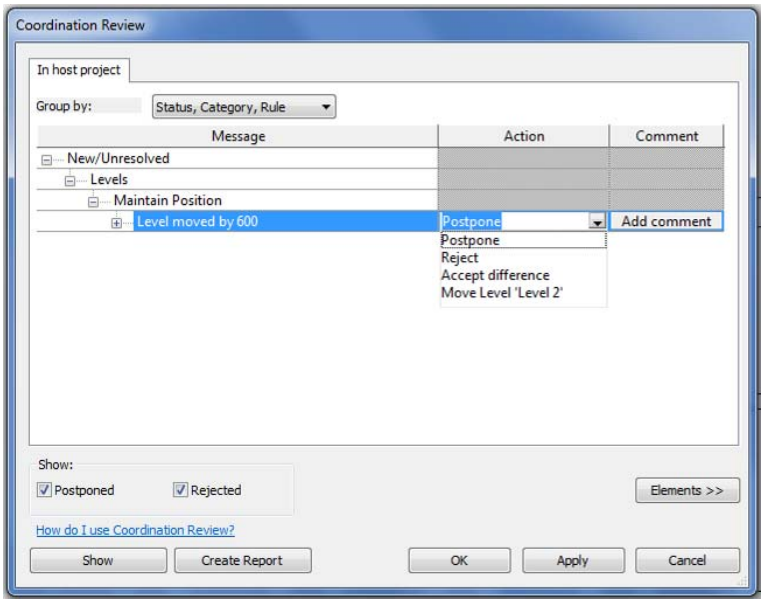
Click Collaborate tab ▸Coordinate panel ▸Copy/Monitor drop-down ▸ (Select Link). Click (Copy).

When you select a copied level, the monitor icon displays next to it to indicate that it has a relationship with the original level in the linked model.



After you establish relationships between elements using the Copy/Monitor tool, you can perform a coordination review to view and address any warnings generated by changes to those elements.

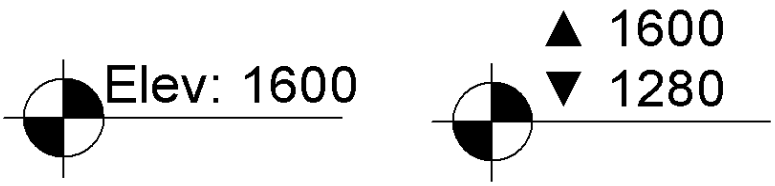
Click Collaborate tab ▸Coordinate panel ▸ Select Link



CHAPTER 7. ANNOTATION

7.1 SPOT ELEVATIONS

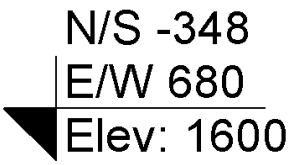
Spot elevations display the actual elevation of a selected point. Spot elevations can also display the top and/or bottom elevation of elements with a thickness. Top and bottom elevations are available for elements in plan views.



You can place spot elevations on non-horizontal surfaces and non-planar edges. You can place them in plan, elevation, and 3D views. Spot elevations are typically used to obtain a point of elevation for ramps, roads, topo surfaces, and stair landings.

Spot Coordinates

You can display the elevation of the selected point and indicator text in addition to the coordinates.



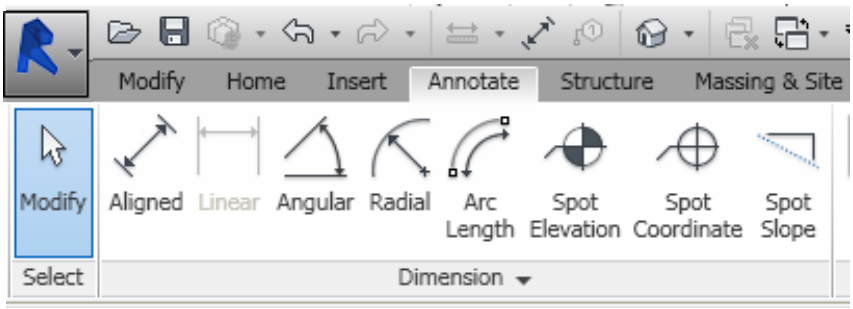
Coordinates are reported with respect to the shared coordinate system.

Spot coordinates can be placed on floors, walls, topo surfaces, and boundary lines. You can also place spot coordinates on non-horizontal surfaces and non-planar edges. When you display the elevation of the selected point in addition to the spot coordinates, you can place the spot coordinate in the same locations you can place a spot elevation.

7.2 DIMENSIONS

Dimensions are view-specific elements that show sizes and distances in a project. There are 2 types of dimensions: temporary and permanent.

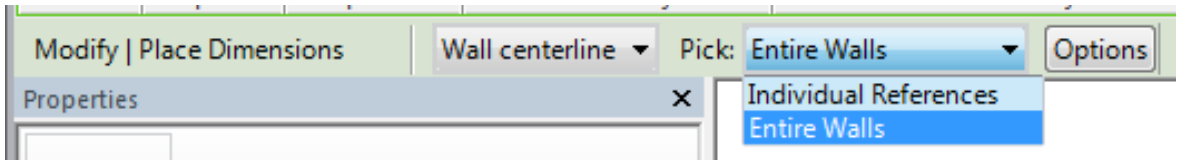
Revit places temporary dimensions as you place components. You create permanent dimensions to define a particular size or distance. Each dimension type can be modified, and the component that is dimensioned updates accordingly.

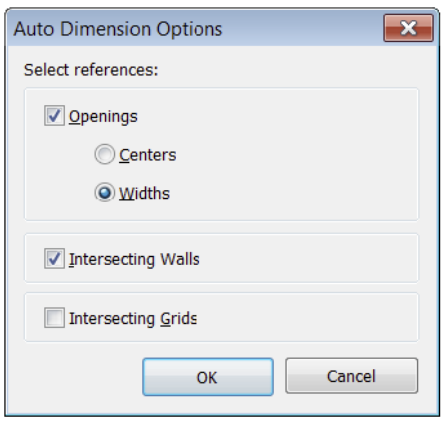


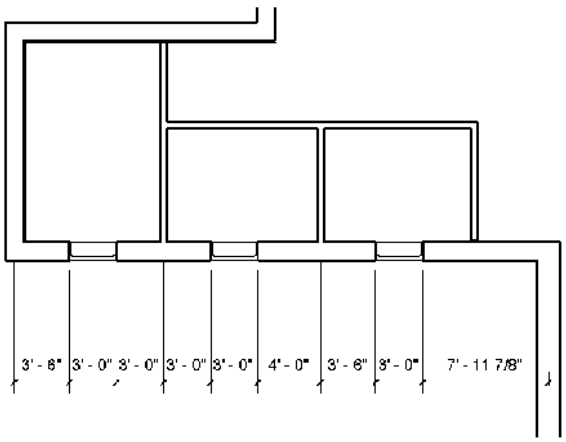
Changing Temporary Dimensions to Permanent Dimensions

1. Select a component in the drawing area.
2. Click the dimension symbol that appears near the temporary dimension. You can then modify the properties of the new dimension and change its type.

Dimension Tools allows you to pick either individual references (default) or entire walls. When the Entire Walls option is selected, click the Options button to modify the Auto Dimension settings. In this example, we have chosen to dimension opening widths as well as intersecting walls. The dimension string shown was placed with a single click on the exterior wall!



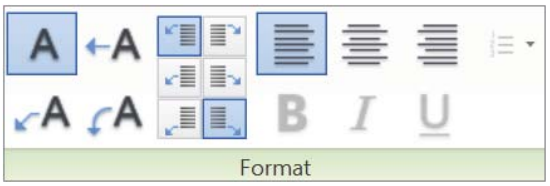




7.3 USING TEXT

The text object consists of a resizable field into which you can enter text with optional features including leaders, bullets, or numbers.

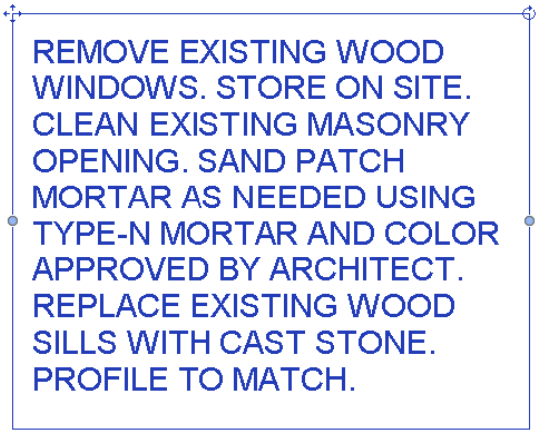
1 Click Annotate tab ▸Text panel ▸ A (Text).

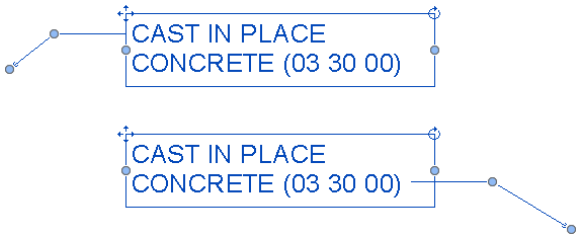


The cursor changes to the text tool A.

2 On the Format panel, select a Leader line option:

- No Leader (default)
- One Segment
- Two Segments
- Curved - to change the curve shape, drag the elbow control.





Grips

The round grips on either side of the text box allow you to resize the width of the box.

Move

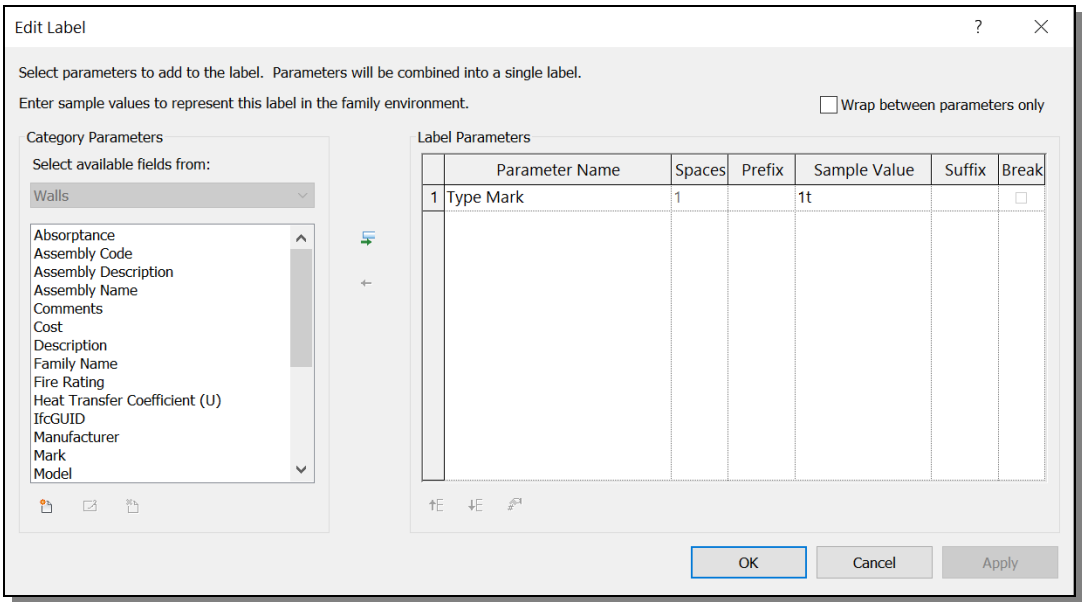
There is a move icon that appears in the upper-left corner of the text box.

Rotate

The upper-right corner shows a rotate icon. Clicking this icon allows you to rotate the text box as you would any object in a project.

7.4 ABOUT TAGS

Tags can be created for any category of Revit model element to report information about the element on sheet views. A tag is 2D annotation family, which can contain a combination of labels and linework, much more useful than plain text. Labels update automatically when the parameters of an element are changed.



In addition, we can load multiple tags for every category family.

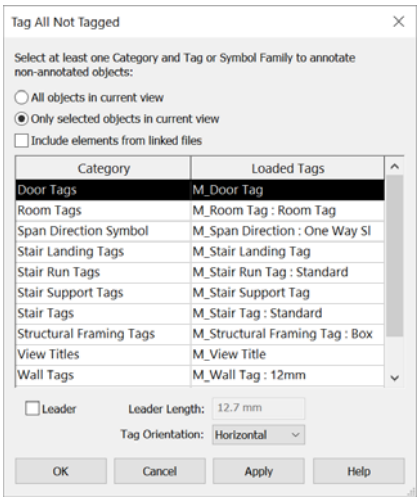
7.4.1 Tag by Category

Use the Tag tool to attach a tag to a selected element. A tag is an annotation for identifying elements in a drawing

Annotate tab ➤ Tag panel ➤ (Tag by Category)

7.4.2 Tag All Not Tagged

If some or all elements in a view do not have tags, you can apply tags and symbols to untagged elements in one operation.



If you do not select elements, the Tag All Not Tagged tool will tag all elements in the view that are not already tagged.

- Click Annotate tab ➢ Tag panel ➢ Tag All.

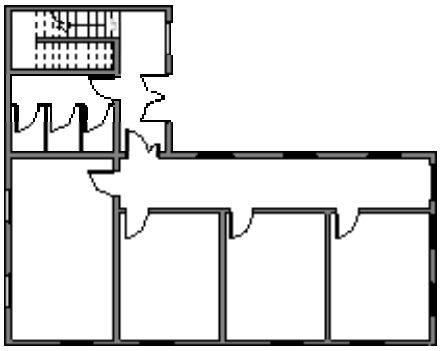
The Tag All Not Tagged dialog displays.

- Specify the elements to tag.
  - To tag all visible elements in the current view that do not have tags, select All objects in current view.
  - To tag only those elements you have selected in the view, select Only selected objects in current view.
  - To tag elements in linked files, select Include elements from linked files.
- Select one or more tag categories.
  - By selecting multiple tag categories, you can tag different types of elements (such as detail items and generic models) in one operation.
  - To select multiple categories, while pressing Shift or Ctrl, select the desired categories.
- Select Leader to attach a leader to each tag
  - For Leader Length, enter a default leader length.
  - For Tag Orientation, select Horizontal or Vertical.

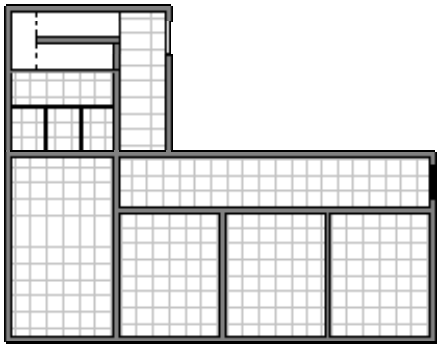
CHAPTER 8. ABOUT PLAN VIEWS

In a 2D view, Revit provided to display a floor plan, a reflected ceiling plan, or structural plan.
The floor plan, reflected ceiling plan (RCP) and structural plan view are the default view in a new project which depend setting in project template. Plan views are created automatically as you add new levels to your project.

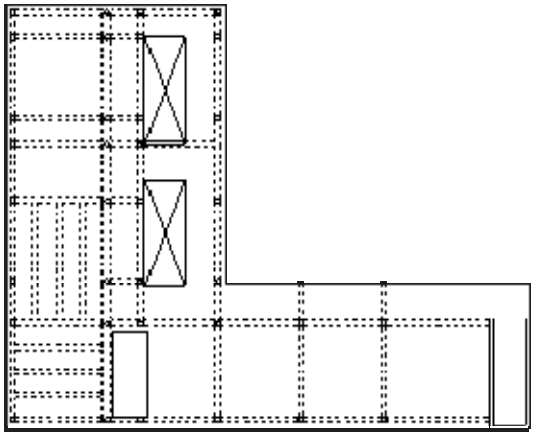
Floor Plan Views



Reflected Ceiling Plan Views



Structural Plan Views

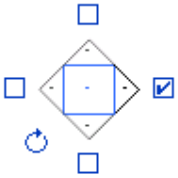


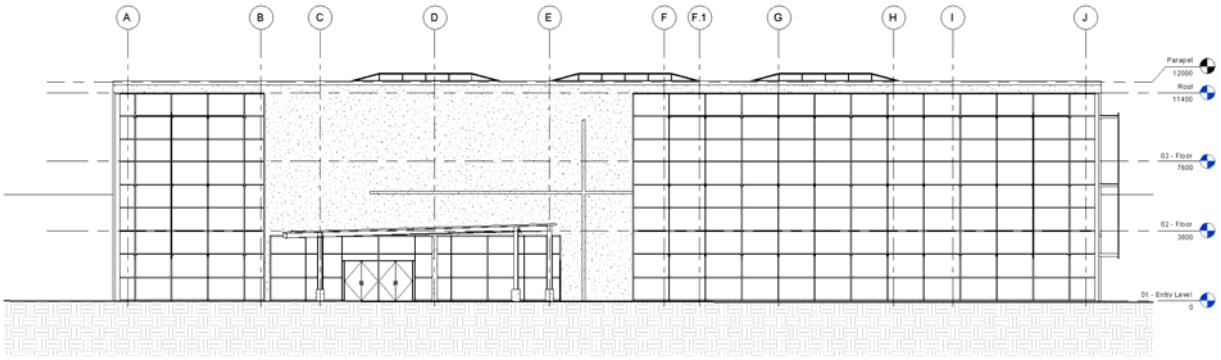
8.1 CREATE AN ELEVATION VIEW

Use elevation views to look at a project from different locations, either exterior or interior.

Click View tab ▸ Create panel ▸ Elevation drop-down ▸ (Elevation)

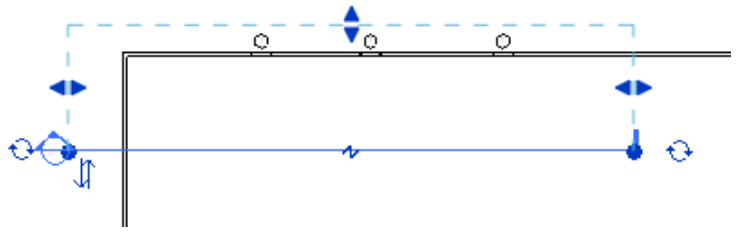
To set different interior elevation views, highlight the square shape of the elevation symbol, and click. The elevation symbol displays with check box options for creating views, as the following image shows.



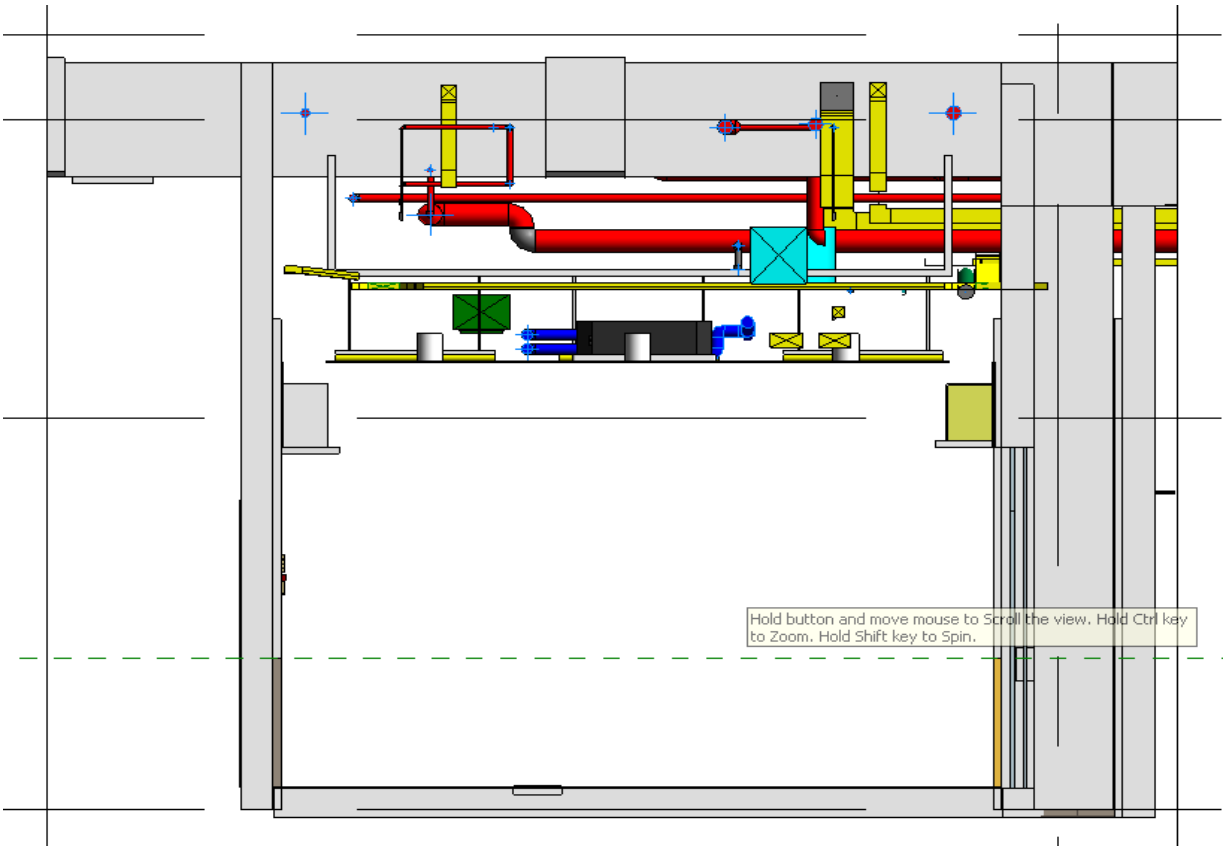


8.2 CREATE A SECTION VIEW

Click View tab ▸ Create panel ▸ (Section).
Click when you reach the end point of the section. The section line and the crop region appear and are selected.



To open the section view, double-click the section header, or select the section view from the Sections grouping of the Project Browser.
The section view changes when the design changes or the section line is moved



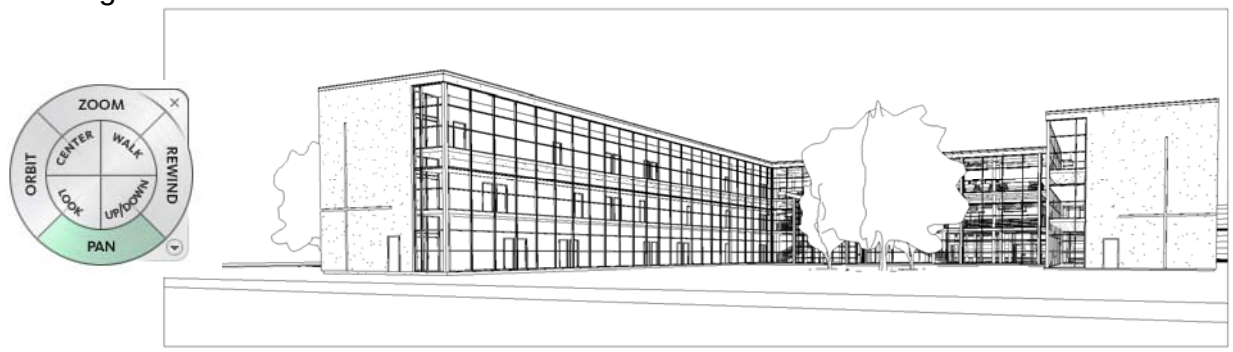
8.3 CREATE A CAMERA VIEW

Click View tab ▸ Create panel ▸ 3D View drop-down ▸ Camera.

Click once in the drawing area to place the camera, and click again to place the target point

In 3D View > Select **"Full Navigation Wheels"**

You can use **Full Navigation wheels** for both viewing an object and touring a building.

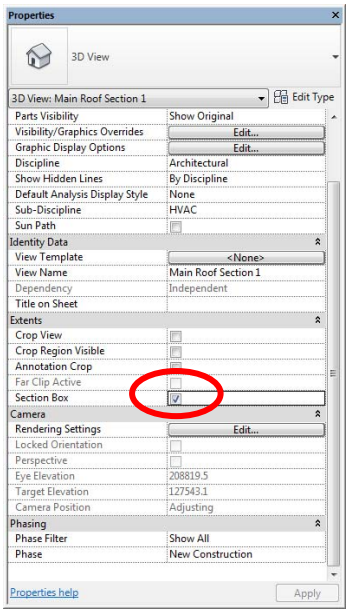


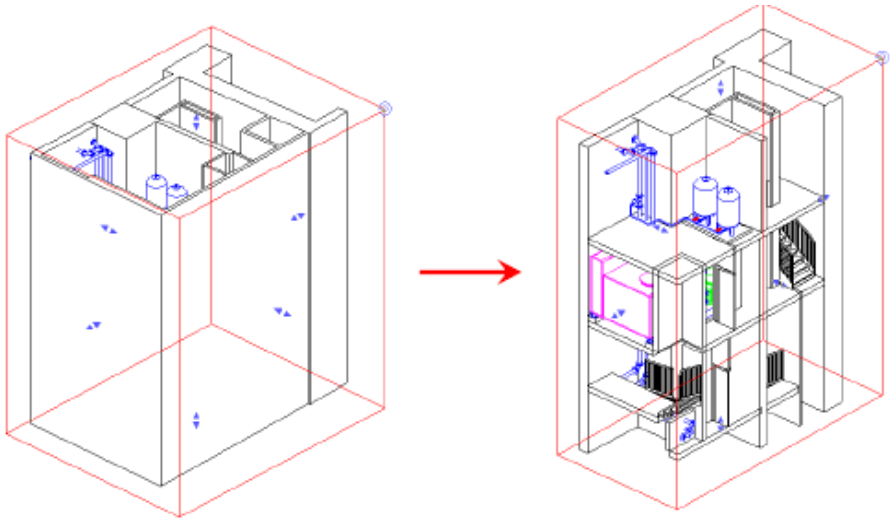
8.4 CREATE SECTION BOX

Use a section box to define the part of the 3D view to export

Go to **3D View,** In Properties > Extents > Tick **"Section Box"**

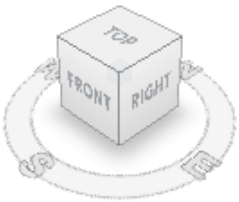
You can cut the model by using the section box





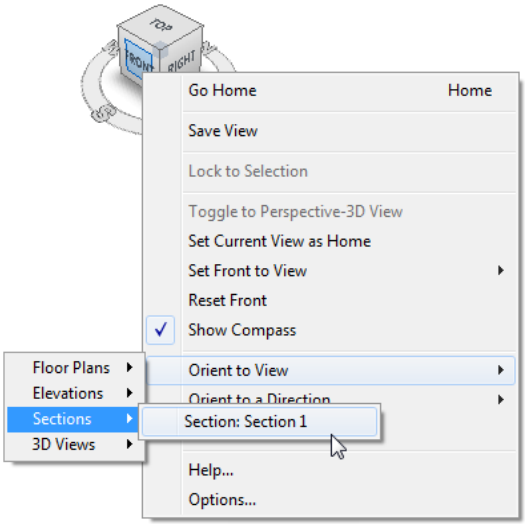
8.5 ORIENT A 3D VIEW

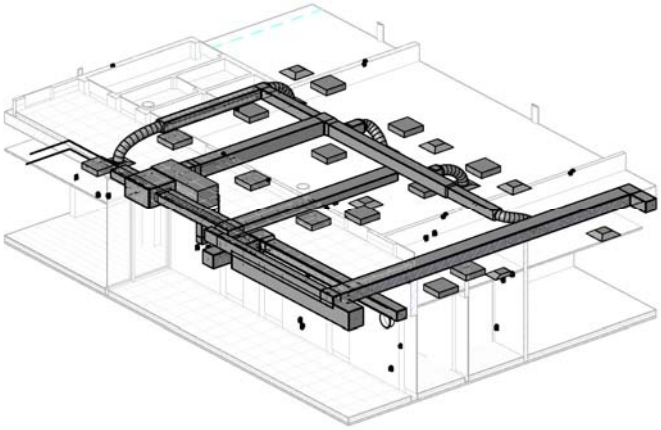
Using the **ViewCube**, you can orient a 3D view to any plan, elevation, section or 3D view in the project.



To orient a 3D view to another view:

1. In a 3D view, right click the ViewCube.
2. Select Orient to View and then select the view type and name.



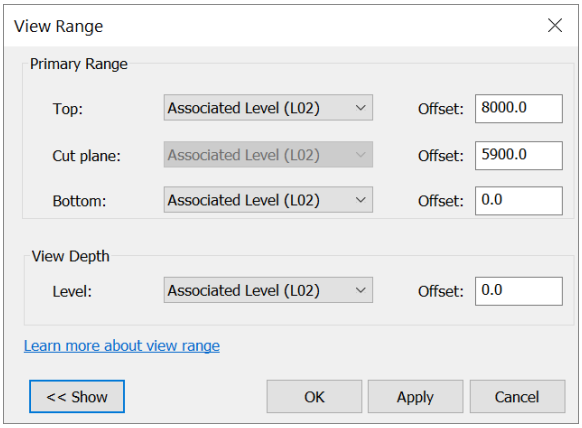


CHAPTER 9. VIEW PROPERTIES

9.1 EXPLORING VIEWS AND MODIFYING VIEW PROPERTIES

On a view, without selecting anything, the property shows the view properties of current view.

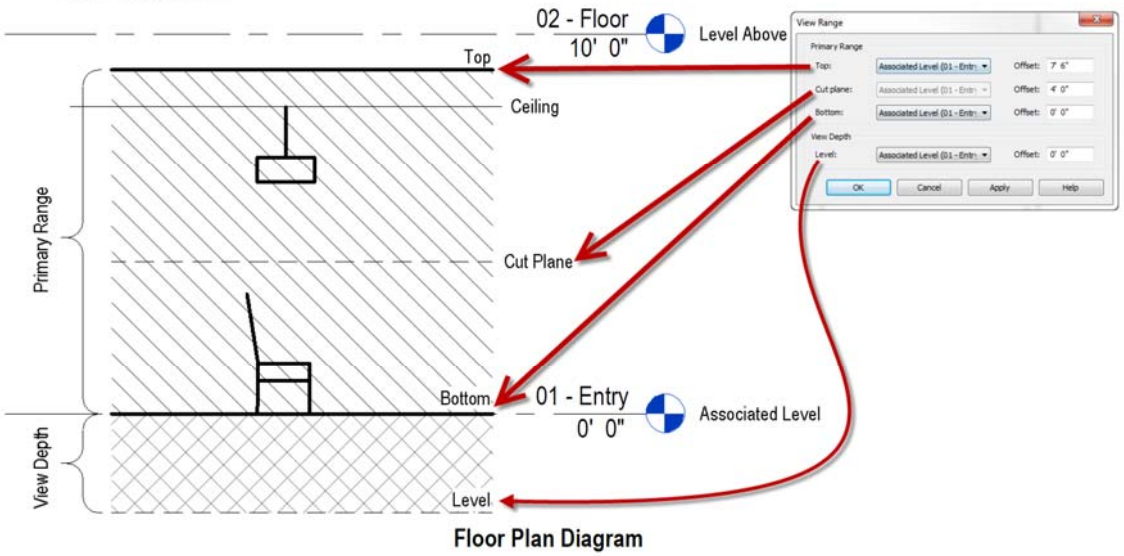
9.1.1 View Range



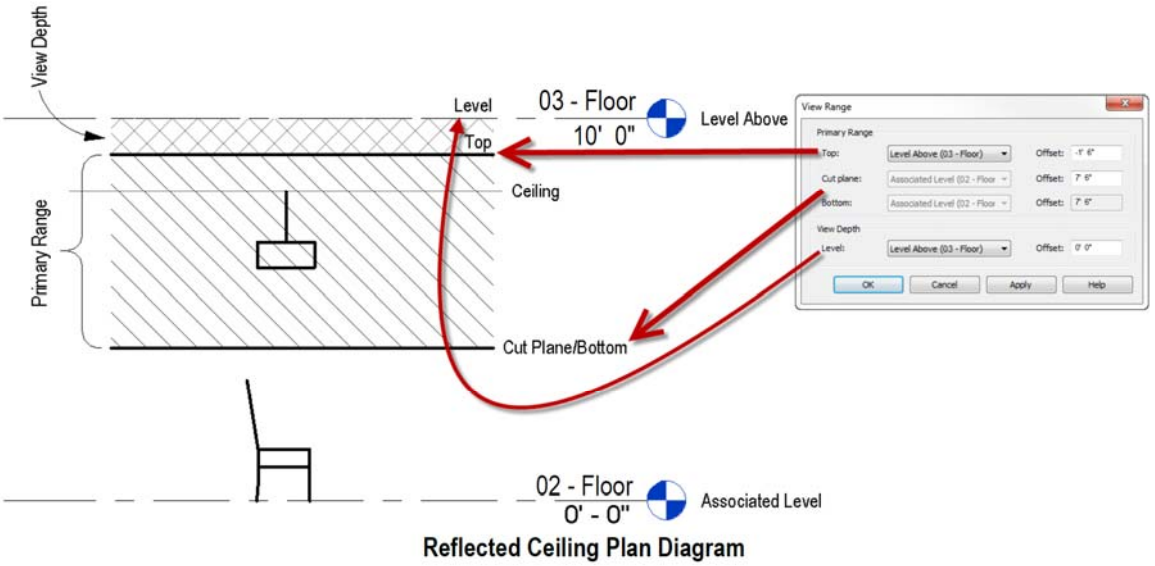
Within the view properties of any plan view, you can set the View Range. With View Range, you can control the specific geometric planes that define the boundaries of each view. These boundaries are set by defining the exact cut plane as well as the top and bottom clip planes.

Every plan view has a property called View Range, also known as a visible range. The view range is a set of horizontal planes that control object visibility and display in the view. The horizontal planes are Top, Cut Plane, and Bottom. The top and bottom clip planes represent the topmost and bottommost portion of the view range. The cut plane is a plane that determines at what height certain elements in the view are shown cut. These 3 planes define the primary range of the view range. View depth is an additional plane outside of the primary range. You can set the level of view depth to show elements below the bottom clip plane. By default, the view depth is coincident with the bottom.

How it Works:



Floor Plan Diagram

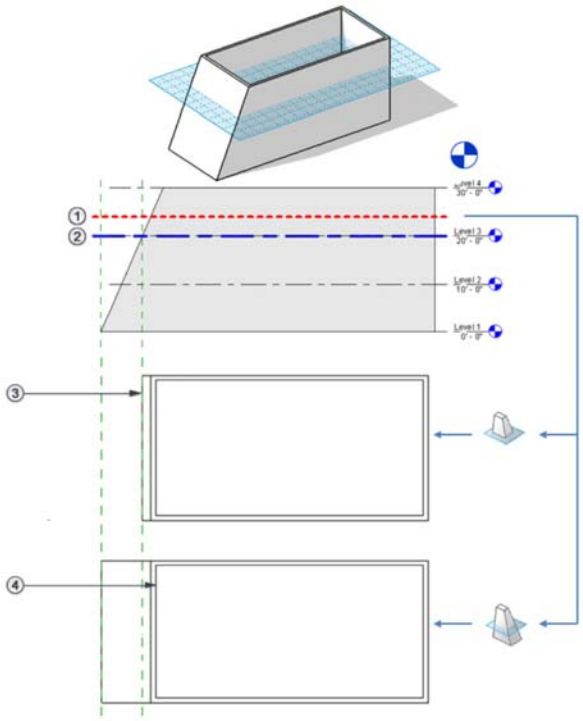


Reflected Ceiling Plan Diagram

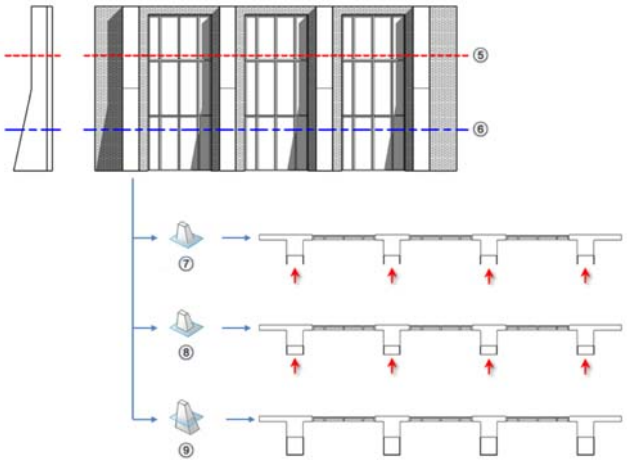
9.1.2 Depth Clipping

Make view adjustment to view parts of a model below the cut plane.
To activate this feature using the Depth Clipping parameter for the plan view. The back clip plane is defined by the View Depth parameter, which is part of the view's View Range properties. Plan views include floor plan views, reflected ceiling plan views, detail plan views, and callout plan views.

The following image illustrates the back clip plane, showing ① the cut plane, ② the view depth, ③ the plan view with the wall below Level 3 clipped, and ④ the plan view with the wall below Level 3 visible.



The following image shows ⑤ the cut plane and ⑥ the view depth for this model, and the resulting plan view representations for the Depth Clipping parameter options: ⑦ Clip without line, ⑧ Clip with line, and ⑨ No clip.



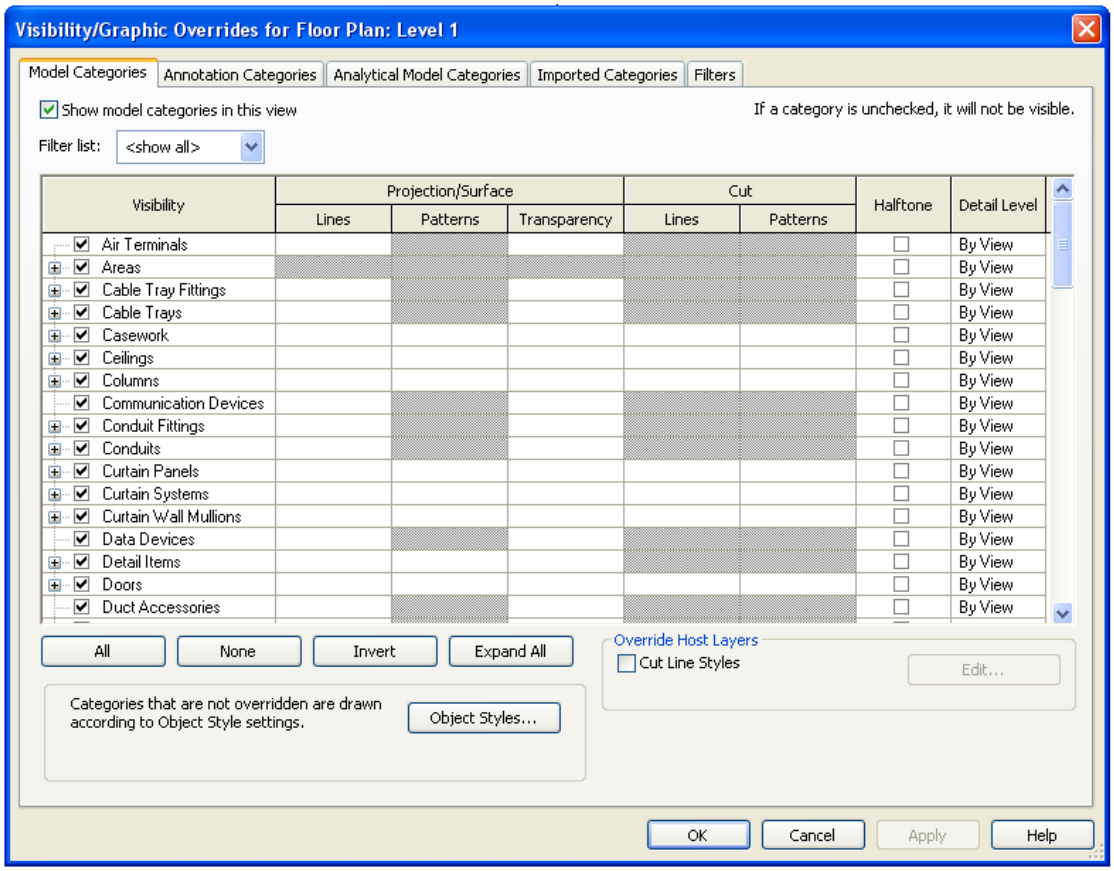
Plan regions respect the Depth Clipping parameter setting of their parent view, but follow their own View Range settings.

Elements that have symbolic representation in certain views (such as structural beams) and non-cuttable families are not affected when you cut a plan view by the back clip plane. They will display and are not cut.

This property does affect printing.

9.1.3 Object Visibility

Click Edit on Visibility/Graphic. Or click “VV” on keyboard. Open a window like bellows,



- Highlight a category row. Click the Override button for the line or pattern to edit.
- Click Apply to view your changes, and click OK to exit the Visibility/Graphics dialog.

For annotation and imported categories, you can only override projection and surface display.

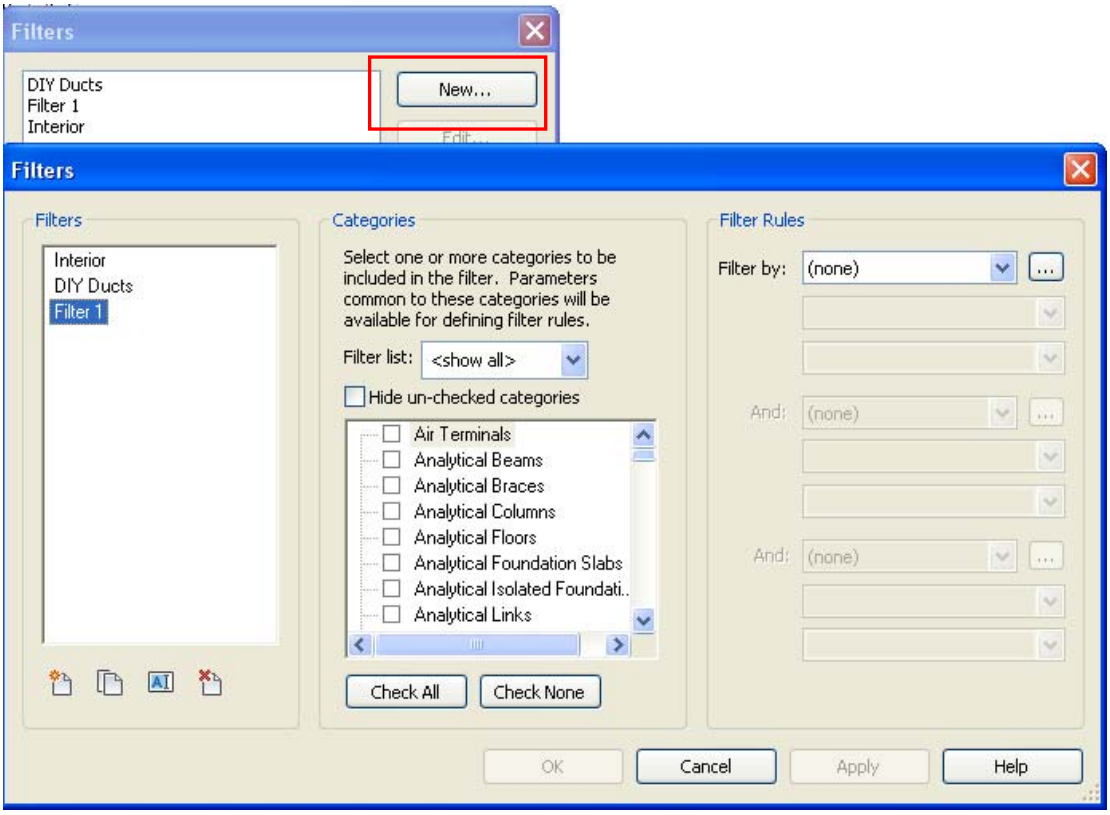
For lines, edit the line weight, line color, and line pattern.

For patterns, edit the fill color and fill pattern. (Optional) Select the Halftone check box next to a category to blend the line color of an element with the background color of the view. This produces a lighter shade for the line color.

For model categories, you can also select a detail level at which to display the element category. The detail level of the category overrides the detail level of the view. For example, you can set a wall to display at medium or fine detail level to see its structure, even if the view detail level is set to coarse. You cannot set the detail level for subcategories. They inherit it from their parent category.

9.2 CREATING A FILTER

1. Click View➢ Filters. Open a dialogue like follows,

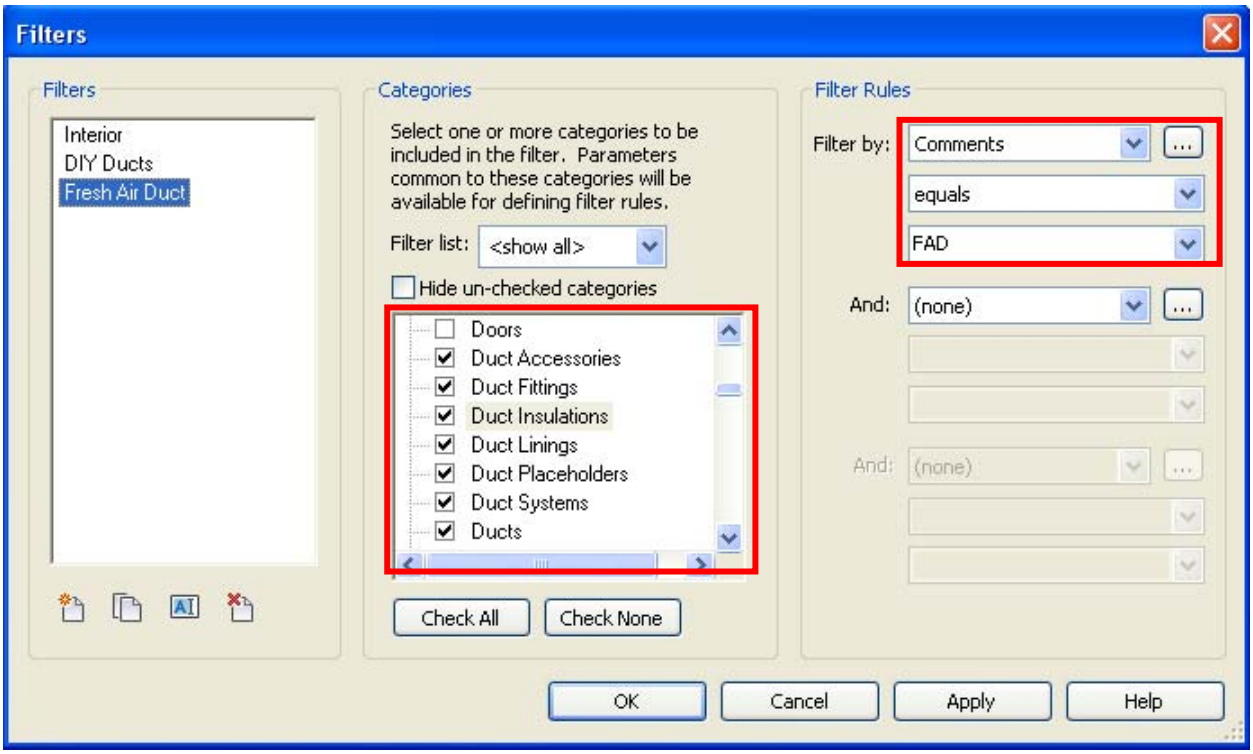


If you are creating a new filter, in the Filter Name dialog, enter a name for the filter. If you are duplicating an existing filter, the new filter displays in the Filters list.

To rename the filter, click the name, and click  (or right-click the name, and click Rename).

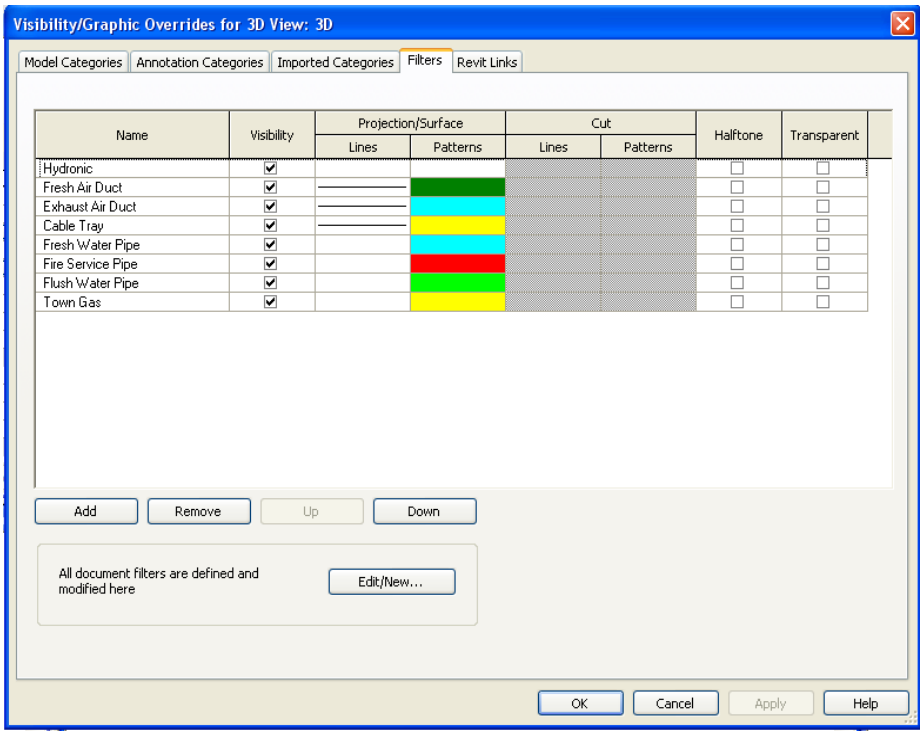
2. Under Categories, click one or more categories to include in the filter. The categories that you select determine the parameters that are available in the Filter By lists. For fresh air duct, the category will select Duct, Duct Fitting and Air Terminal.
3. Under Filter Rules, Select the filter operator from the following options:
   - **Equals**. The characters must match exactly.
   - **Does not equal**. Excludes everything that does not match the value you enter.
   - **Is greater than**. Looks for values greater than the value you enter
   - **Is greater than or equal to**. Looks for values greater than or equal to the value you enter.
   - **Is less than**. Looks for values less than the value you enter
   - **Is less than or equal to**. Looks for values less than or equal to the value you enter.
   - **Contains**. Selects a character anywhere in a string.
   - **Does not contain**. Excludes a character anywhere in a string. etc

Here, we use Comments Equals to FAD to filter the fresh air duct and air terminal. Select Duct and Duct Fittings from categories and define Filter Rules, Comments Equals FAD.

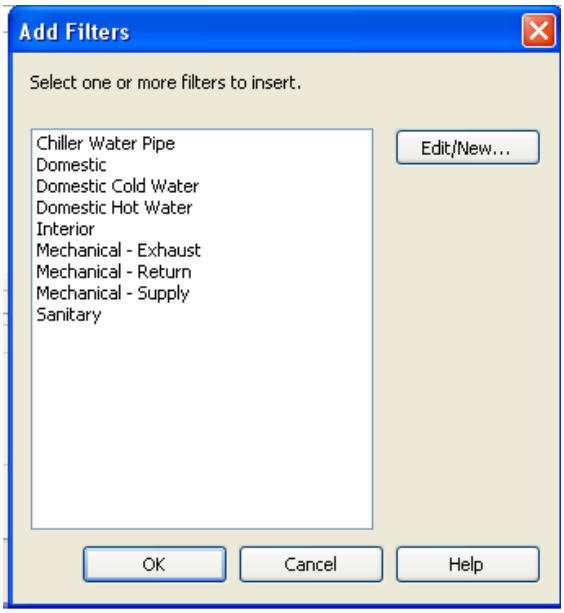


9.3 APPLYING A FILTER

After create filters, open a plan view or 3d view, use keyboard click VV.



Click Add. Open the dialogue like this.

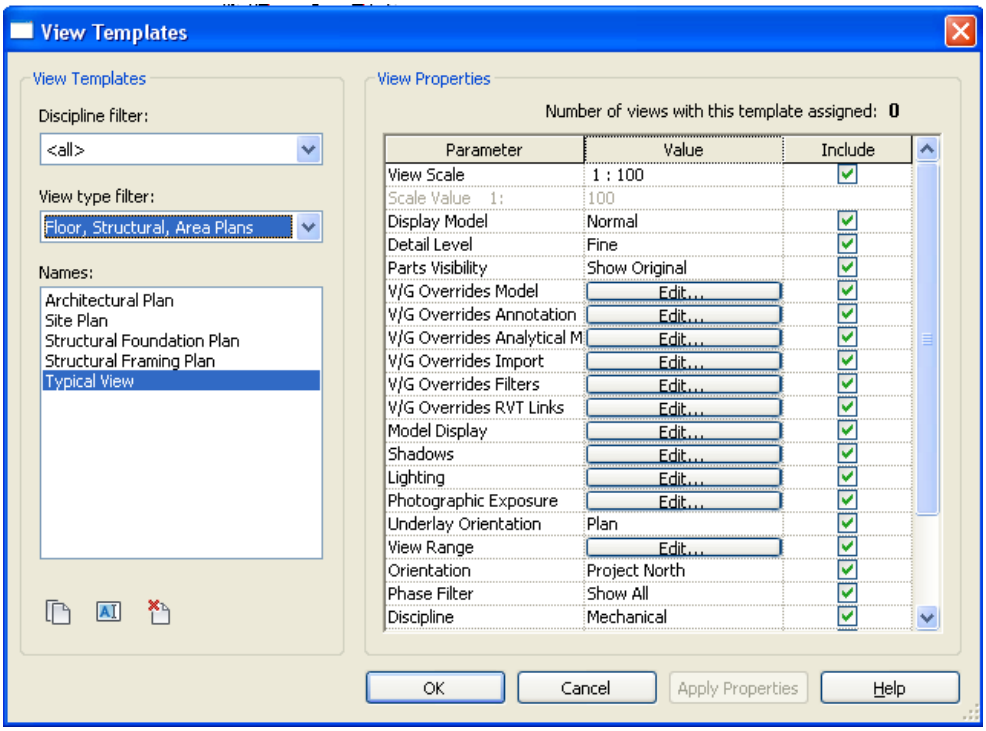


Select the filter or add new filters. Click ok and set the colors and pattern.

9.4 Creating a Filter Template

Click View ➤ View Templates drop-down.

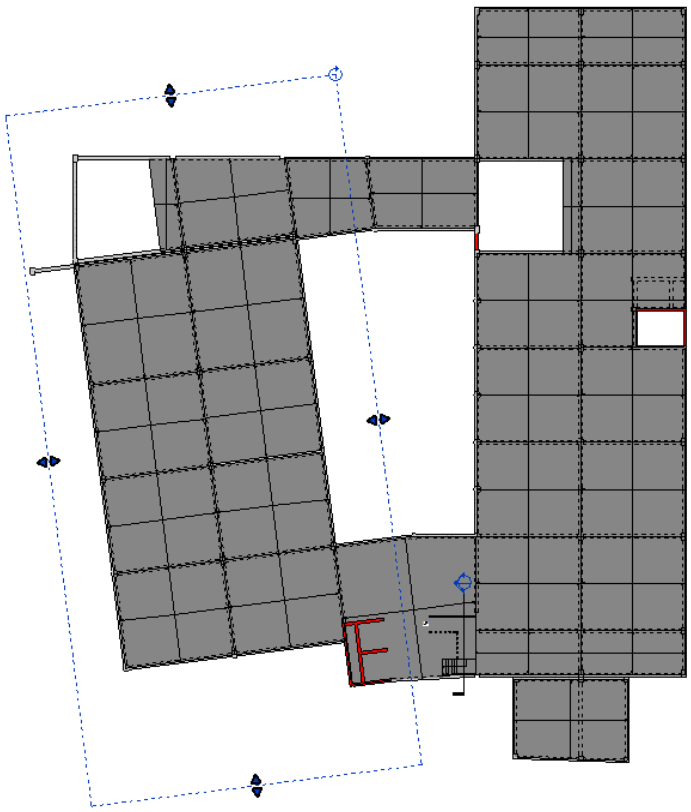
The View Templates dialog displays.



Tip: If a view has been set up all the filters, this template will remember its setting. When applying template to other view, the filter will automatically change to template filter setting.

9.5 CREATING A SCOPE BOX

Use a scope box to specify the views in which the datum elements will display. When you add grids, levels, and reference lines to a project, they can display in more views than desired. For example, when you add grid lines to a plan view, the grid lines display in all plan views of the model. However, you may want the grid lines to display in only certain views.



You create scope boxes in plan views only. After a scope box is created, you can change its size and position in a 3D view.

1. In a plan view, click View tab ➤ Create panel ➤  (Scope Box).
2. On the Options Bar, enter a name and specify a height for the scope box, if desired.
3. To draw a scope box, click in the upper left-hand corner to start the box. Click in the lower right-hand corner to finish it.
4. When you draw a scope box, it displays drag controls, which you can use to resize the scope box. You can also rotate the scope box using the rotate control and the Rotate tool.

Tip: You can also change the name of the scope box after creating it. Select the scope box, and on the Properties palette, enter a value for the Name property.

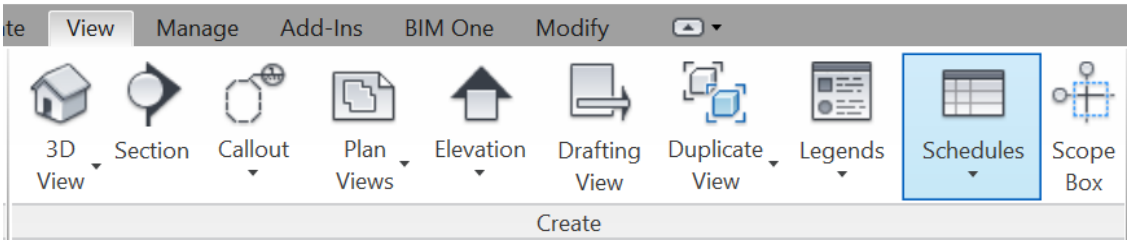
CHAPTER 10. CREATION OF BILL OF MATERIALS

10.1 ABOUT SCHEDULE

One of the uses of BIM, and increasingly a deliverable, is that what is on drawings matches what is in schedules. Revit can provide overviews of various information contained in the model.

The creation of bill materials can be achieved by the function of *Quantity Schedule* and *Material Take-off Schedule.*

- ***Quantity Schedule*** can count any data from the model. It can be wall schedule, to show wall length, wall area, or wall volume. Revit can calculate values for you in these schedules, based on the properties of model and formulas provided. For example, calculate the area and length or count the number of wall.
- **Material takeoff schedules** list the sub-components or materials of any Revit family. They have all the functionality and characteristics of other schedule views, but allow to show more detail about the assembly of a component. Any material that is placed in a component within Revit can be scheduled if material is applied.



10.2 CREATING A QUANTITY SCHEDULE

- Click View menu ➤ New ➤ Schedule/Quantities, or on the View tab of the Design Bar, click Schedule/Quantities.
- In the New Schedule dialog, select a component from the category list. A default name appears in the Name text box, which we can change as necessary.
- Select Schedule building components.
- Specify the phase.
- Click OK.
- In the Schedule Properties dialog, specify the schedule properties.
- Click OK.

10.3 CREATING A MATERIAL TAKEOFF SCHEDULE

- Click View menu ➢ New ➢ Material Takeoff.
- In the Material Takeoff dialog, click a category for the material takeoff schedule, and click OK.
- In the Material Takeoff Properties dialog, for Available Fields, select the material attributes.
- Optionally, sort and group, or format the schedule.
- Click OK to create the material takeoff schedule.
- The material takeoff schedule displays, and the view is listed in the Project Browser under Schedules/Quantities.

10.4 CUSTOMIZE SCHEDULES

To create a more workable Schedule it can be useful to format the Schedule. We can filter fields, calculate totals, etc.
In the properties window of the Schedule, by clicking any of the *Edit* buttons the Schedule Properties window opens.

10.4.1 Formatting Schedules

There are several choices available for formatting the look of the schedule.

- Specify the order and type of properties to display.
- Create totals
- Create your own custom properties, which you can then include in the schedule
- Apply phases to a schedule
- Set conditions to apply background color to cells in the schedule in order to verify design parameters are met.

In the ***Fields*** tab we can change the Fields you would like to use in our Schedule.

In the ***Filter*** tab, we can use filters to see only certain types of information in a schedule.

- We can create up to 4 filters, and all filters must be satisfied for the data to display.
- Many types of scheduled fields can be used to create filters. Types include text, number, integer, length, area, volume, yes/no, level, and key schedule parameters.

Filtering is not supported for the following scheduled fields:

- Family
- Type
- Family and Type
- Area Type (in area schedules)
- From Room, To Room (in door schedules)
- Material parameters

In the ***Sorting/Grouping*** tab you can sort our Schedule. You can also add blank lines between sorted categories. And you can choose to calculate totals. Un-checking the *Itemize every instance* will group the values in a sorted category. NOTE: grouping the values will leave some of the values blank. You will need to change the *Formatting* of these *Fields* (see next part)

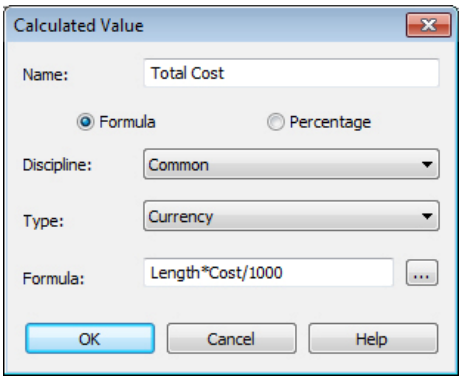
In the ***Formatting*** tab you can change the formatting of the fields in our schedule. The most important item here is the *Calculate totals* option for some of the fields. Checking this option will calculate the totals of grouped values.

10.4.2 To add a calculated value:

Formulas are used to calculate values (i.e. total costs).

- Click the *Calculated Value* button and give this value a useful name (i.e. Total Cost). Choose the right type of value from the drop down menu (in this case Currency).
- Click the **...** button behind the Formula field to see the fields that can be used for the formula. Create the formula by clicking the field you want, type the mathematical operator (+, -, *, /, etc.), click another field or value, a mathematical operator, etc.

Just make sure you end the formula with dividing by the number of units (in this example a price per meter is used and the length is in mm, so you have to divide by 1000. If Cost would be per m^2 and you'd use the area (areas are in m^2) you would have to divide it by 1 to get the cost *per one wall*.

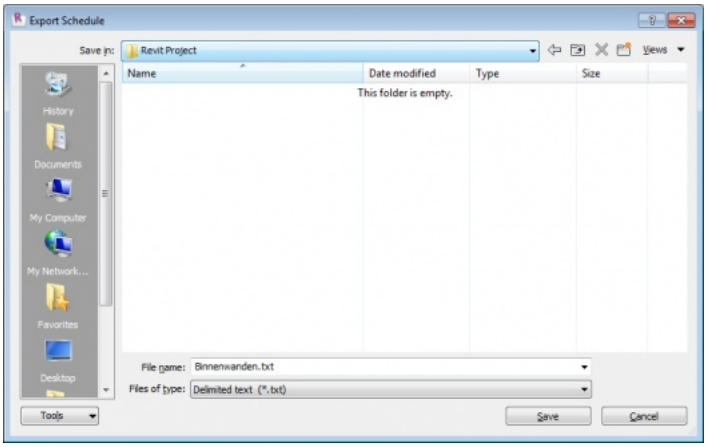


10.5 EXPORT TO MICROSOFT EXCEL

A Schedule can be exported to Excel to do further calculations or exchange data with non-Revit users.

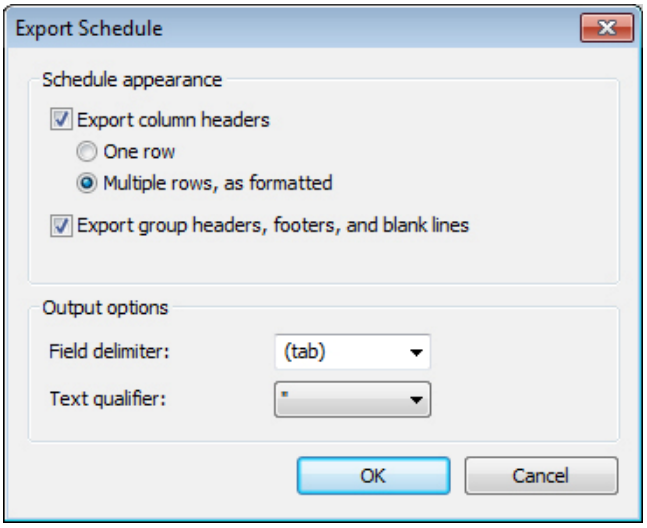
- Click the Application Button ➤ Export ➤ Reports ➤ Schedule

Choose a path and a file name to store the TXT file.



➤ Click Save.

Leave the settings as they are.



➤ Click Ok.

Open the Schedule in Excel

File » Open...

Set **Files of Type** to **Text Files (*.prn;*.txt;*.csv)**

Browse to the location where you saved the TXT file. Select the file.

Click Open

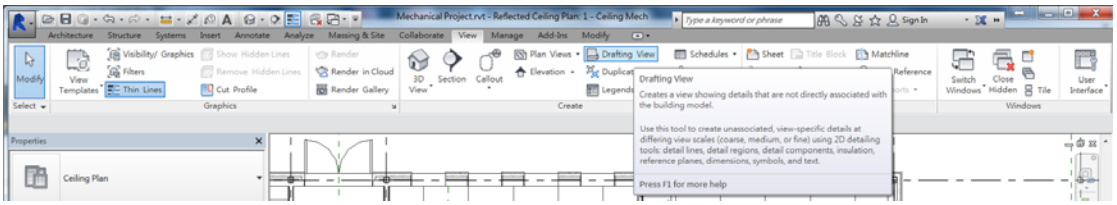
Leave all the settings as they are and click Finish

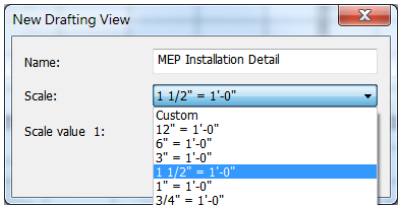
CHAPTER 11. PREPARING DRAWING AND SHEET

11.1 CREATE DETAIL VIEW

There are 2 main types of views you can create for detailing: detail views and drafting views.

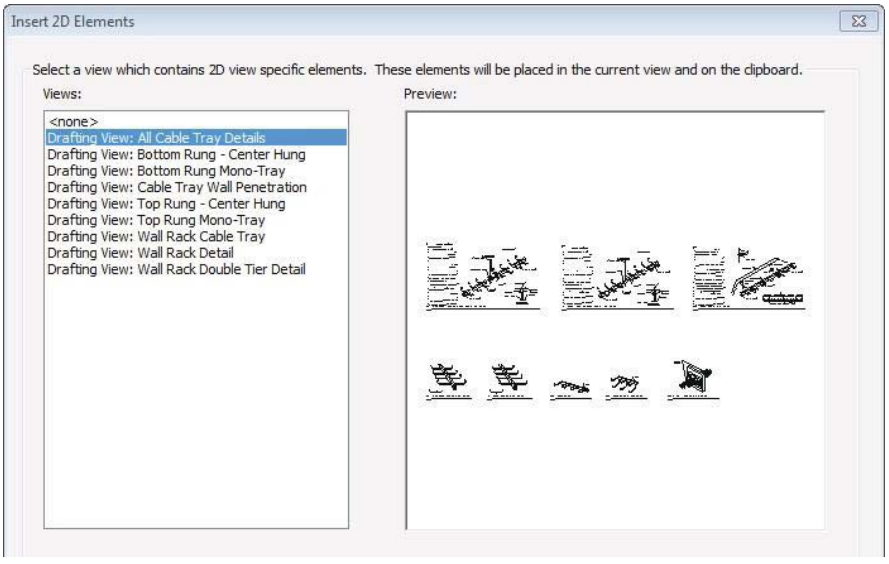
- A detail view contains elements from the building information model.
- A drafting view is a sheet of paper that is not directly associated with the building information model.





11.2 MANAGE DETAIL LIBRARY

- Saving a drafting view as a file allows to put it in a location where build a library of details and diagrams that can be accessed for use on other projects.
- Centralize all drafting view into a detail library by insert view from file function.
- Organize detail library in any manner that suits workflow or processes.



11.3 IMPORT CAD

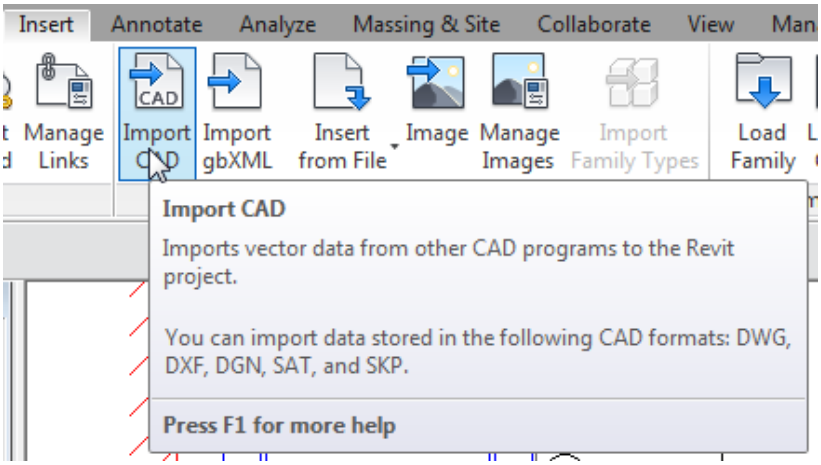
If you have already done a conceptual design in AutoCAD (or other CAD programs), then you can import a CAD file into REVIT.

Difference between Link & Import

Linking CAD means the CAD file has a relative relationship with Revit project, when CAD drawing is updated, the linked CAD drawing in Revit can be updated simultaneously.

Importing CAD file means the CAD drawing was pasted it directly into the Revit model, you can define the visibility of CAD file of its layers. And you can set the visibility of CAD drawing in different Revit views. In order to maintain the CAD drawing even when the Revit model was relocated, Import tool is suggested.

- Click Insert ➤ Import CAD ➤choose the CAD drawing from browse.



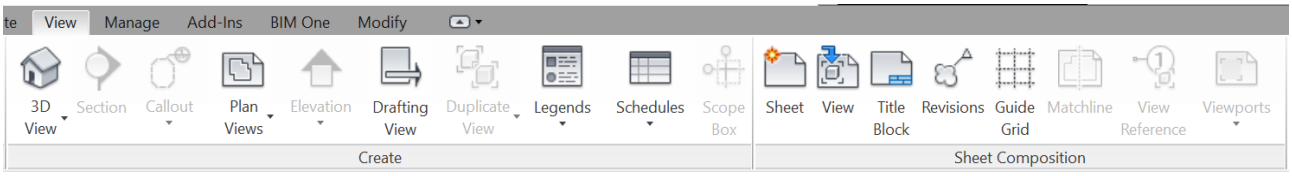
CAD Details

- One of the primary benefits of Revit is the ability to reuse CAD drawings. Making the transition to Revit can use CAD details and diagrams in your Revit projects, and re-create in Revit format to build a new library of details for use on projects.
- Converting CAD details to Revit reduces the number of CAD files have to link into projects, which helps improve file performance.

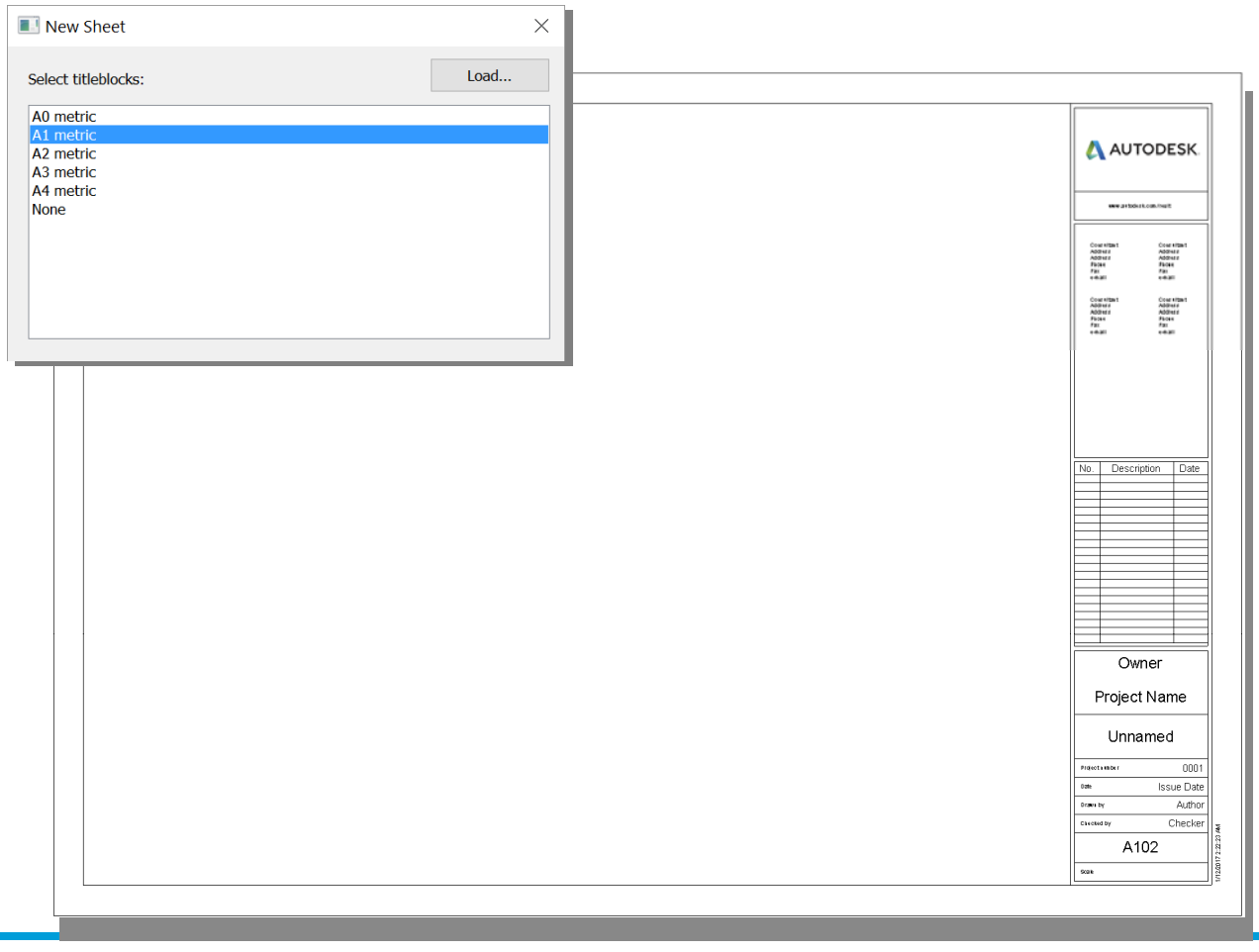
11.4 CREATE AND PRINT SHEET

11.4.1 Creating Sheets

Revit can produce construction documents of the same quality that we have grown accustomed to in traditional CAD systems.



- Sheet features that allow to combine a Titleblock and create construction documents from model which can include the schedules, details, diagrams, plan, section, and elevation.
- Titleblocks are a unique family type within Revit. A titleblock typically contains information about the project in general along with information specific to the items shown on the sheet. The most effective way to provide information on a titleblock is by using parameters.
- The use of parameters lets you make changes in a single location that updates all of your sheets in the project.



11.4.2 Preparing a Sheet

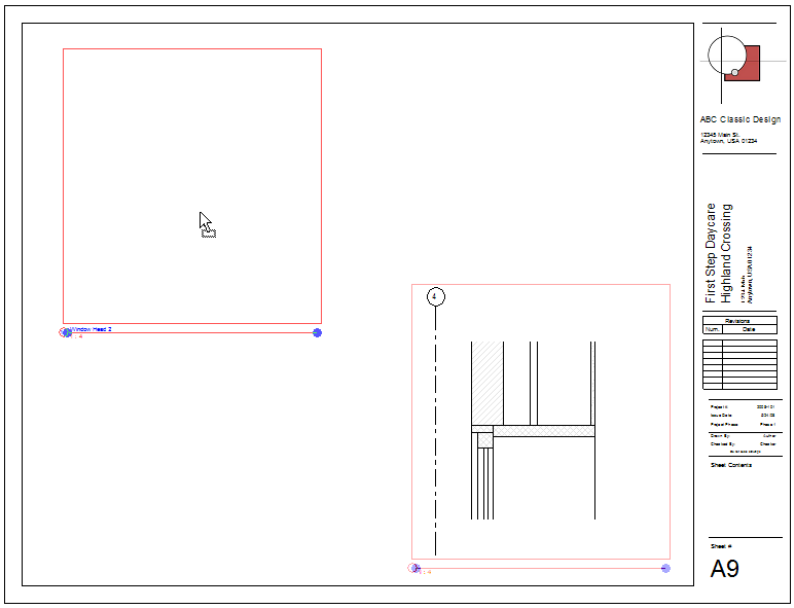
A sheet can be added one or more views of a building, including floor plans, site plans, ceiling plans, elevations, 3D views, sections, detail views, drafting views, and rendered views. Each view can be placed on ONE sheet only.
Note: Legends and schedules can be placed on multiple sheets.

To add views to a sheet

- Open the sheet.
- To add a view to the sheet, use one of the following methods:
  - In the Project Browser, expand the list of views, locate the view, and drag it onto the sheet.
  - Click View tab ➤ Sheet Composition panel ➤ (Place View). In the Views dialog, select a view, and click Add View to Sheet.
- As you move the cursor over the sheet in the drawing area, a viewport for the selected view moves with it. Click to place the viewport in the desired location. Use the Align Views on a Sheet for precise placement on sheets. Use Snap to Sheet to snap between datums in the model viewport and annotations on the sheet.
- If needed, you can modify the individual views on the sheet as follows:
  - To change the view title that displays on the sheet, double-click the title, and edit it.
  - To move the view to a new location on the sheet, select its viewport, and drag it. You can align views to grid lines for precise placement.

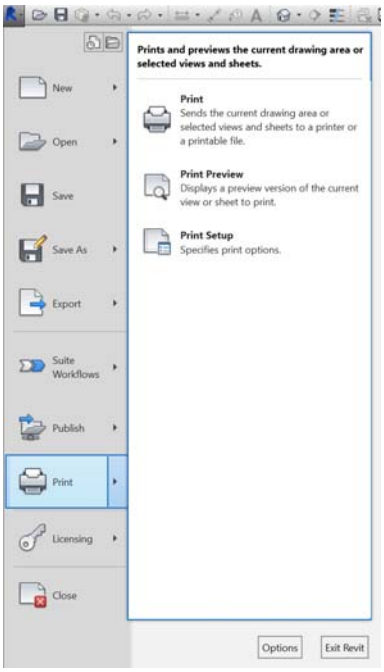
In additional,

- Change the scale of the view.
- Add dimensions to the view.
- Add text notes to the view.
- Pan the view.



11.4.3 Printing Sheets and Views

To streamline the printing process, we can create and save print setups for different type of print jobs. We can also create and save sets of views/sheets, so it is easy to reprint a set later.



- There are so many types of printers and print drivers that it would be difficult, if not impossible, to describe print settings that would work for everyone on every project. The best thing that we can do to make our printing tasks easier and more efficient is to take a sample project and experiment with different print settings until the desired results are achieved.
- Any of the views in your project can be printed, except for schedules. A schedule would have to be placed on a sheet so that the sheet could be printed.
- The Name drop-down list at the top is for saved print setups. Once you have established the settings that produce the desired print quality, you can save the setup for future use.
- In the Print Range section, choose to print what is currently visible in the drawing area or the currently open view, or you can select views and sheets to be printed
- Filter the list of available views and sheets to show only views or only sheets by using the check boxes at the bottom of the dialog box.
- Once chosen a set of views or sheets, save the selection set for future use.
- The Name drop-down at the top of the dialog box lists all the saved selection sets.