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AS10573-L

Attention to Detail: Creating Construction Details in Revit

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Learning Objectives

- Determine what to model and what not to model
- Learn how to modify detail view properties to facilitate effective communication of detail geometry
- Learn how to modify model geometry to make it usable for construction documents
- Learn how to add detail components, line work, and keynotes to finish out the detail

Description

A good model is important in a Building Information Modeling (BIM) workflow—and equally important is generating a good set of construction documents, complete with detail drawings. This class teaches you how to take full advantage of your 3D model and add 2D embellishments combined with display modification techniques to create your construction details. After mastering basic modeling in Revit software, many users hit the wall and struggle with this vital aspect of project delivery. This class will teach you how to bridge the gap between modeling and detailing.

Your AU Expert

Having been a registered architect with over 25 years of experience in Autodesk® architectural applications, Matt has worked with AutoCAD® Architecture since its initial release and Revit® Architecture since its purchase by Autodesk. Matt is an Autodesk Certified Instructor at an Autodesk Authorized Training Center. In addition to assisting customers in implementing Revit platform products, he has also consulted with Autodesk development staff in product design and usability for AutoCAD Architecture. He co-authored Architectural Desktop 2007—An Advanced Implementation Guide (Second Edition). In 2010, Matt was one of the recipients of Autodesk's Distinguished Speaker Award and has consistently been a highly-rated instructor at Autodesk University since he began presenting in 2000.

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Overview

Much attention is paid in any demonstration or class having to do with Revit on the modeling process. To be sure, this is important; without a model you don't have a project, after all. But equally important is the ability to generate construction documents that go beyond the model. Unfortunately, many firms choose to forego using the detailing and drafting tools in Revit and generate their details in AutoCAD instead. This is a bad idea for two reasons:

- Generating details in AutoCAD separates the detailing process from the Revit workflow, increasing the opportunity for errors and omissions.
- Generating details in DWG format and then importing/linking those details into the Revit project so that they can be plotted on sheets can affect the project file in adverse ways – file size can grow disproportionately to the size of the DWG files being imported, performance suffers and the project file can become unstable. In general it is not a good idea to have a lot of DWG files, if any, in a Revit project.

Admittedly, the drafting and detailing process in Revit is markedly different than AutoCAD's and that is probably the main reason that firms tend to adopt it last if at all. However once the tools have been mastered most users report that they are creating details faster and more accurately than they used to in AutoCAD. No matter how cumbersome the detailing tools may seem to be at first, remember that you are typically leveraging existing model geometry – your detail is half done before you even begin. Additionally when done properly and at the right time in the project, change management is greatly enhanced. It just takes a little investment in learning the new tools and processes.

Level of Detail

One of the most common mistakes new users of Revit make is to "over-model" – to put too much detail in the model. This can cause the model to become inordinately large very quickly, and can cause you to spend lots of time on minutiae with little or no payback. It is important to realize when it is not appropriate to model an object and to simply show certain objects in a detail as 2D geometry instead.

As a general rule of thumb, consider using the scale of your typical overall floor plans as the first "litmus test" as to whether or not you are going to model something. In a commercial project for example, your floor plan scale is probably around 1/8"=1'-0" (assuming you're working on a project in Imperial Units). If something would not normally be seen at that scale you should think twice before modeling it. That doesn't necessarily mean that you shouldn't model it, but you need to weigh the consequences and effort required to model the object against the benefits and payback. If it is something that would take a long time to model and would only be seen in one or two views then it might be better to show it using 2D detailing tools instead.

The Revit Detailing Process

Creating a hybrid 3D/2D detail (that is, a detail that is based partly on the project's model geometry and partly on 2D detail components and line work) can be broken down into four main phases or steps:

- **Turn off unwanted geometry.** This does not mean incorrect geometry. In this step you merely use Visibility/Graphics Overrides and other view properties to turn off or crop out parts of the model or project that you don't want to see in the detail.
- **Suppress or change the display of incorrect model geometry.** There usually things in a model that, when viewed at a larger scale, are incorrect. In this step you use 2D detailing tools such as Masking Regions and Cut Profiles to either suppress them entirely or to modify the way they

display themselves in the current view. It is important to note that you are not editing the model, even though it may look that way. You are merely changing the way it displays in the view.

- **Add 2D geometry to complete the detail graphics.** Once the model geometry has been stripped down to just those items that are correct, the rest of the detail can be added using 2D Detail Lines, Detail Components and Filled Regions.
- **Annotate and dimension the detail.**

The following hands-on lab will walk you through the process of creating a construction detail in Revit from start to finish.

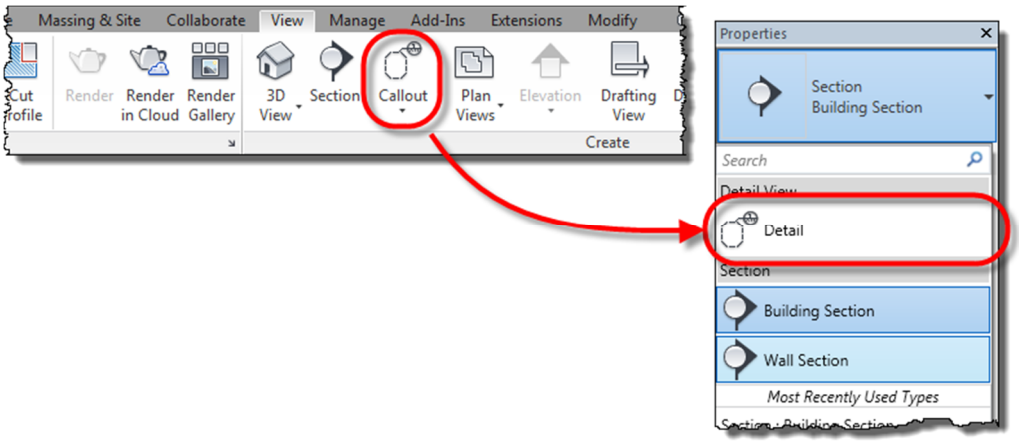
Task 1 – Create the Detail Callouts

The first step in the creation of a detail is to create a Callout View. Callouts can be used in Plan, Section or Elevation views, and once created are the same Family of View as the parent in which they were created. However, anytime you create a Callout, you have an additional View Type to choose from: "Detail". If your Callout is truly a detail and not an enlarged plan, for example, you should choose the "Detail" View Type when creating it so that it will be organized in the Project Browser with other details.

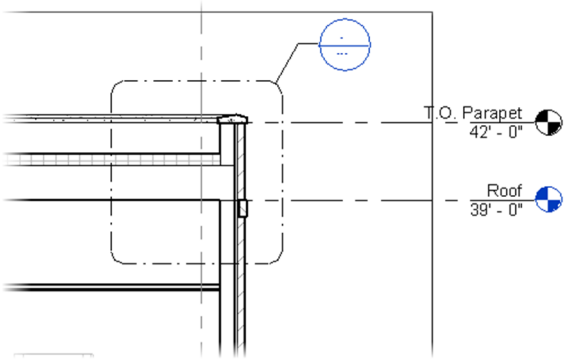
1. Open the file ***Details_1.rvt*** from the lab dataset folder. It should open in the *Level 1* Floor Plan View.
2. Double-click the Callout Bubble on the Vertical Section to navigate to the *Section 1* Building Section View.

We will create two Callout Views – one for the parapet condition and one for a typical floor/wall connection.

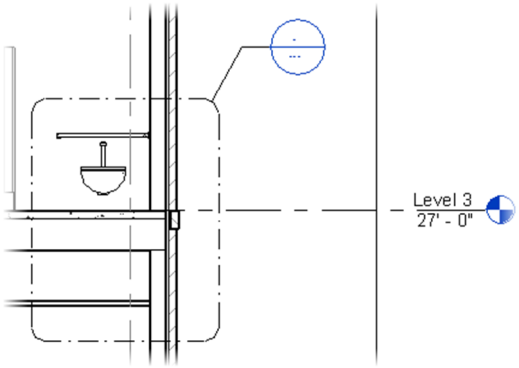
3. From the **View** tab of the Ribbon, choose the **Callout** tool. In the Properties Palette, change the Type to "Detail".



4. Place the Callout Boundary and Tag as shown in the following image. You can edit the Callout Boundary and Tag position by selecting the Callout Boundary after it is initially placed and editing the grips.



5. Create the second Callout View as shown below, again, making sure it is set to the "Detail" View Type.



6. In the Project Browser, rename the *Detail 0* Detail View to "Parapet Detail" and the *Detail 1* Detail View to "Floor/Wall Connection Detail".
7. Navigate to the two Detail Views and set their Scales to 1 ½"=1'-0" and the Detail Level to "Fine".

> ***Note:*** If you need to change the shape of the Callout Boundary, you can do so by selecting the boundary, then selecting the **Edit Boundary** tool on the Modify tab of the ribbon. This will edit both the Callout Boundary as well as the actual Crop Boundary of the view itself.

Task 2 – Modify the View Properties

The next task is to clean up the overall view, suppressing elements that are irrelevant to the detail and that may cause confusion.

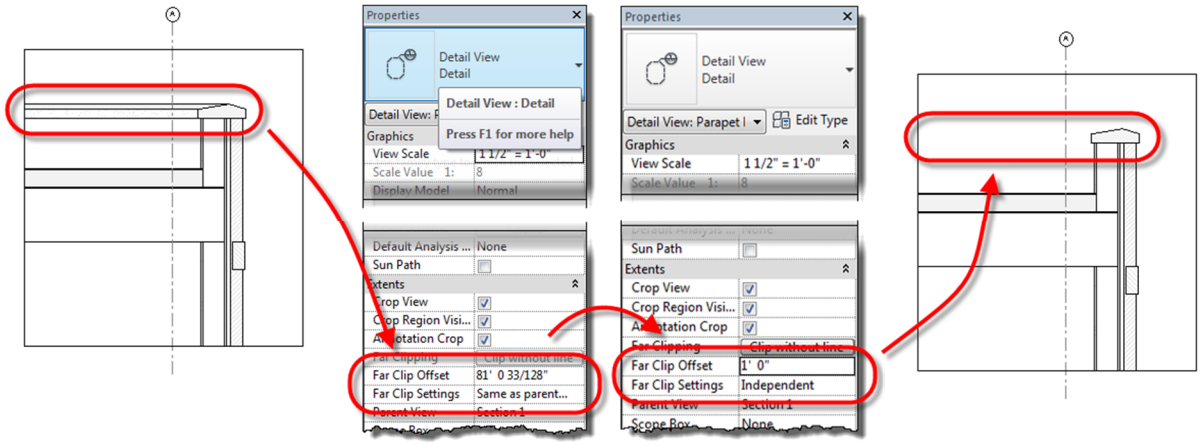
> ***Note:*** If you need to get caught up, you can open the file ***Details_2.rvt*** from the lab datasets folder.

8. Navigate to the *Parapet Detail* Detail View.
9. Use Visibility/Graphics Overrides to turn off the "Levels" category in the "Annotation" tab of the Visibility/Graphics Overrides dialog box.

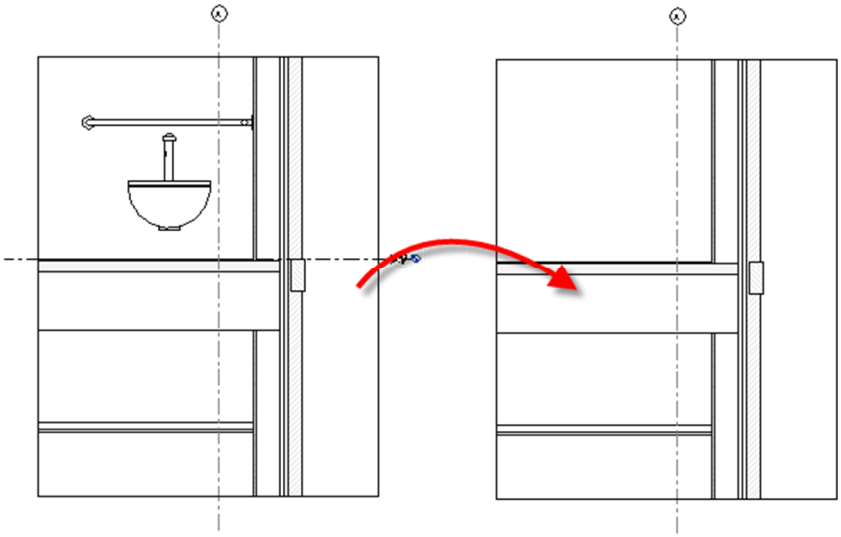
Next we need to suppress part of the parapet cap that is showing beyond the cut line of the Section. We don't want to turn off the entire "Sweep" sub-category of Walls – that would remove the parapet cap

entirely from the detail. Instead we need to modify the Far Clip settings for the view. Currently the Clip Depth is the same as the Parent view, which is a Building Section.

10. In the Properties Palette, change the Far Clip Settings to “Independent”, then set the Far Clip Offset to “1’-0”” as shown in the following image.



11. Navigate to the *Floor/Wall Connection Detail* Detail View and use the same process to turn off the Levels category and set the Far Clip Offset to 6”.



Task 3 – Modify Model Geometry for the Detail

Next we need to suppress or modify some of the model geometry that, at this scale, is incorrect. There are several “warts” in the *Floor/Wall Connection Detail* Detail View that need to be corrected.

- The Floor Slab includes a Layer for a 14K1 bar joist. In this example it was decided not to model the bar joists and the structural engineer is not using Revit, so there is no structural model to use instead. Again, the decision to model or not is one that you will have to weigh carefully in some cases. In this case, it may have been better to model the basic structure of the building to make the detailing process easier, however for this class we will use Detail Components to show

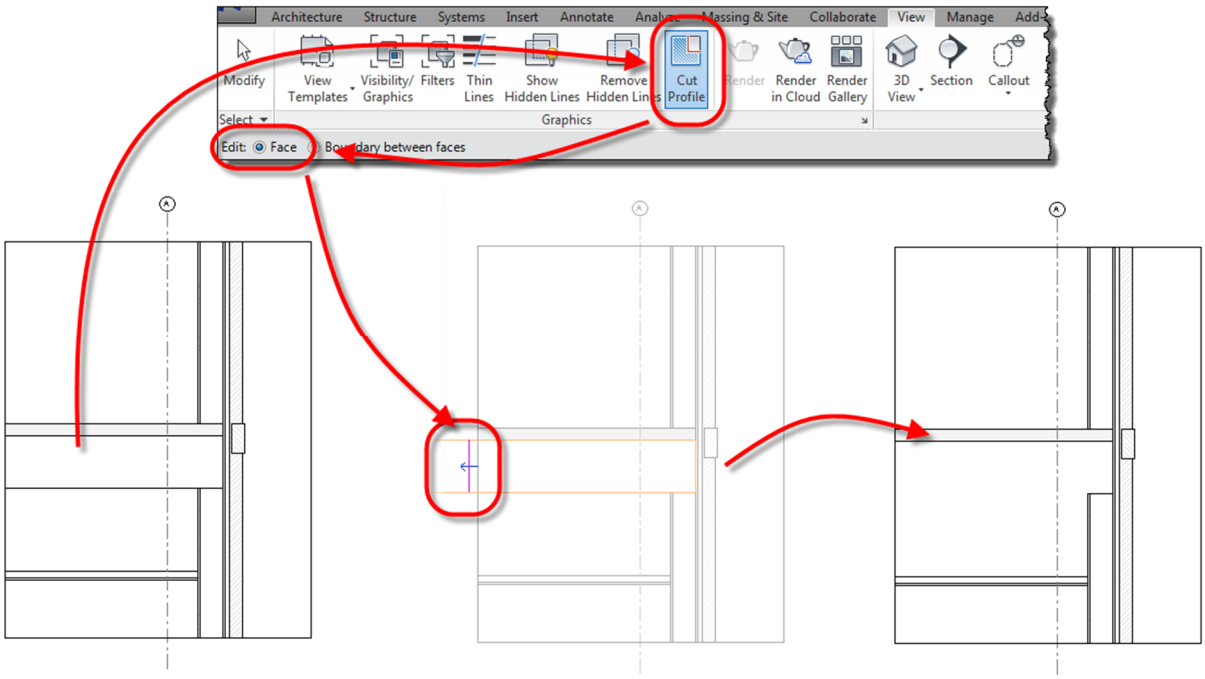
the structural framing where required. We will need to suppress the bar joist Layer in the Floor Slab and replace it with a 2D Detail Component.

- The metal stud and GWB Layers in the Wall are broken by the Floor, but in reality the stud needs to extend to the bottom of the bar joist or deck, and the GWB should extend just a little above the Ceiling.
- The boundary between the brick and air gap layers in the wall should not pass behind the soldier course. Instead it should "jog" over to the back of the soldier course, removing the thin sliver of brick hatching behind it.

To fix these issues, we'll use the **Cut Profile** tool on the **View** tab of the Ribbon. Again, it is important to remember that while it may appear that we are editing the model, we are merely changing the way that the faces (the layers in the wall and floor) present themselves in this view. It is a 2D, view-specific effect.

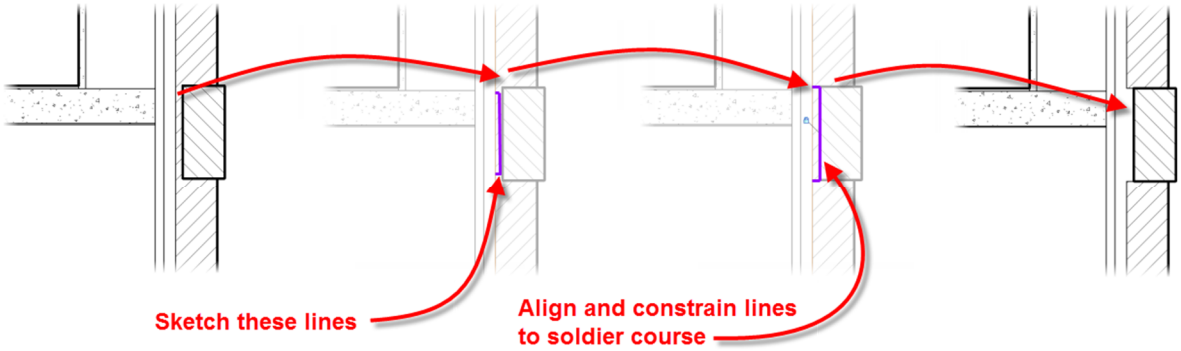
> ***Note:*** If you need to get caught up, you can open the file ***Details_3.rvt*** from the lab datasets folder.

12. From the **View** tab of the Ribbon, select the **Cut Profile** tool. In the Options Bar, make sure that "Face" is selected. Pick the Layer in the Floor that represents the 14K1 bar joist (see the image below) and draw a vertical line from the top edge to the bottom edge just outside of the view's crop boundary as shown. Make sure the blue arrow points to the right – you can select it to flip it. Finish the sketch by clicking the green check mark in the Ribbon. The bar joist layer should no longer be visible.



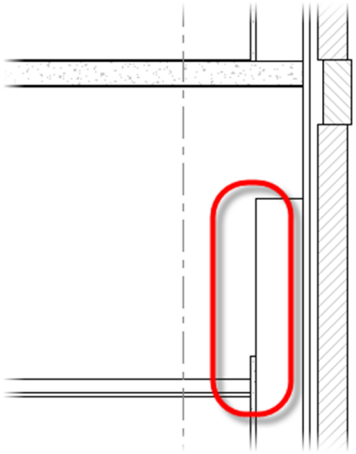
The bar joist Layer has not been deleted. It has merely been partly suppressed in this view. If you were to drag the right edge of the Crop Boundary to the right a bit you would see it. You can also select the sketch line of the Cut Profile and modify it or even delete it to bring the Layer back to full visibility.

13. Select the **Cut Profile** tool from the Ribbon again and this time, choose "Boundary between faces" on the Options Bar. Select the boundary line between the air gap in the Wall and the brick Layer. Sketch the Cut Profile line as shown in the following image. Note that the sketch is done in two steps. First, sketch the lines loosely, then use the **Align** tool on the **Modify** tab of the Ribbon to align and constrain (lock) the sketch lines to the soldier course. Click the green check mark to finish the sketch when done.



Note: By constraining the lines to the model geometry, you can reduce the amount of editing that has to be done to manage changes in the design. In this case if the soldier course has to move, the Cut Profile will follow it. Because this constraint only exists in the current view, there is very little that it can conflict with. Also, the constraint is dependent on the model. Revit will not allow the model to be modified by editing the sketch, so it's not possible for someone to accidentally move the soldier course by moving the Cut Profile sketch. While it is not always possible to use Align with constraints between model and detail geometry, you should try to do so whenever possible.

14. On your own, modify the Cut Profile of the GWB so that it extends to just a few inches above the Ceiling as shown below. The exact distance is not important.



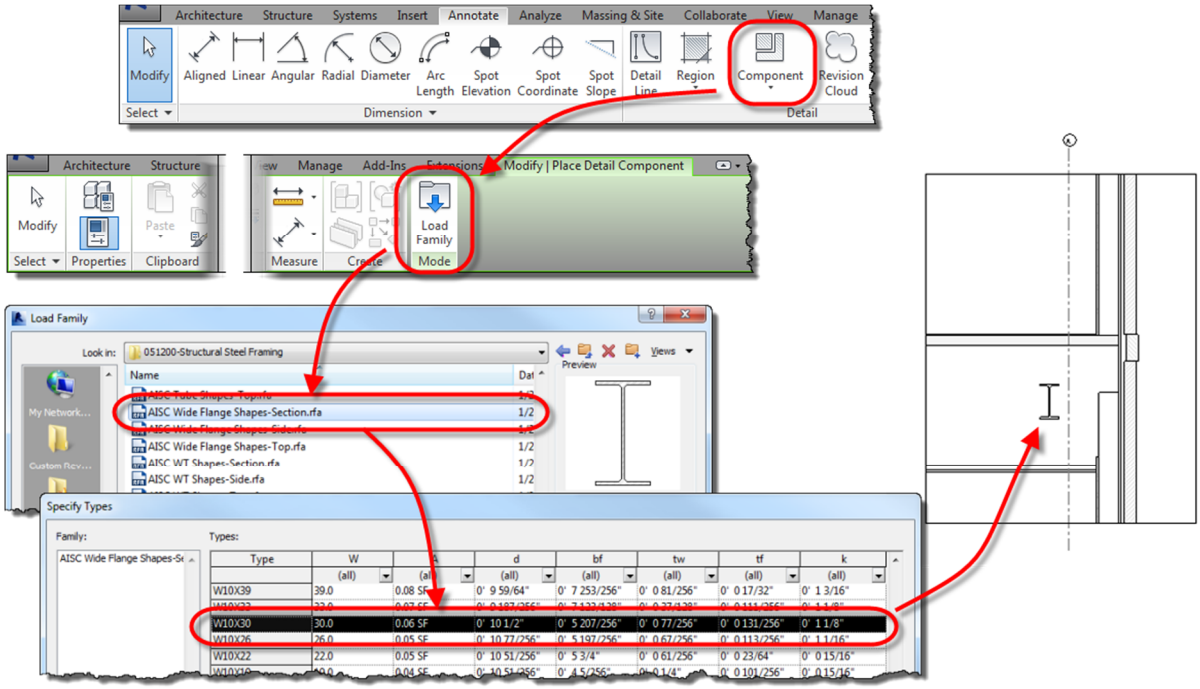
Task 4 – Embellish the Detail with 2D Geometry and Annotation

Once the model components have been modified to appear more correct for the current level of detail, we can begin to add geometry to represent those objects that we chose not to model. This can be done using a combination of Detail Components, Detail Lines and Filled Regions. All of these items are view-specific – they exist only in the view that they are created on.

First we will add the bar joist and structural framing Detail Components.

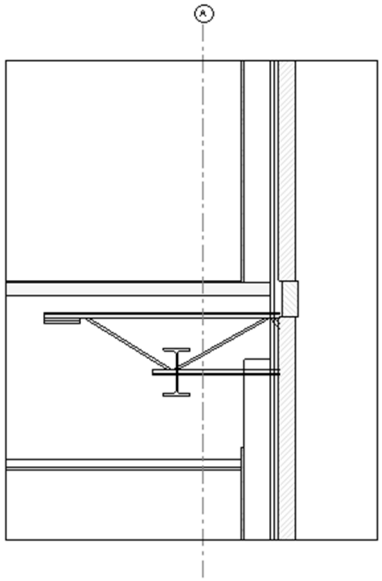
> ***Note:*** If you need to get caught up, you can open the file ***Details_4.rvt*** from the lab datasets folder.

15. From the **Annotate** tab of the Ribbon, select the **Component** tool, then click **Load Family** from the **Modify** Ribbon. Navigate to the "Detail Items" folder, then "Division 05 – Metals", then "051200-Structural Steel Framing". Select the ***AISC Wide Flange Shapes-Section.rfa*** file and click **OK**. In the Type Catalog that appears next, choose the "W10x30" Type and click **OK**. Place the beam Detail Component in the detail as shown below. The exact position is not important at this time.

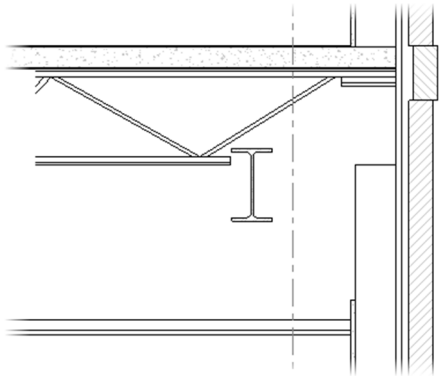


> ***Note:*** It is important that you choose the "Detail Items" folder and not the "Structural Framing" folder. Items in "Structural Framing" are 3D model components. We would have used Families from this folder if we had decided to model the structural framing instead of simply represent it in the details.

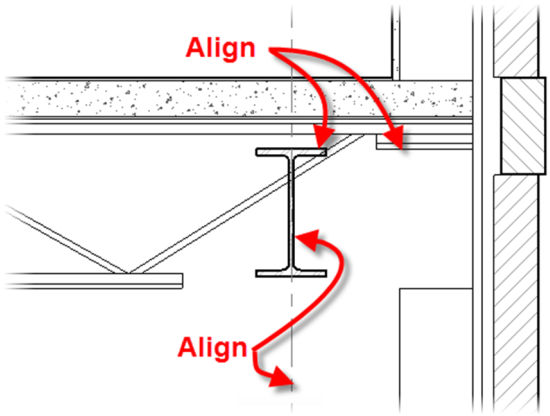
16. Use the same process to insert a bar joist. In the "052100-Steel Joist Framing" folder select the ***K-Series Bar Joist-Side.rfa*** file. Choose the "14K1" bar joist type and place it similar to the one in the following image.



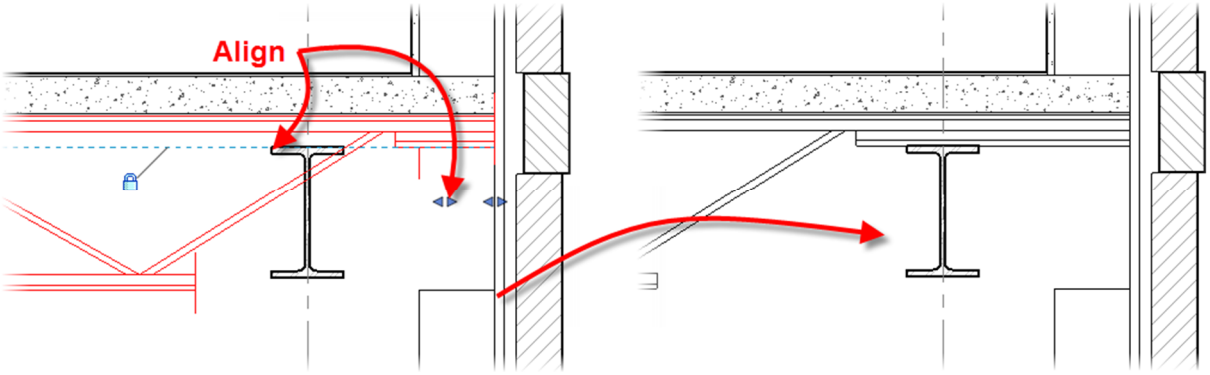
17. Select the bar joist, and from the **Modify** tab of the Ribbon, use the **Mirror** tool with "Copy" unchecked in the Options Bar to flip the Bar Joist around to the correct orientation and move it to the position shown below.



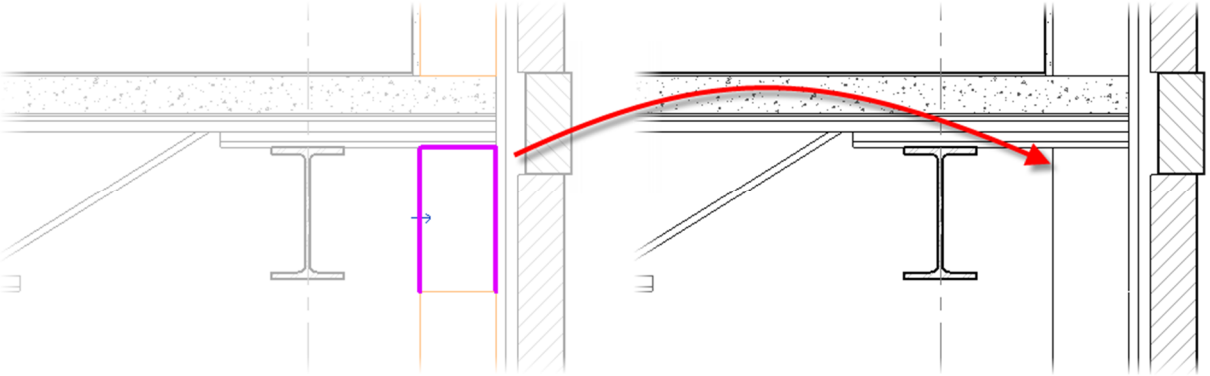
18. Align and lock the center of the beam to the column grid, and the top of the beam to the bottom of the bearing plate of the joist as shown below.



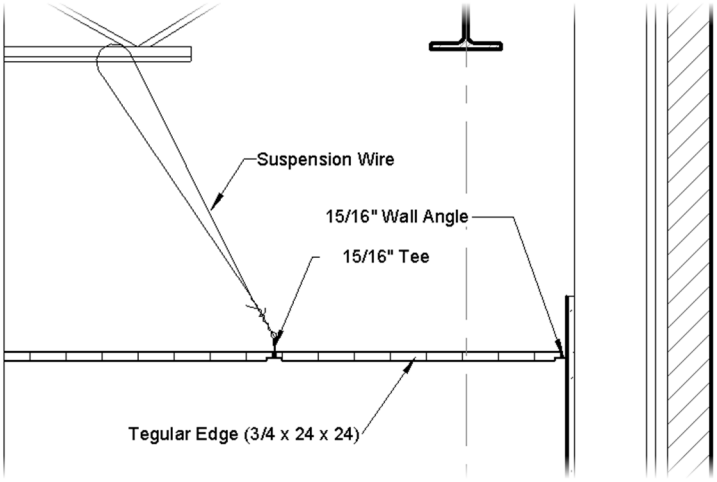
19. Align the Reference Plain in the bar joist that is at the grip locations shown below to the left edge of the beam and constrain it. (The grips will not be visible, however you will see the ghost image of the reference plane when you move the cursor across it and you will be able to select it).



20. Use the **Cut Profile** tool to adjust the stud as shown below.



21. On your own, try to add the Detail Components for the 2'x2' acoustical tile ceiling as shown below (the notes are shown for clarification purposes only – don't add them to the detail). Refer to the following page for a few tips on completing this step.



Some tips to assist you:

- All of the Detail Components you will need for this portion of the detail are located in the "Div 09-Finishes" folder under "095000-Ceilings". You can load them all at the same time by using the <CTRL> key to select multiple families.
- As we did with the bar joist and the beam, place all of the components in the general location first, then use the **Align** tool to move them into final position. Start by mirroring the Wall Angle, then aligning it with the edge of the GWB Component of the Wall and the bottom of the Ceiling element from the model.
- Once the Wall Angle has been placed, you can turn off the "Ceilings" category in the view before placing the rest of the Detail Components.
- Use the **Align** tool with constraints to place the rest of the components, with the exception of the Suspension Wire. You will need to move and rotate it into position, using the grips to make it longer.
- Once all of the Detail Components are placed, you may need to adjust the position of the right edge of the crop boundary to get the same extents as those shown in the previous image.

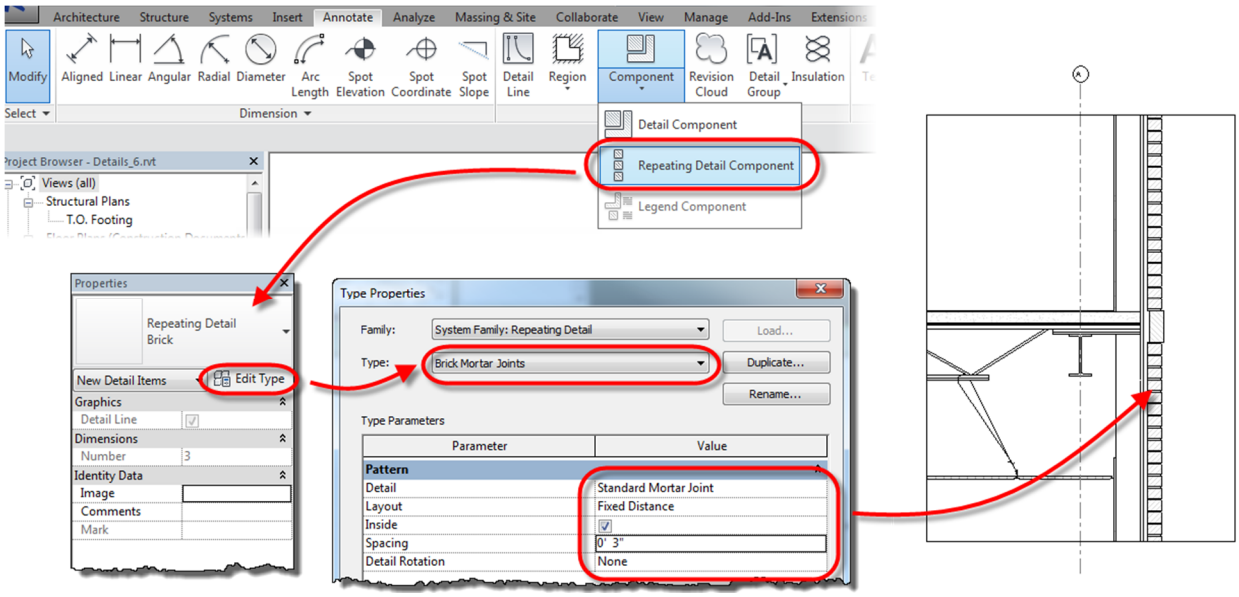
There are three additional major embellishments that need to be made:

- The brick needs to show mortar joints. While it's obviously not effective to model each and every brick, the coursing needs to be shown in the detail.
- The floor deck is not correct at this scale. For the detail it should be shown with the actual ribs that make up the deck. While Revit has the ability to include a "Structural Deck" layer in a Floor or Slab that can show the ribs automatically, the line weights for these are frequently much too heavy and cannot be modified.
- We need to show insulation in the exterior walls.

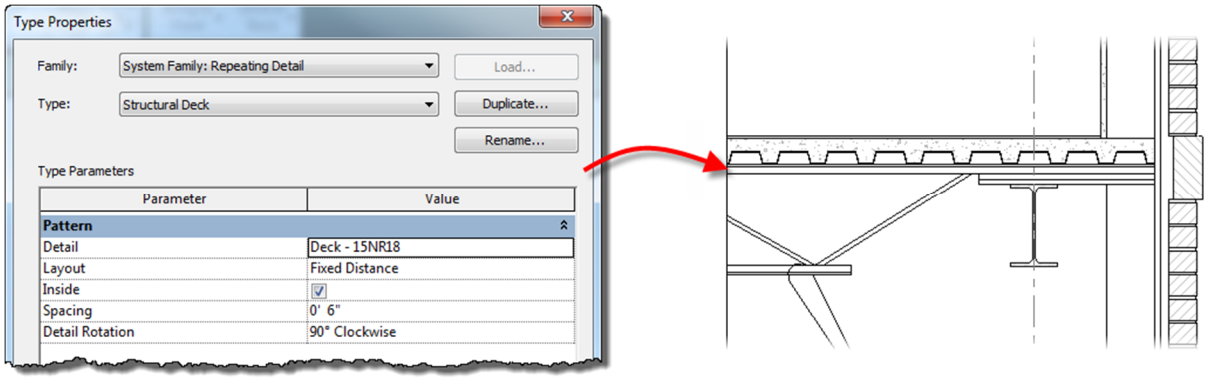
To accomplish the mortar joints and the deck, we will use Repeating Details. These consist of standard Detail Components assigned to a Repeating Detail Type.

> ***Note:*** If you need to get caught up, you can open the file ***Details_5.rvt*** from the lab datasets folder.

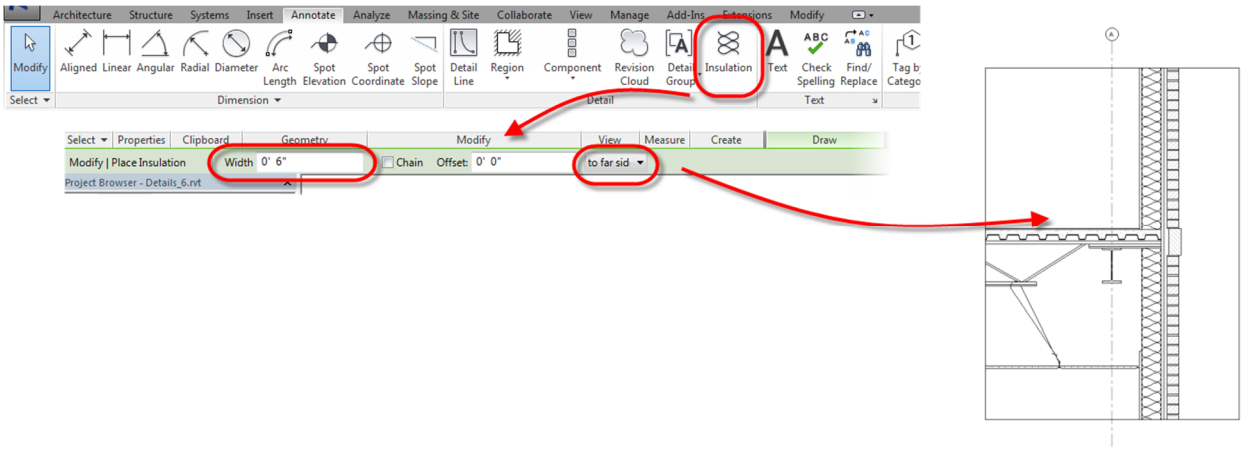
22. From the **Insert** tab of the Ribbon, select **Load Family**. Load the Families ***Standard Mortar Joint.rfa*** and ***Deck - 15NR18.rfa*** from the lab dataset folder.
23. From the **Annotate** tab of the Ribbon, select the **Repeating Detail Component** tool from the **Component** drop down menu as shown in the following image. Click the **Edit Type** button in the Properties Palette and duplicate the current Repeating Detail Type, renaming the new type to "Brick Mortar Joints". Set the Detail value to "Standard Mortar Joint", Layout to "Fixed Distance", make sure "Inside" is checked on, set Spacing to 0'-3" and check that the Detail Rotation is set to "None". Click **OK** to finish creating the Repeating Detail Type and place the mortar joints above and below the soldier course as shown in the following image. When placing the Repeating Details if you need to flip the orientation you can press the <SPACE> bar while you are picking the starting and ending points of the pattern.



24. Repeat the process above to create the deck Repeating Detail Component using the settings shown below, then add it to the Floor as shown. Note that the Detail Rotation value is set to 90º Clockwise.



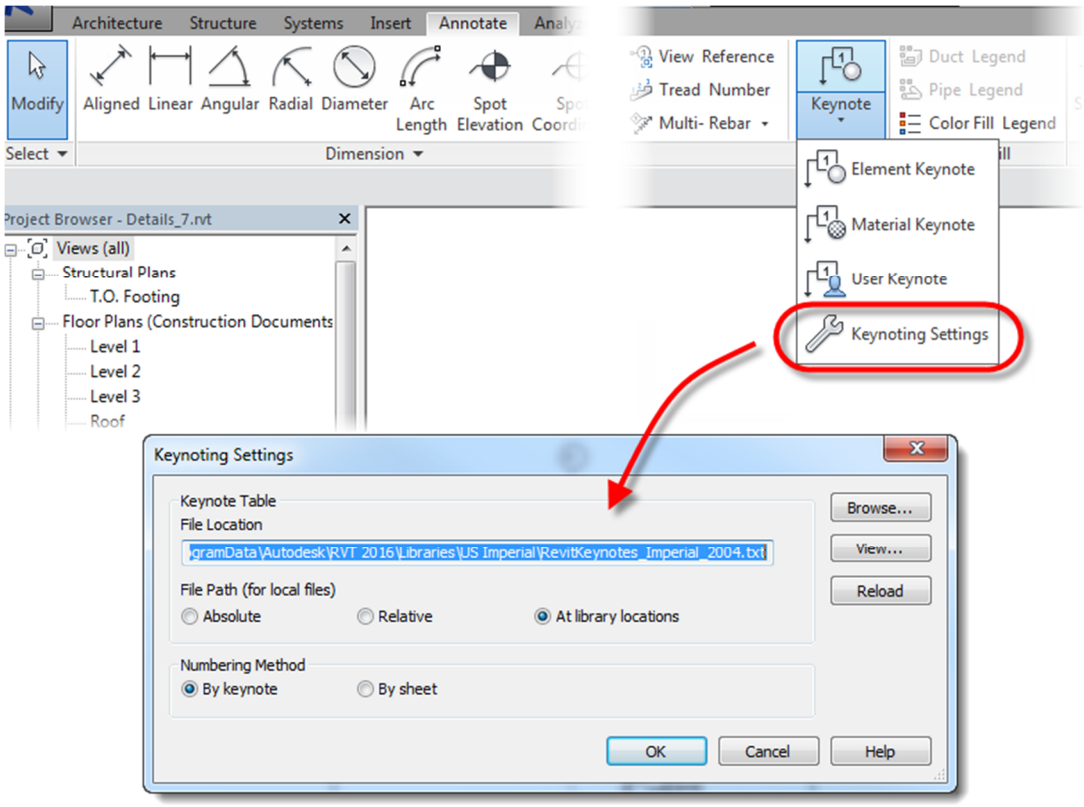
25. From the **Annotate** tab of the Ribbon, click the **Insulation** tool. In the Options Bar, set the Width to 6” and use the alignment drop down to change the orientation from “center” to “near side” to “far side” as required to draw the Insulation as shown in the following image. Note that you can dynamically change the alignment as you create the Insulation.



The detail geometry is substantially complete. While some of the line work line weights might need to be adjusted a bit, that level of development is probably best saved for later in the project. At this point it is time to add annotation. For purposes of this exercise we'll focus on Revit's Keynoting capabilities.

> ***Note:*** If you need to get caught up, you can open the file ***Details_6.rvt*** from the lab datasets folder.

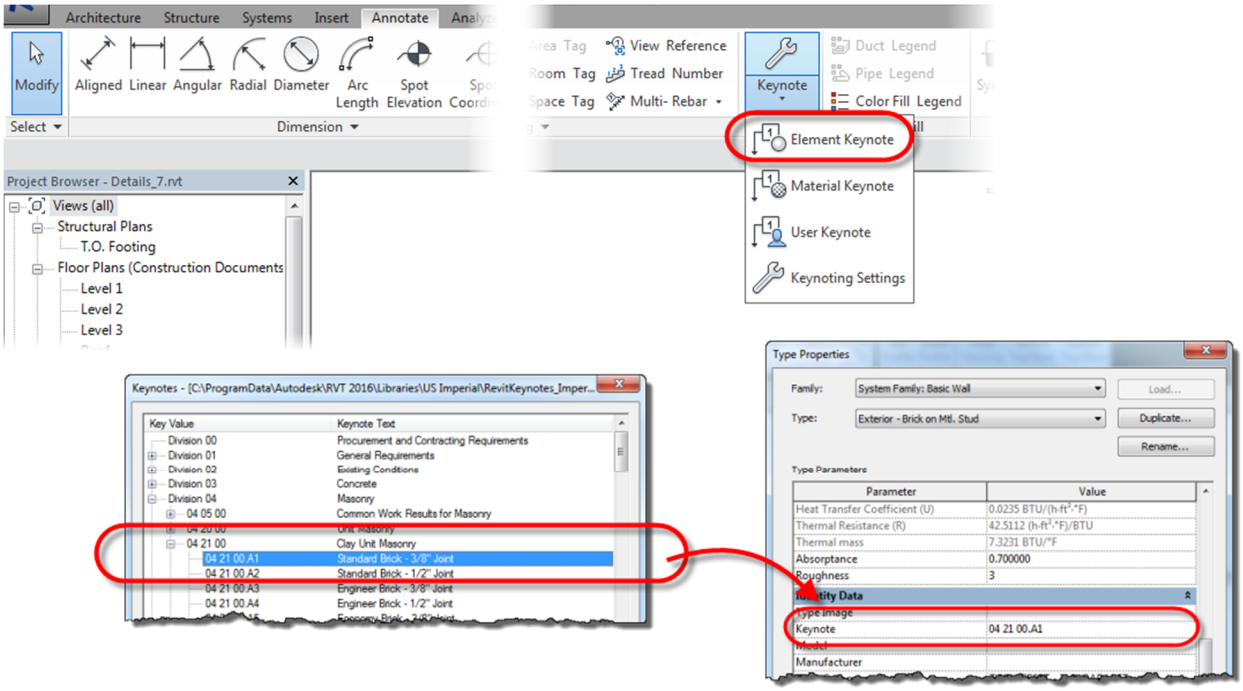
26. From the **Annotate** tab of the Ribbon, click **Keynoting Settings** from the **Keynotes** drop down menu. Make sure your settings match the figure below and click **OK**.



For purposes of this exercise, we will start with the default settings for Revit Keynoting. Most important among these settings is the Keynote Table File Location – the keynotes are actually defined in this file, which is a simple ASCII text file. You can either customize the existing file to suit your needs or build a new one completely from scratch. Information explaining how to do that is included in the supplemental documentation for this lab. Note also in these settings that we are starting out with the Numbering Method set to "By Keynote", which means that Keynote numbers will be the same for a given Element or Material regardless of which sheet or detail they fall in. In the terminology of the U.S. National CAD Standard, these are referred to as "Reference Keynotes".

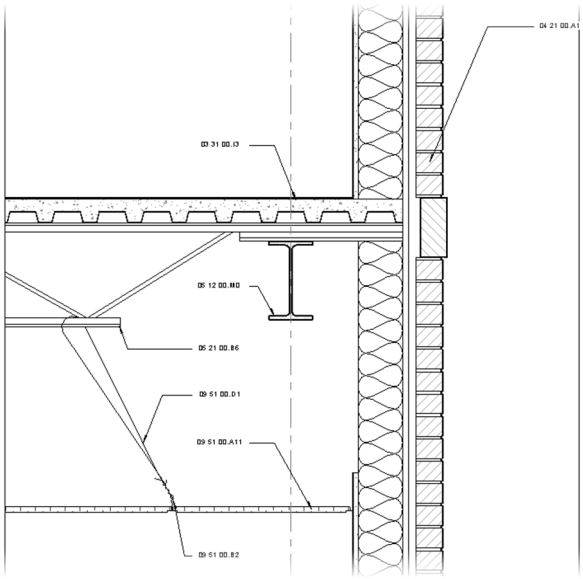
27. From the **Annotate** tab of the Ribbon, click the **Element Keynote** tool from the **Keynote** drop down menu. Change the Keynote Type in the Type Selector to "Keynote Number", then select the exterior brick Wall and place the Tag to the right. When the Keynotes dialog appears expand "Division 04 Masonry", then "04 21 00 Clay Unit Masonry", then choose "04 21 00.A1 Standard Brick – 3/8" Joint" and click **OK**.

> ***Note:*** If the Keynote disappears, you can select the crop boundary and drag the Annotation Crop boundary out to accommodate the note.

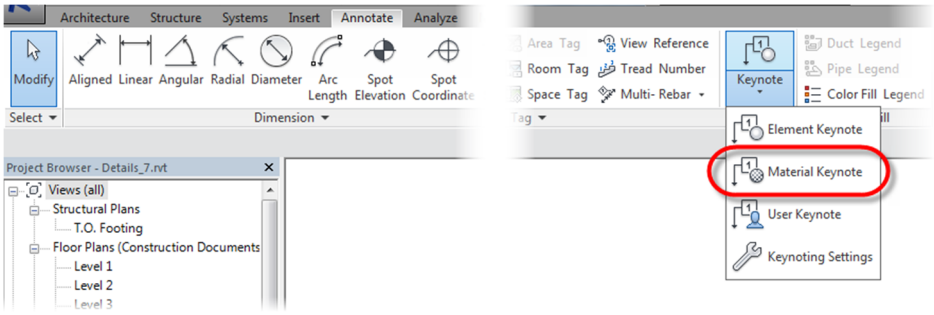


The Keynotes dialog appeared because there had not been a Keynote assigned to the Wall Type previously. By selecting the Keynote from the dialog, we actually edited the Wall Type and assigned the Keynote to it. Future selections of Walls of this particular type with the Element Keynote tool will result in the Keynote automatically being assigned. If you intend to use Revit's Keynoting feature on a regular basis, you should get in the habit of pre-assigning Keynotes to your Type and Material definitions whenever it makes sense to do so.

28. Place the rest of the Element Keynotes shown in the following image. When the Floor is selected, choose the Keynote “03 31 00.I3 3 Cast-in-Place Concrete Slab w/ Metal Decking” note.



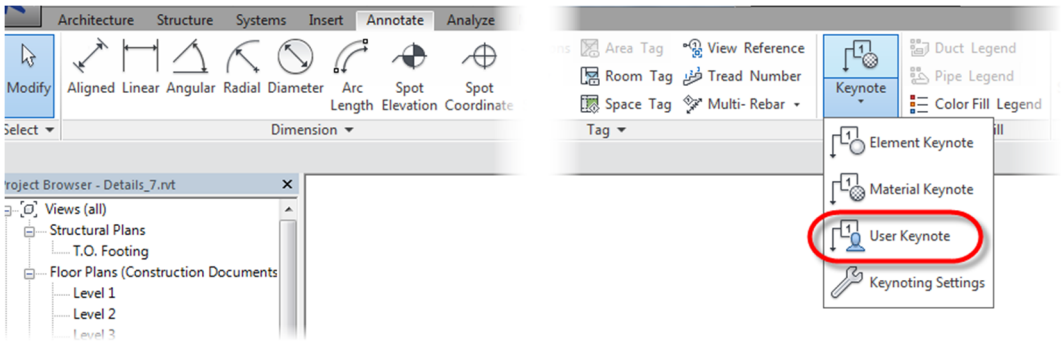
29. From the **Annotate** tab of the Ribbon, click the **Material Keynote** tool in the **Keynote** drop down menu. Select the Gypsum Wall Board layer in the Wall and place the note. When the Keynotes dialog box comes up, choose “Division 09 Finishes” then “09 29 00 Gypsum Board” for the Keynote to apply.



As with the Element Types, Keynotes can be assigned to Material Definitions. When you place a Material Keynote on a Material, if there is no Keynote assigned to it already, you will be sent to the Keynotes dialog. When you choose the Keynote, it is assigned to the Material Definition.

30. Use the same tool to apply a Keynote to the rigid insulation on the outside of the stud. When the Keynotes dialog appears, select “Division 7 Thermal Insulation”, then “07 21 00 Thermal Insulation” and finally “07 21 00.B2 1” Rigid Insulation” as the Keynote.

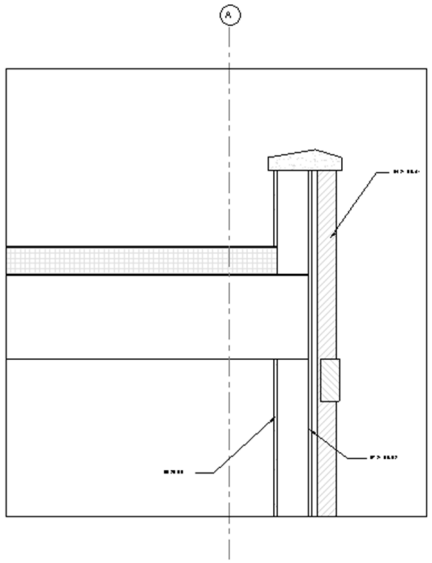
31. From the **Annotate** tab of the Ribbon, click the **User Keynote** tool in the **Keynote** drop down menu. Place the Keynote leader arrow on top of the batt insulation. When the Keynote dialog appears choose “Division 7 Thermal Insulation”, then “07 21 00 Thermal Insulation” and finally “07 21 00.A2 R13 Batt Insulation” as the Keynote.



When you place a User Keynote, any Keynote that may be assigned to an Element or Material is ignored and can be overridden. The resulting choice is not applied to the Element Type or Material Definition.

Before moving to the last part of the lab exercises, we need to add just a few Keynotes to the Parapet Detail that was created earlier, even though it has not been completed yet.

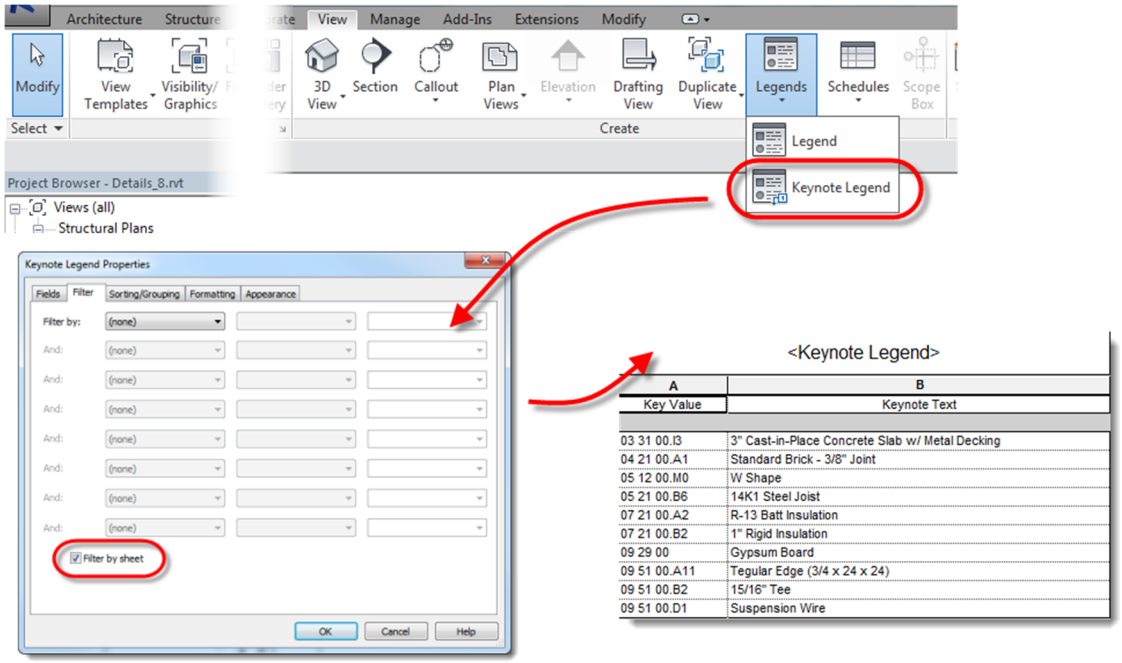
32. Navigate to the *Parapet Detail* Detail View. Add an Element Keynote to the Wall and Material Keynotes to the Gypsum Board and the Rigid Insulation layers of the Wall as shown below.



Next we will create a Keynote Legend and experiment with how Keynotes and Keynote Legends behave when placed on Sheets.

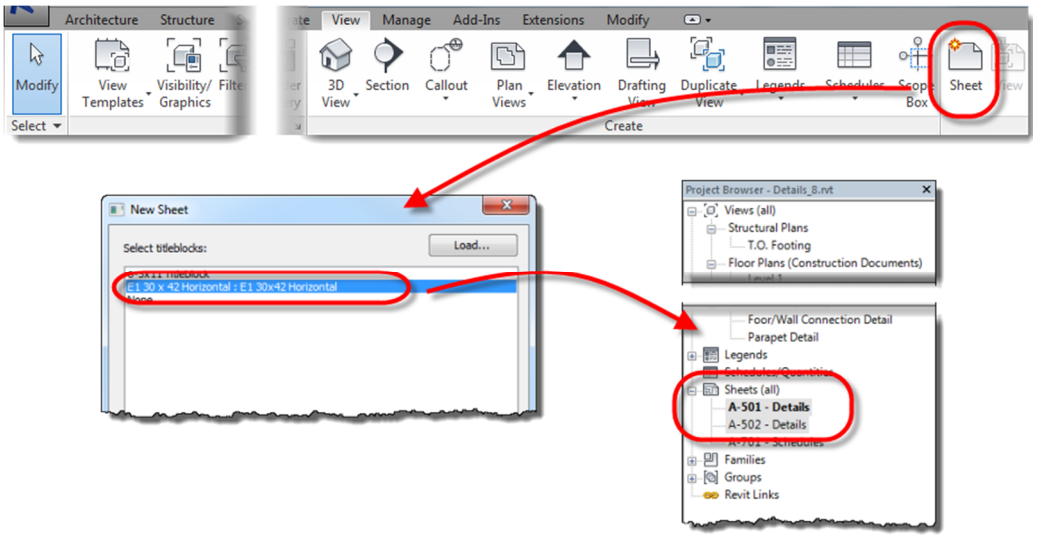
> ***Note:*** If you need to get caught up, you can open the file ***Details_7.rvt*** from the lab datasets folder.

33. From the **View** tab of the Ribbon click the **Keynote Legend** tool from the **Legends** drop down menu. Click **OK** to accept the default name of "Keynote Legend". In the Keynote Legend Properties dialog on the **Filter** tab, check on "Filter by sheet" as shown below and click **OK**.

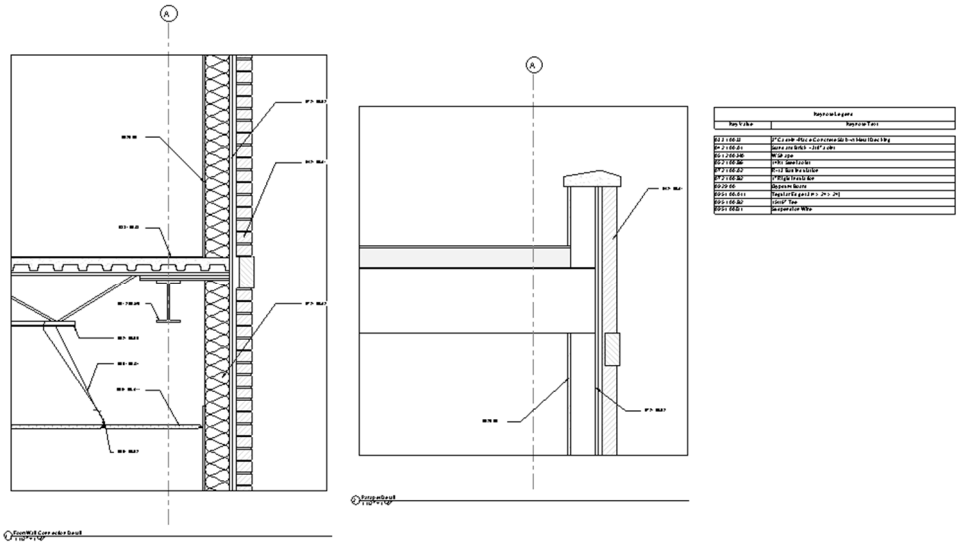


Note: Legend views can be placed on multiple sheets. The "Filter by sheet" option for Keynote Legends means that only the Keynotes that are actually displayed on the details on a given sheet will be shown in the copy of the Keynote Legend that is on that sheet.

34. Create two new Sheets using the E1 30 x 42 Horizontal Titleblock and name them "A-501 – Details" and "A-502 Details".



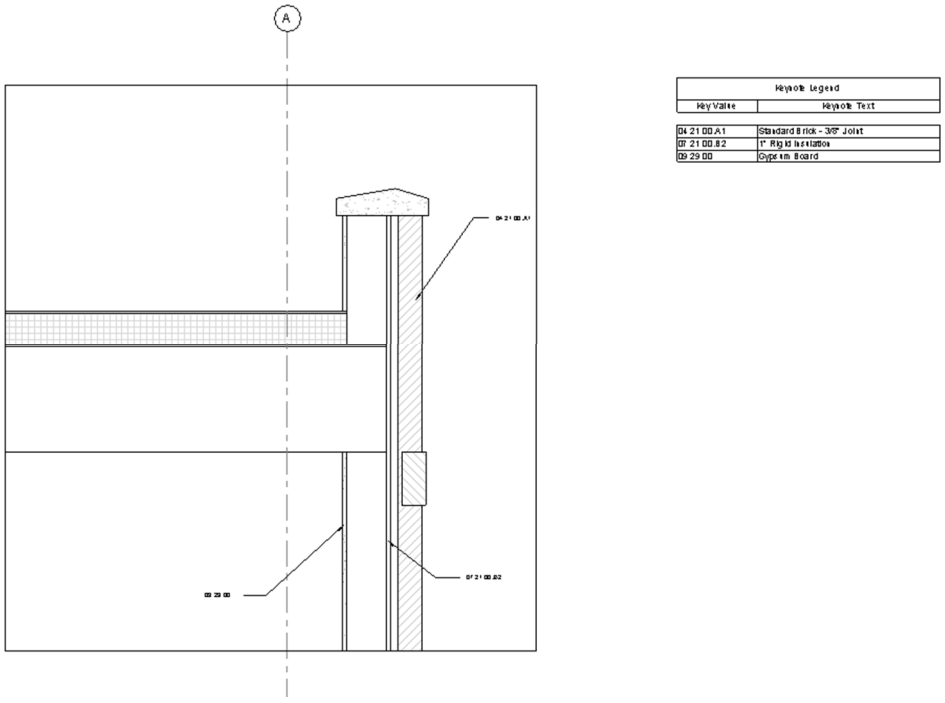
35. Navigate to the *A-501 – Details* Sheet and drag the *Floor/Wall Connection Detail* and *Parapet Detail* Detail Views onto the sheet, then drag the *Keynote Legend* Legend View onto the Sheet.



All of the Keynotes used in both Detail Views should be represented in the Keynote Legend.

36. Delete the *Parapet Detail* Detail View from the Sheet.

37. Navigate to the *A-502 – Details* Sheet and drag the *Parapet Detail* Detail View and the *Keynote Legend* Legend View onto the sheet.

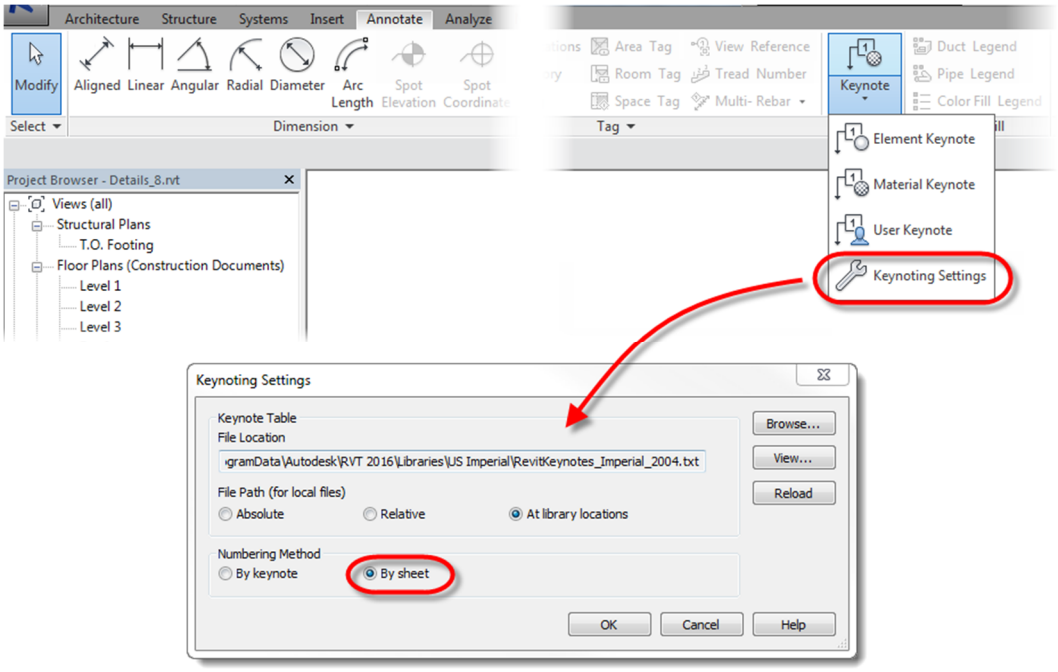


Keynote Legend	
Key Value	Keynote Text
04 21 00.A1	Standard Brick - 3/8" Joint
07 21 00.B2	1" Rigid Insulation
09 29 00	Gypsum Board

In this example the Keynote Legend should only show the Keynotes that are used in the Parapet Detail.

Revit also allows you to use Sheet Keynotes, where the Keynote numbering is unique to each sheet. In other words, the same Keynote can be numbered differently on each Sheet.

38. From the **Annotate** tab of the Ribbon, click **Keynoting Settings** from the **Keynote** drop-down menu. Set the Numbering Method to "Sheet" and click **OK**.



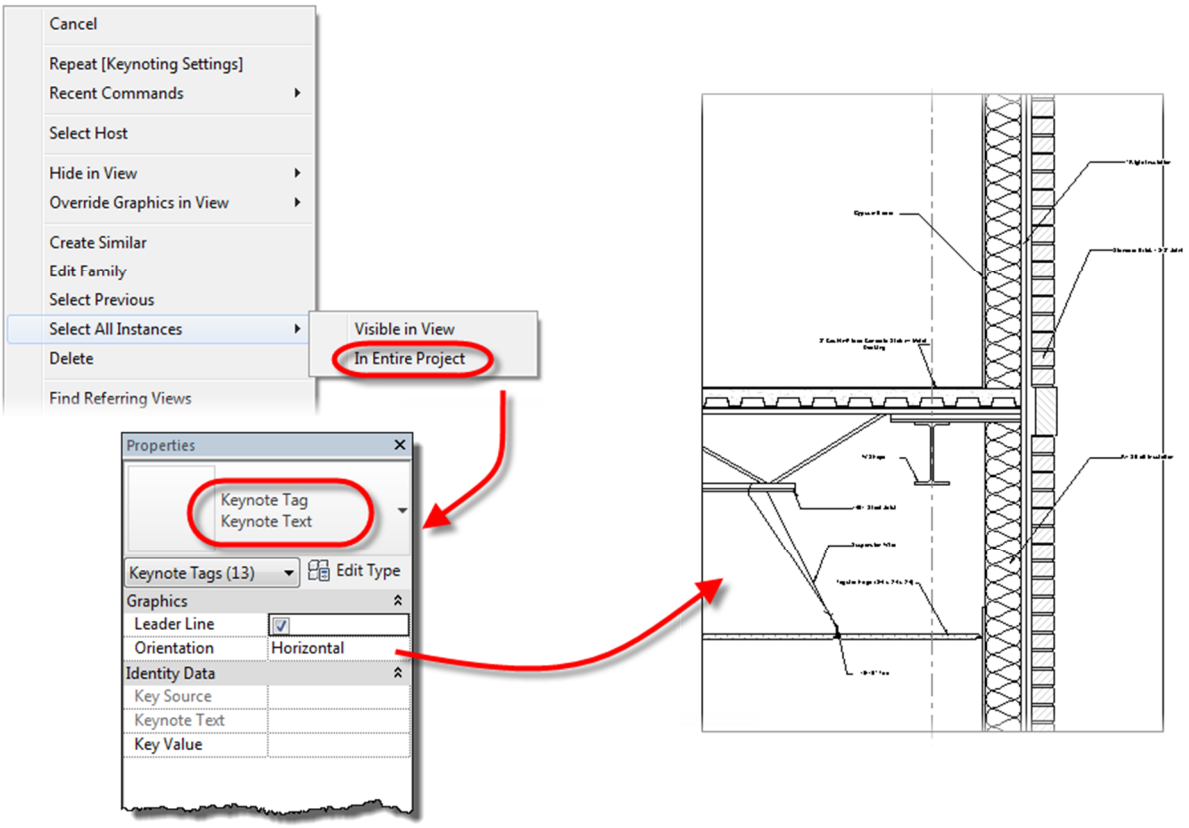
The Keynote Numbers in the Viewports and on the Keynote Legends should change to single-digit numbers.

39. Compare the Keynote Legends on the two Sheets. In particular note the numbers for the Gypsum Board the 1" Rigid Insulation notes. They should be different on the two sheets.

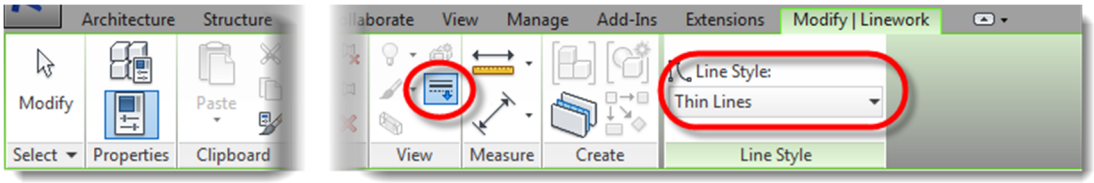
You can also use the Keynote feature in Revit to simply automate your annotation without using the Keynote numbers or legends.

40. Navigate to the *Floor/Wall Connection Detail* Detail View.
41. Select any one of the Keynote Tags, right-click and select **Select All Instances -> In Entire Project** from the menu as shown in the image on the following page. In the Properties Palette change the Keynote Tag Type to "Keynote Text".

All of the Keynote numbers should now be replaced with the actual Keynote text.



At this point the Detail is not quite complete by some standards. It may be desirable to modify some of the line weights using the **Modify Linework** tool shown below. For more on this, visit the Screencasts that are available with this lab.



Summary

In this short lab we have covered a lot of ground. Hopefully you now have a better idea of how to determine what elements of your project you should model and what elements can be more efficiently represented with 2D components in a Detail View. Critical to the Detailing process in Revit is knowing how to modify the View Properties and how to use Cut Profiles to modify the way model elements represent themselves in the view. Once you have the Detail pared down to “bare bones”, build it back up with 2D detail line work, then add your annotation: Dimensions, Text Notes and/or Keynotes.

Try these tools on your next project. With a little practice you’ll become more comfortable with this workflow and you won’t want to go back to AutoCAD to generate your details – you’ll rather keep it all inside Revit, where it belongs!