ES17637-L

Integrating Structural Design, Analysis, and Detailing: Advance Steel and Robot

Aaron M. Vorwerk
AIA, NCARB, EIT, LEED AP BD+C
Sr. Technical Sales Specialist, AEC, Autodesk

Stephen Bessette
Technical Sales Support, MEP & Fabrication, Autodesk

Exercise Guide

Please reference this document during our hands-on exercises. It has been formatted to position adjacent to your Advance Steel and RSA windows.

Exercise 1: Modeling Beams and Columns in Advance Steel

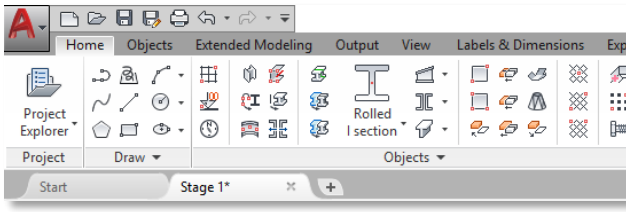
In this exercise, we'll develop an understanding of some basic modeling techniques in Advance Steel.

1. Start Autodesk® Advance Steel 2017.

2. Select **File** > **Open**.

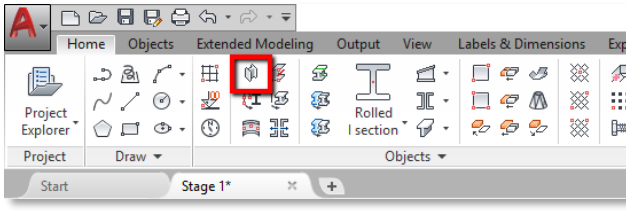
3. Choose **01- AS Model 1.dwg**.

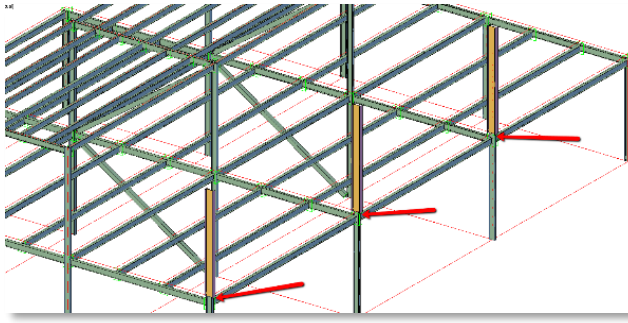
4. In the **Home** ribbon, choose **Project** > **Project Explorer.**



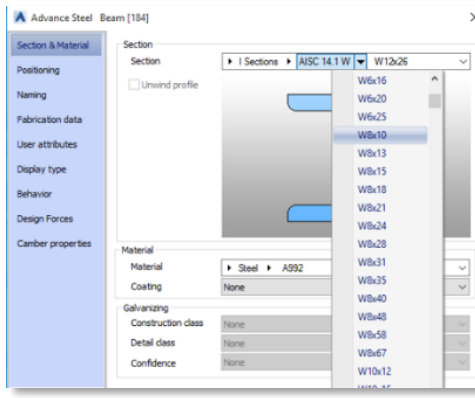
5. In the **Project Explorer**, turn off **Level 1** and **Level 2**.

6. In the **Home** ribbon, select **Objects** > **Column** and create 3 columns.

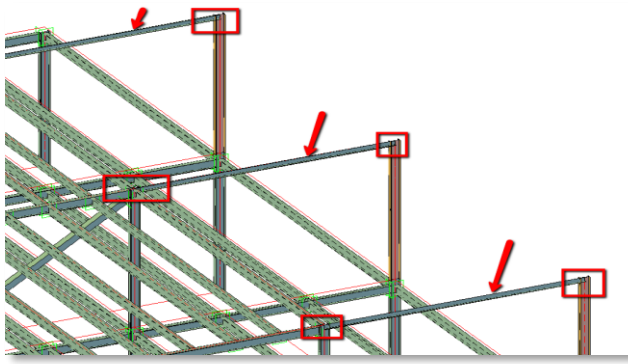




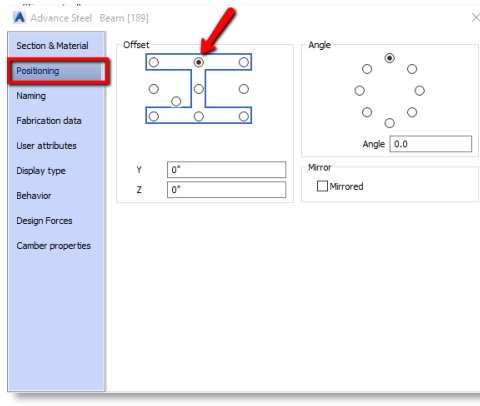
7. In the **Advance Properties** dialog box, change the column size to **W8x10**.



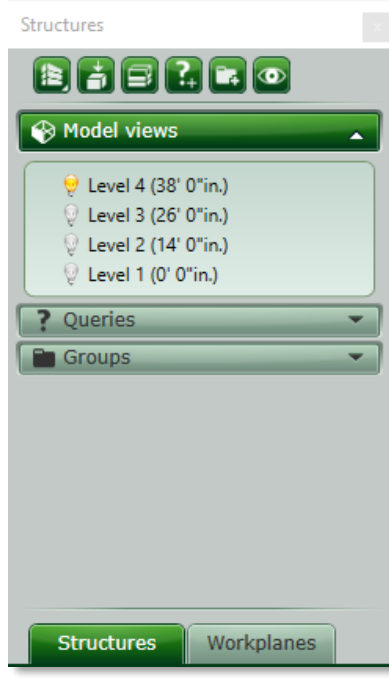
8. In the **Home** ribbon, select **Objects** > **Rolled I section** to draw the main beams. Connect these from node to node at the top of the columns.



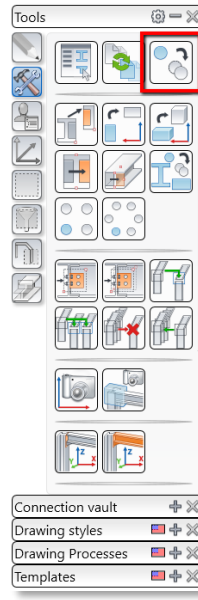
9. In the **Advance Properties** dialog box, change the beam positioning to **top flange**.



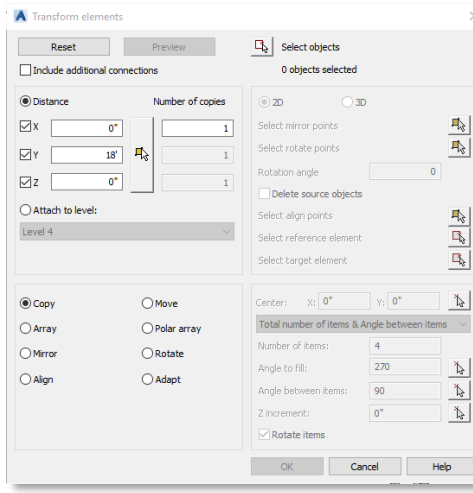
10. In the **Home** ribbon, select **Project** > **Project Explorer** and turn off **Level 3**.



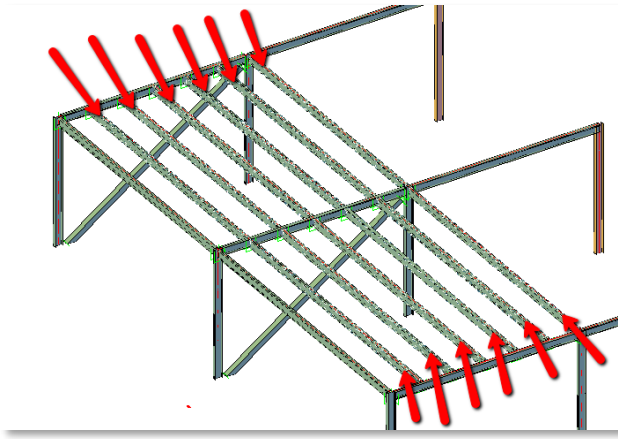
11. In the **Advance Steel Tool Palette** > **Tools** menu > select **Advance Copy**.



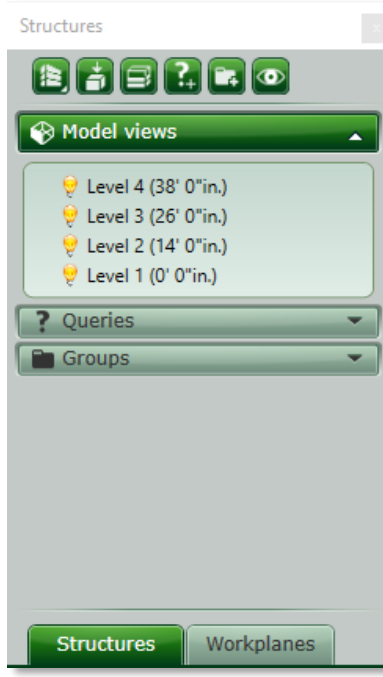
12. In the **Transform Elements** dialog box, enter **18'** for the **Y** component and click **Select Objects**.



13. Select the existing beams (see image).

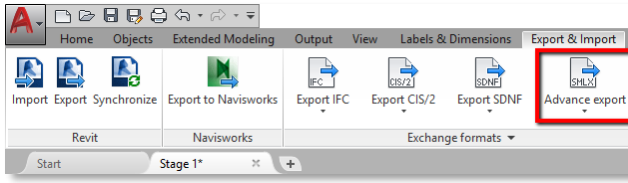


14. In the **Home** ribbon, select **Project** > **Project Explorer** and turn on all of the levels.



15. Save the model.

16. In the **Export & Import** ribbon, select **Exchange Formats** > **Advance Export** to export the model to the SMLX file format (**01 – AS Model 1.smlx**).



Exercise 2: Code group design for steel members using Advance Steel and RSA

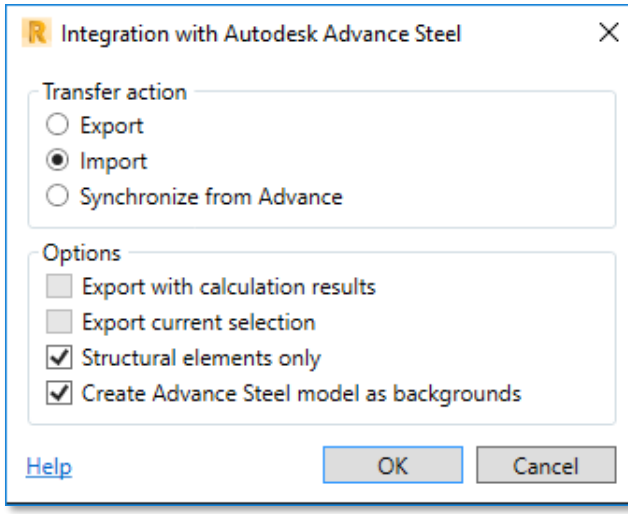
In this exercise, we'll start by importing our model from Advance Steel to RSA. We'll then prepare and perform analysis on the structural model in RSA. We'll review the results of the analysis and perform code group design on a selected set of members. Finally, we'll export the updated model for use in Advance Steel.

Import Advance Steel into RSA

1. Open **RSA** and start a new Building Design project.

2. Select **Add-ins** tab > **Integration** > **Autodesk Advance Steel**.

3. Select **Import** and then **OK**.



4. Select **02 – AS Export.smlx** and then **Open**.

5. RSA will open and begin importing the Advance Steel model data.

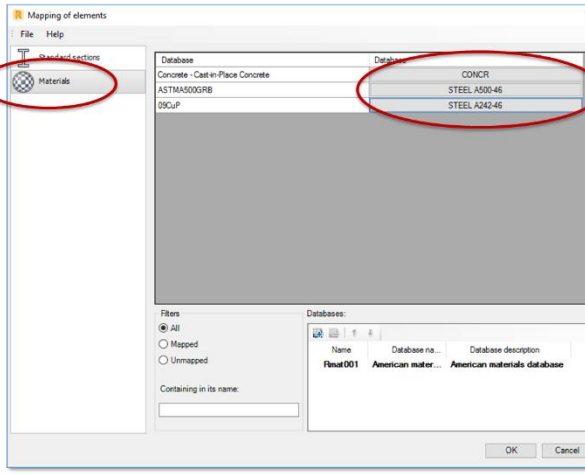
Map sections and materials

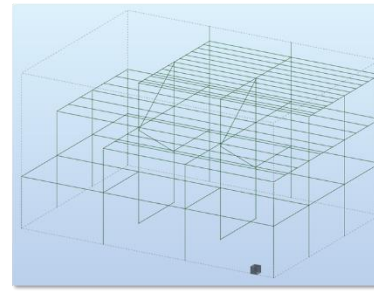
6. In this example, a few materials need to be mapped.

7. In the **Mapping of elements** dialog, Select **Materials** at left, then click the buttons to the right of each material and set to the values shown and listed below.

   *(Concrete – Cast-in-Place Concrete = **CONCR**; ASTMA500GRB = **STEEL A500-46**; 09CuP = **STEEL A242-46**)*

8. Click **OK** when finished to view the imported geometry.

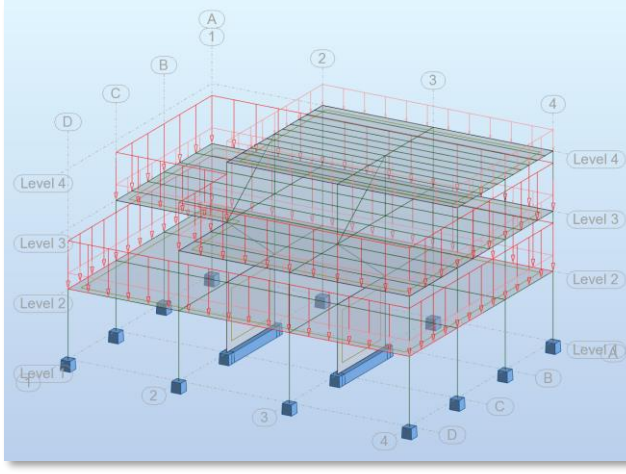




Add supports, panels, and loads

9. Open **04 – Analysis Start.rtd**. To save time, much of the prep work on the imported model has been completed for you.

10. Note that grids, levels, supports, panels (i.e. slabs and walls), and loads are visible in this model.

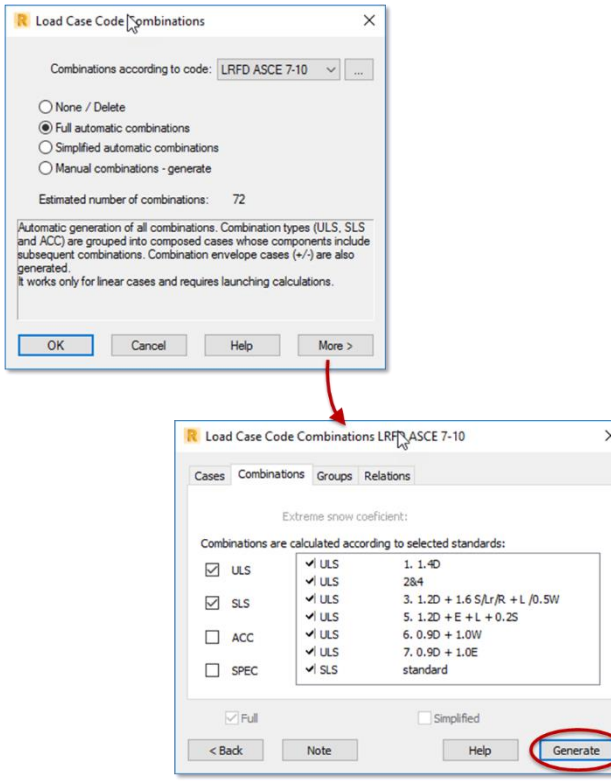


Generate load case combinations

11. Select **Loads** tab > **Automatic Combinations** to open the Load Case Code Combinations dialog.

12. Select **Full automatic combinations**, then click **More** to view the combinations in more detail.

13. Select **Generate** to build out the load combinations list per ASCE 7-10.

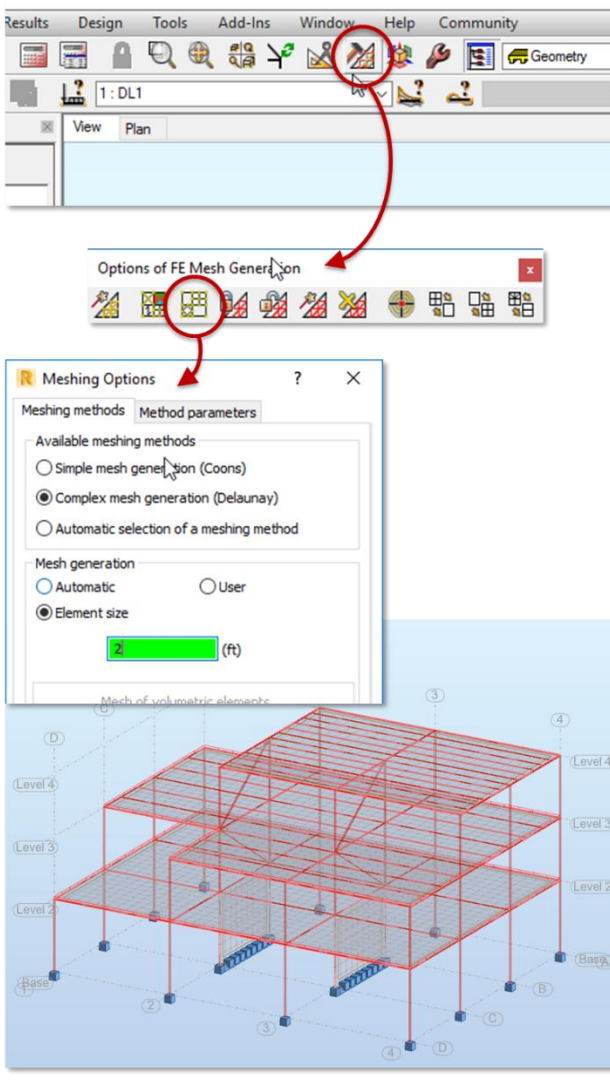


Create finite element mesh

14. Click the **Options of FE Mesh Generation** icon to open this toolbar, then choose **Meshing Options** (select **Yes** to the pop-up message to select all panel elements).

15. Select **Complex mesh generation (Delaunay)** and set the **Element size** to 2 feet. Select **OK**.

16. Select **Generation of calculation model** to create the FE mesh.



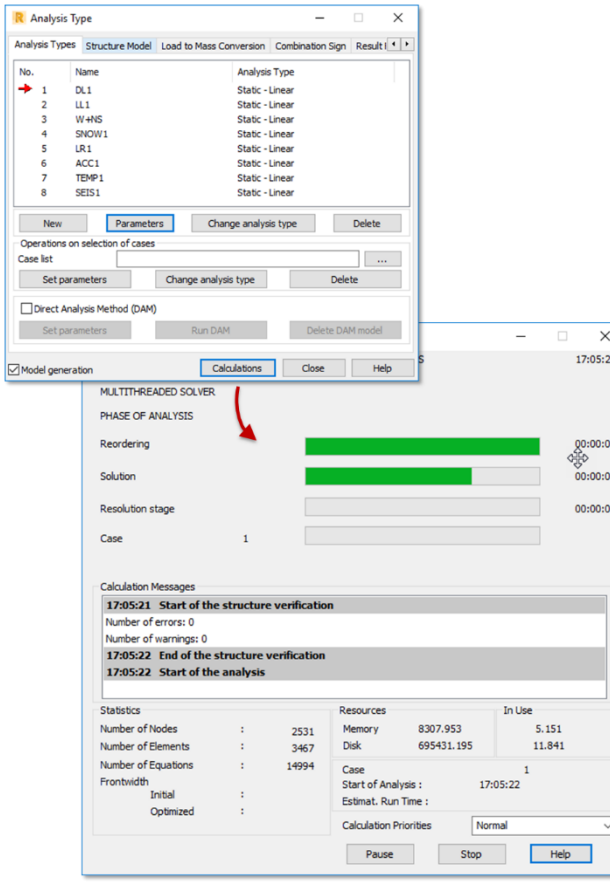
17. Select **Mesh Freeze** to store this mesh; then close the toolbar.

Perform analysis

18. Time for analysis! If you've gotten lost along the way, open **05 – Analysis Ready.rtd** to catch up.

19. Go to **Analysis** tab > **Analysis Types** to open this menu. Observe additional capabilities under the **New** and **Parameters** buttons.

20. Select **Calculations** to run the analysis. Once completed, a green light at the bottom of the screen indicates that current results are available.

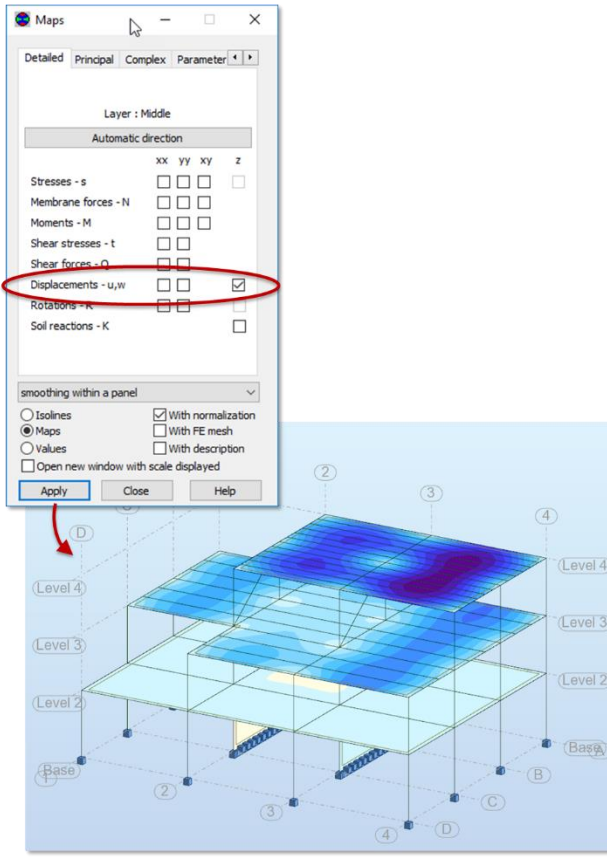


View results

21. Select **Results** tab > **Maps** to open this dialog.

22. Select the **z** direction for **Displacements – u,w** and select **Apply**.

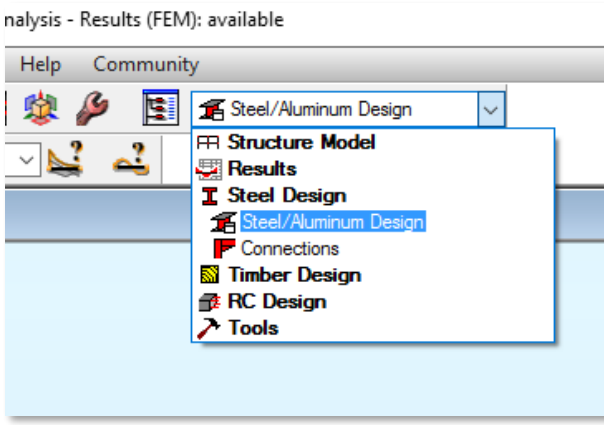
23. Note the color mapping in RSA is similar to the results previously explored in Revit. The interior beams of the top deck indicate the largest displacements; we'll make them the focus of this exercise.



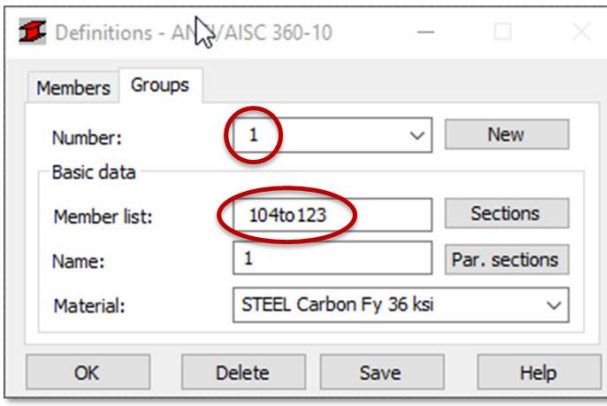
24. Deselect the **z** checkbox and select **Apply** again to remove the map.

Configure code group for design

25. For this step, let's change our RSA layout. Locate the **Layouts** toolbar and change from **Geometry** to **Steel/Aluminum Design**.



26. Proceed to the **Groups** tab of the **Definitions** dialog. Click **New** to create a new code group and enter members **104 to 123** (the interior beams from the top deck) in the **Member list**. *Note: RSA offers many selection methods, but we are directly entering known bar numbers in this example.*

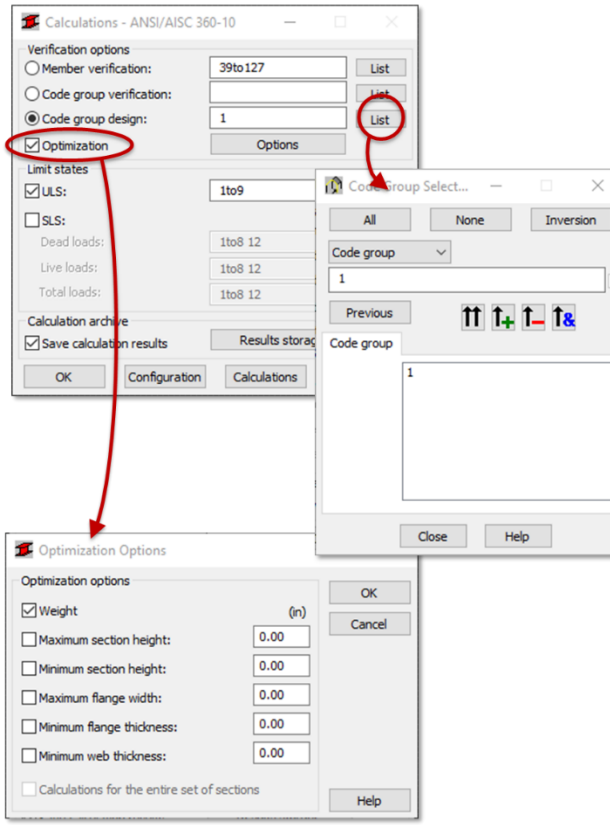


27. Select **Save.**

Perform code group design with optimization

28. Proceed to the **Calculations** dialog and select the **Code group design** option. Enter **1** or use the **List** button to find and select group 1 using the “up” arrow icons.

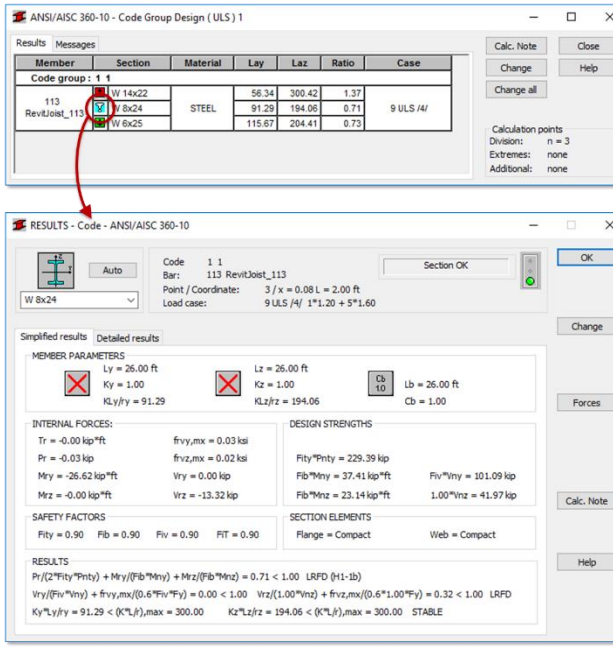
29. Select **Optimization** and check the **Weight** option. Select OK to close this dialog. If you’re behind, open **06 – Design.rtd** to catch up.



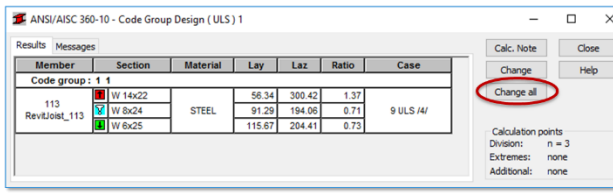
30. Select **Calculations** to perform code group design for the selected settings.

Select optimal sections

31. The **Code Group Design** module highlights the optimal section for the group (W 8x24 here). Click on the icon next to this section to view results; select **OK** to return.



32. In the **Code Group Design** dialog, select **Change all** to resize the sections. **Close** the dialog and **Cancel** saving the calculation results.

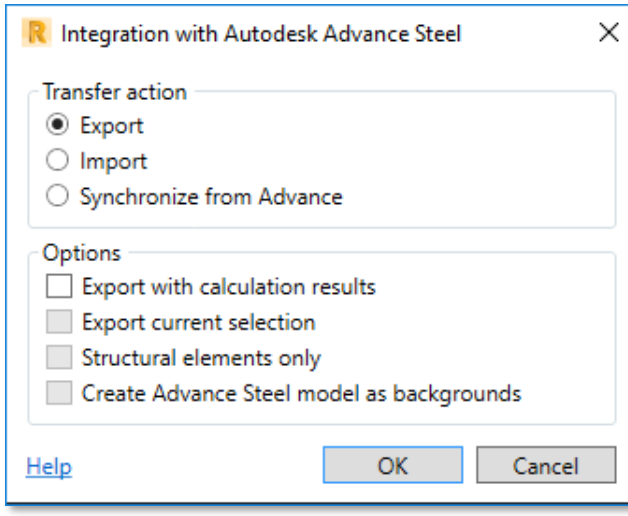


Export updated geometry

33. Return to **Add-ins** tab > **Integration** > **Autodesk Advance Steel**.

34. Select **Export** and click **OK**.

35. Save the file as **07 – RSA Export.smlx**.

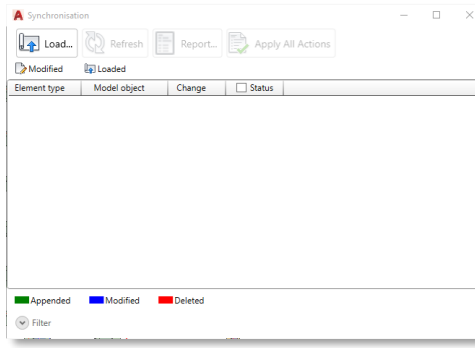


Exercise 3: Synchronization

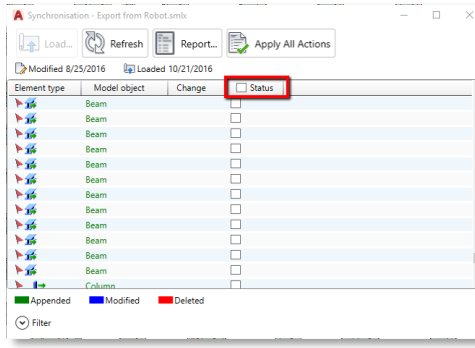
In this exercise, we'll import the updated geometry from RSA.

1. In Advance Steel 2017, on the **Export & Import** ribbon, select **Exchange Formats** > **Advance Export** pulldown > **Advance Synchronization.**

2. In the **Synchronization** dialog box, click **Load** and select the SMLX file exported from Robot.



3. In the **Synchronization** dialog box, click the box next to **Status** and select **Apply All Actions**.

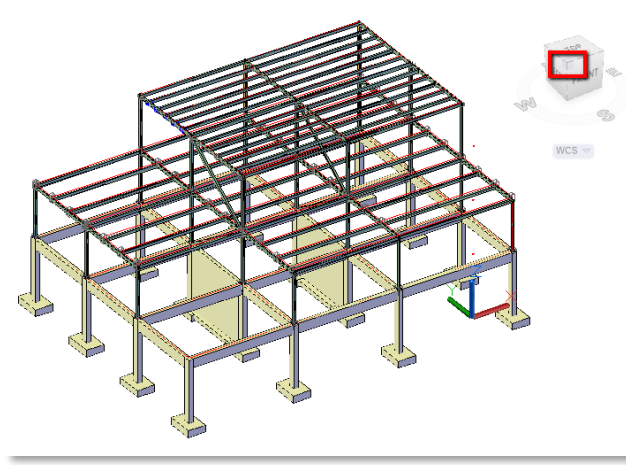


Exercise 4: Connections

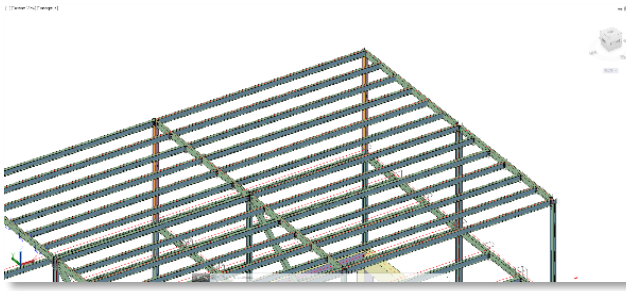
In this exercise, we'll add a few connections to begin detailing the model.

1. Open **03 – AS Model2.dwg**.

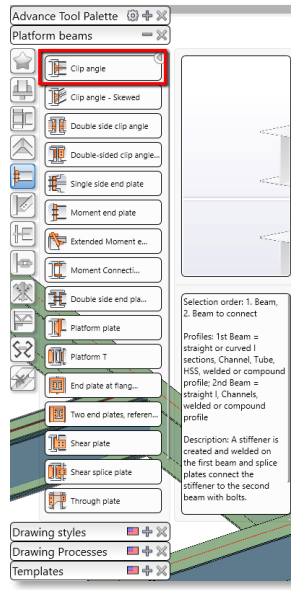
2. Set the view to **Southwest Isometric** using the View Cube.



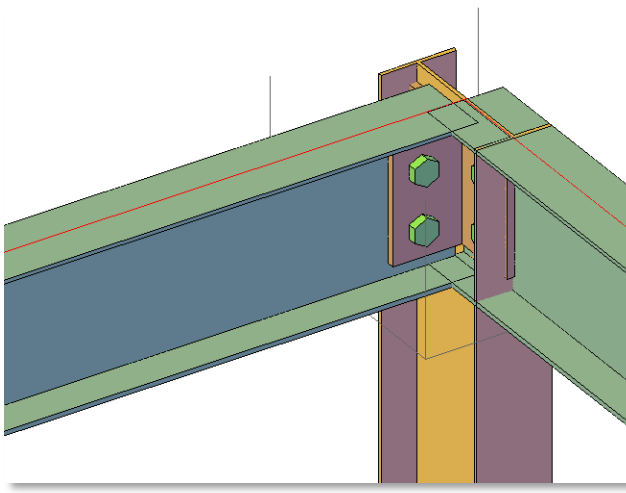
3. Zoom into the northeast corner of the top floor.



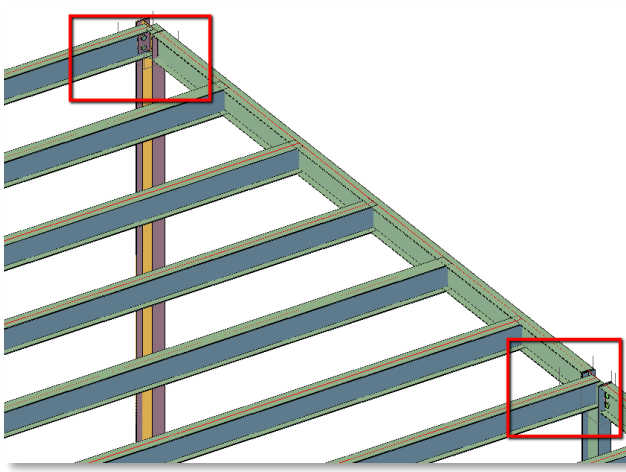
4. In the Connection Vault Tool Palette (**Home** > **Extended Modeling** > **Connection Vault**), **Platform Beams** menu, select **Clip Angle**.



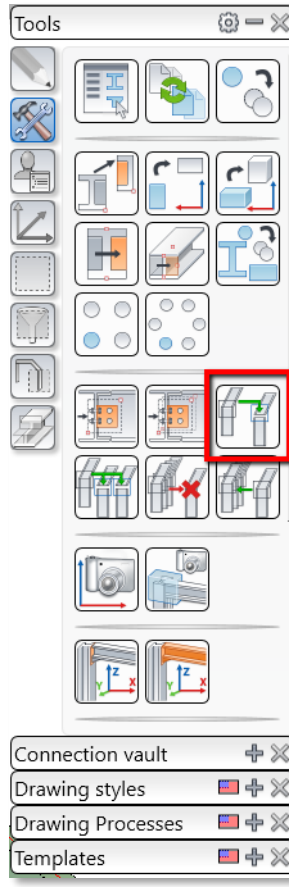
5. Select the column and press **Enter**. Then select the exterior beam intersecting the web and press **Enter**.



6. Zoom out to see the next column beam intersection.

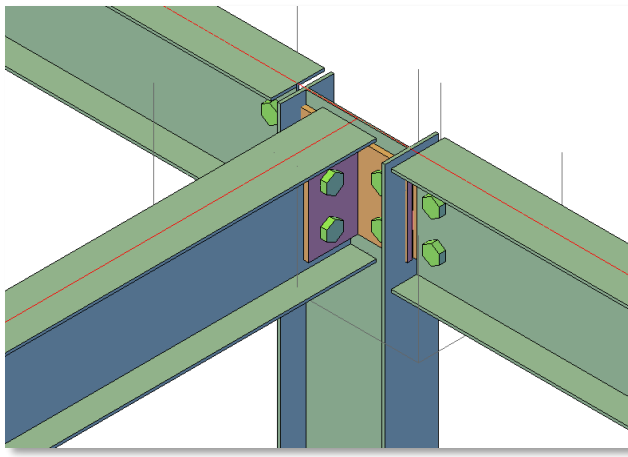


7. In the **Advance Tool Palette**, **Tools** menu, select **Create Joint in Joint Group**.

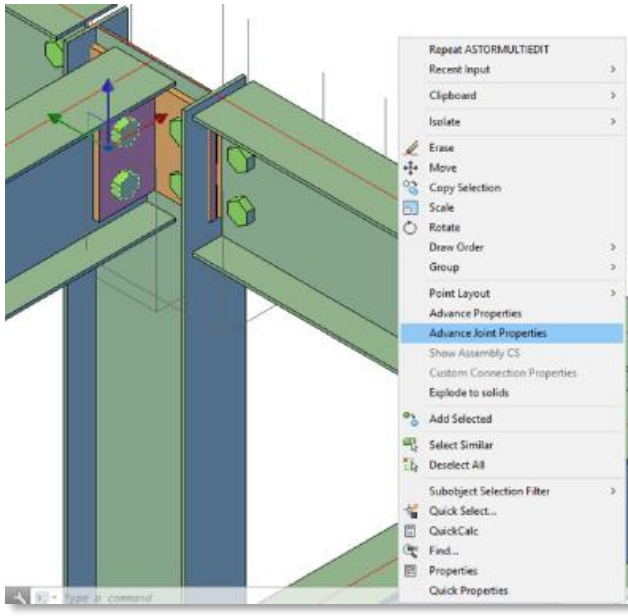


8. Select any portion of the clip angle connection previously created (e.g. bolts) and press **Enter**.

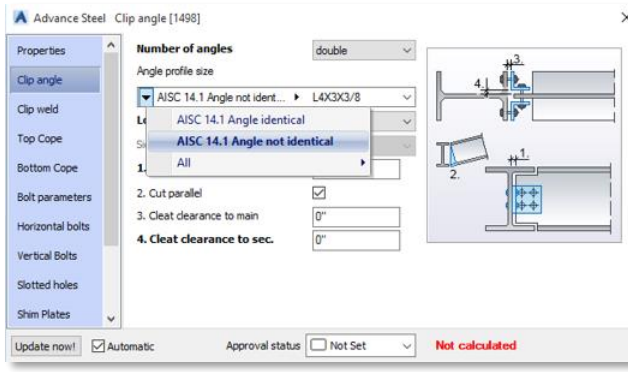
9. Select the column and press **Enter**. Then select the beam intersecting the column web and press **Enter**.



10. Select any portion of the joint created (e.g. bolts), right-click and select **Advance Joint Properties**.



11. In the dialog box, check **Upgrade to master**.
12. Select the clip angle header and change the profile size to **AISC 14.1 Angle Not Identical L 4x3x3/8**.

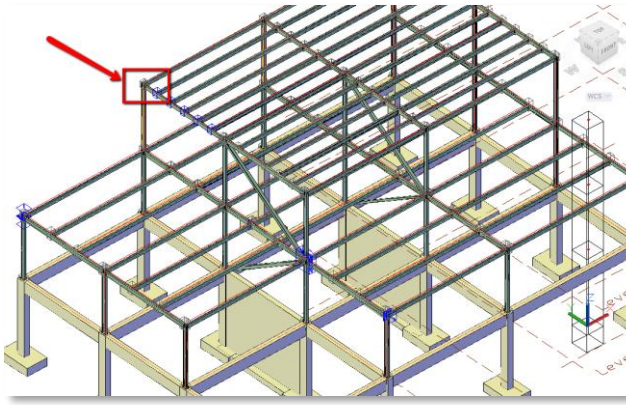


Exercise 5: Detailing

In this exercise, we'll generate a few detail views of the model using Advance Steel's document automation tools.

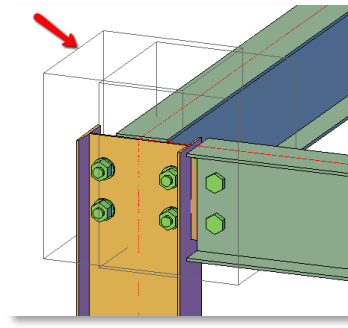
1. In Advance Steel, open **08 – AS Model 3.dwg**.

2. Zoom into the northwest corner of the top level in the model.

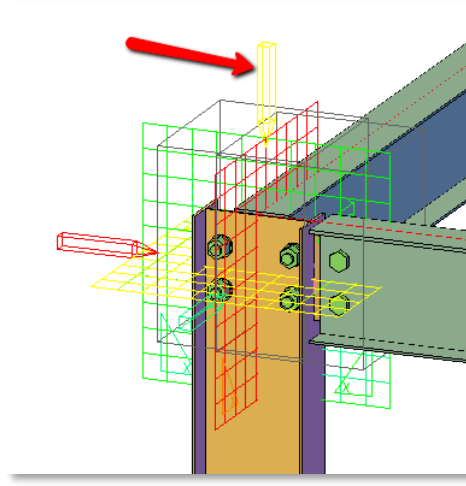


3. In the **Advance Tool Palette** > **Tools**, select **Camera(s) at Node**.

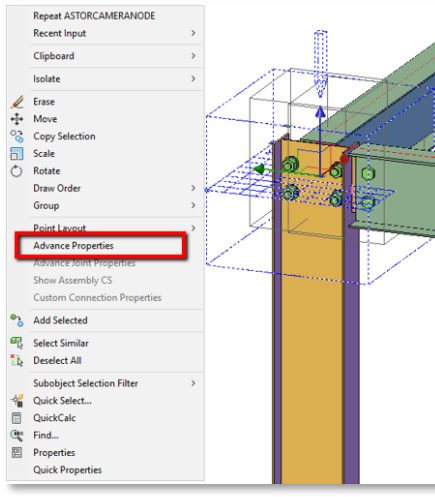
4. Select the bounding box for the clip angle connections.



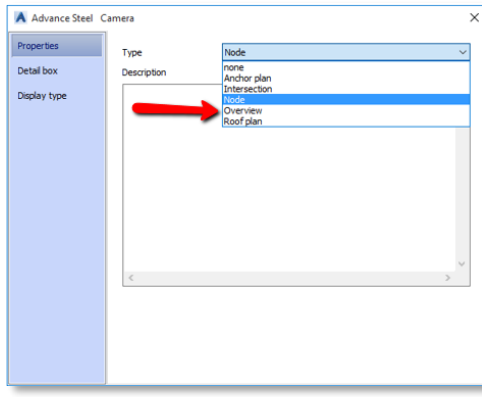
5. Select the top plane and press **Enter**.



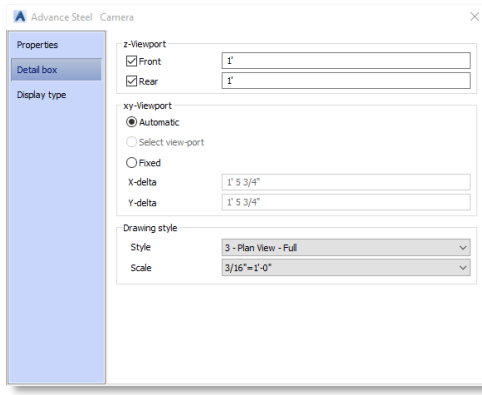
6. Select the camera, right-click and select **Advance Properties**.



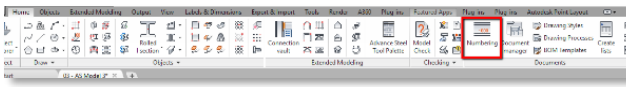
7. In the **Properties** menu, change **Type** to **Overview**, and type “**Roof Framing Plan**” under the **Description**.



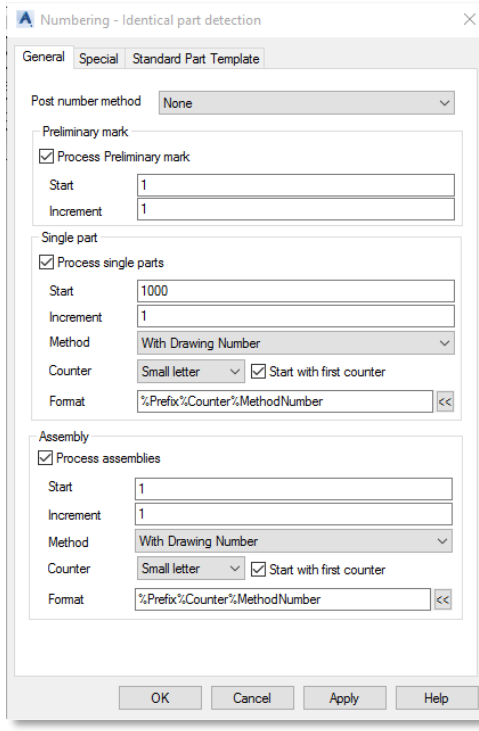
8. In the **Detail Box** menu, change the following:
    a. z-Viewport to 1’ (Front and Rear)
    b. xy-Viewport to Automatic
    c. Style: 3 – Plan View – Full
    d. Scale: 3/16” = 1’ – 0”



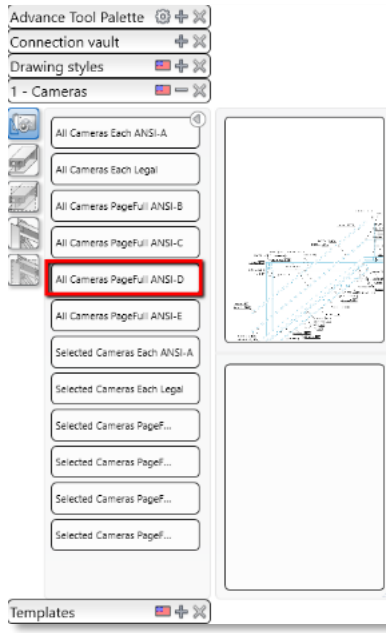
9. In the **Home** ribbon > **Documents** panel > Select **Numbering**.



10. In the **Numbering** dialog box, select the boxes next to **Process Preliminary mark**, **Process single parts**, and **Process assemblies** then press **OK**.



11. In the **Drawing Process Tool Palette**, select **Cameras** > **All Cameras PageFull ANSI-D**.



12. In the **Process Properties** dialog box, select **OK**.

13. On the **Home** ribbon, in the **Documents** panel, select **Document Manager**.

14. In the **Document Manager**, double-click any detail drawing to open it.