Autodesk University 2012

PD2299 – Easier Plant Design Using Autodesk® Plant Design Suite Ultimate 2013

Ian Matthew – Autodesk, Inc.

PD2299

This class will take you through the workflows incorporated in the Autodesk Plant Design Suite. Starting with P&ID's, we will cover creating Plant Design models using all the components within the Autodesk Plant Design Suite Ultimate edition

Learning Objectives

At the end of this class, you will be able to:

- Follow complete Plant Design workflows that are inside the Autodesk Plant Design Suite - Ultimate
- Make AutoCAD® Plant 3D and AutoCAD® P&ID work together during piping and validation
- Follow the structural workflow in the Plant Design Suite from plant 3D through Revit® to AutoCAD® Structural Detailing
- Incorporate Autodesk Inventor® models in Plant 3D

About the Speaker

Ian Matthew is responsible for the production of technical sales collateral and sales tools to support the Autodesk's solutions for Oil & Gas and the Autodesk® Plant Solutions sales process. This includes development of product demonstrations and presentations for the Autodesk reseller channel as well as internal sales personnel. Ian also provides product and market expertise for conferences, trade shows, webinars and seminars. Ian has 25+ years' experience working in the field of computer-aided design of process plants, having worked at CAD Centre of Cambridge, England (now AVEVA), and Intergraph Corporation, where he performed the product management role for the introduction and development of PDS. Following his tenure at Intergraph, Ian held business development positions at Rebis, Dassault Systèmes, and Bentley® Systems. Ian holds BSc Tech in chemical engineering and fuel technology and MSc Tech in chemical engineering and fuel technology degrees from Sheffield University, England.

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Introduction

There are 3 Plant Design Suites 2013. They are the Standard Edition, the Premium Edition and the Ultimate Edition. They comprise the following products:

Standard
AutoCAD
AutoCAD P&ID
Autodesk Sketchbook Designer
Autodesk Showcase

Premium
AutoCAD
AutoCAD P&ID
AutoCAD Plant 3D
AutoCAD Structural Detailing
Autodesk Revit Structure
Autodesk Navisworks Simulate
Autodesk Sketchbook Designer
Autodesk Showcase

Ultimate
AutoCAD
AutoCAD P&ID
AutoCAD Plant 3D
AutoCAD Structural Detailing
Autodesk Revit Structure
Autodesk Navisworks Manage
Autodesk Inventor
Autodesk Sketchbook Designer
Autodesk Showcase

This document is a set of instructions that will take you through the major components of the Plant Design Suites, AutoCAD P&ID, AutoCAD Plant 3D and Autodesk Navisworks. Autodesk Revit Structure, AutoCAD Structural Detailing and Autodesk inventor are also included and this document will attempt to guide you briefly through these products in short step-by-step instructions.

Every attempt has been made to ensure the accuracy of this document, however, some errors may occur but you should be able to follow the steps with some slight changes.

Getting Started

A dataset is available as additional materials for this class. Feel free to download the dataset and use it to follow along with this document.

For quickest results, unzip the demo set into the folder “C:\AutoCAD Plant 3D Projects\” The project folder **Plant Suites 2013** will contain all the files necessary to follow this class.

Plant Design Workflow

In this document we will cover the following workflows:

- P&ID’s
- Plant 3D
  - Structures
  - Equipment Modeling
  - Piping
- Structural Workflow
  - AutoCAD Plant 3D
  - Autodesk Revit Structure

    - AutoCAD Structural Detailing (ASD)
- Mechanical Equipment Workflow
    - Autodesk Inventor
    - AutoCAD Plant 3D
- Project Collaboration & Construction Planning
    - Navisworks Interference Detective
    - Navisworks TimeLiner
- Deliverables
    - Piping Isometrics
    - Orthographic Drawings

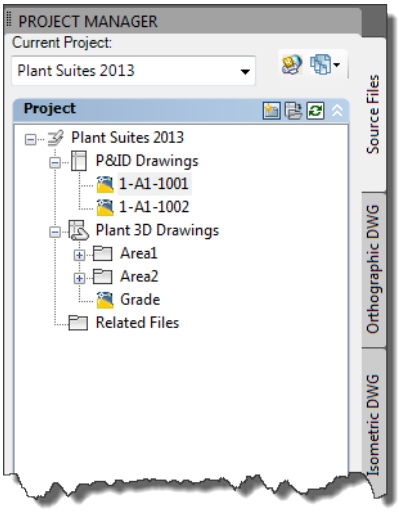
AutoCAD P&ID

We will start with a short tour of AutoCAD P&ID 2013 highlighting the following:

- Project Manager organizes all your project P&ID's and provides some simple drawing management
- P&ID is a simple-to-use P&ID drafting tool with built-in intelligence designed to increase P&ID productivity
- P&ID data can be simply managed through Data Manager and allows non-P&ID users to add more data to the P&ID without having to open an AutoCAD P&ID drawing.
- Reports can be created quickly and easily either from inside AutoCAD P&ID or outside the drawing using AutoCAD Plant Report Creator.

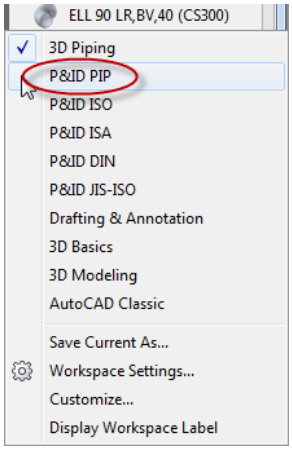
Self-guided Tour

1. Open the project 'Plant Suites 2013':

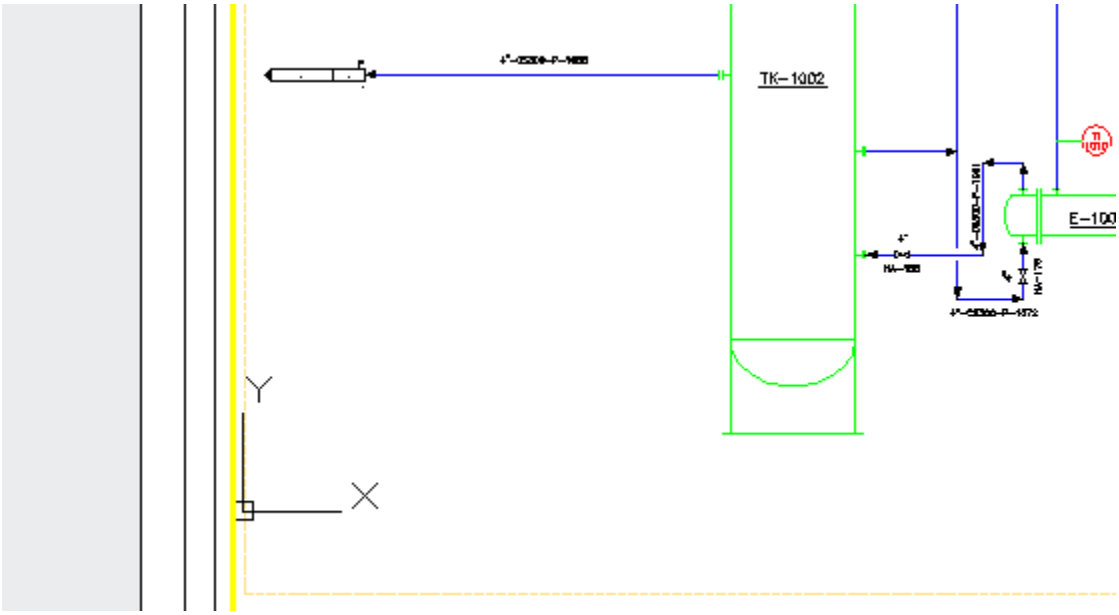


2. Open the P&ID '1-A1-1002'
    - When the drawing opens, make sure you are in the P&ID Workspace. If not, click on the workspace symbol:

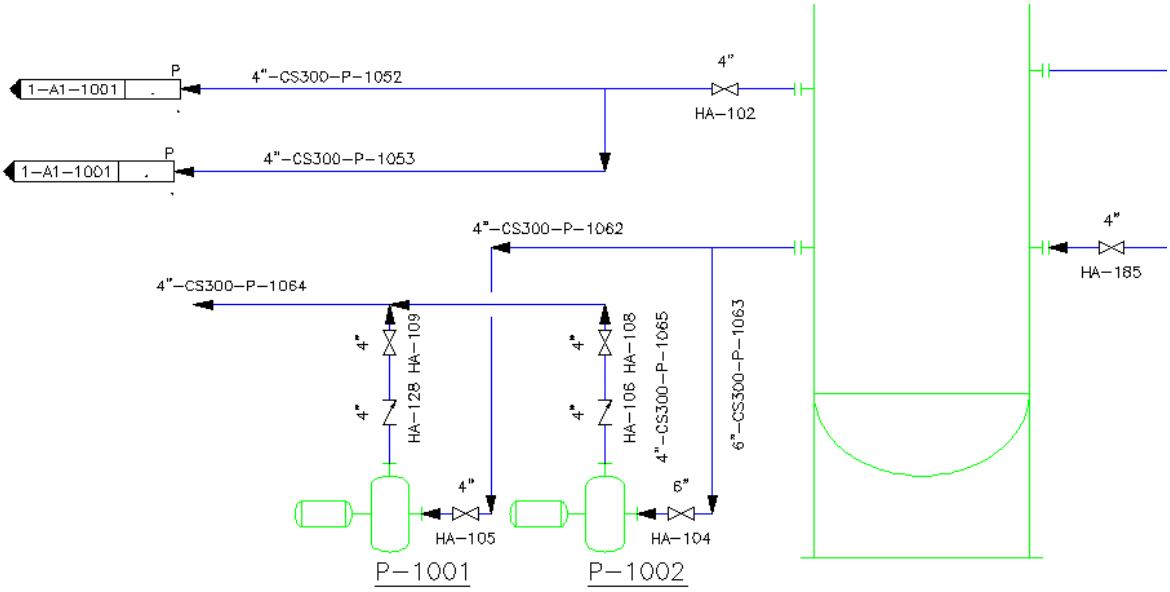
and select the **P&ID PIP** workspace:



3. Zoom into the bottom left:



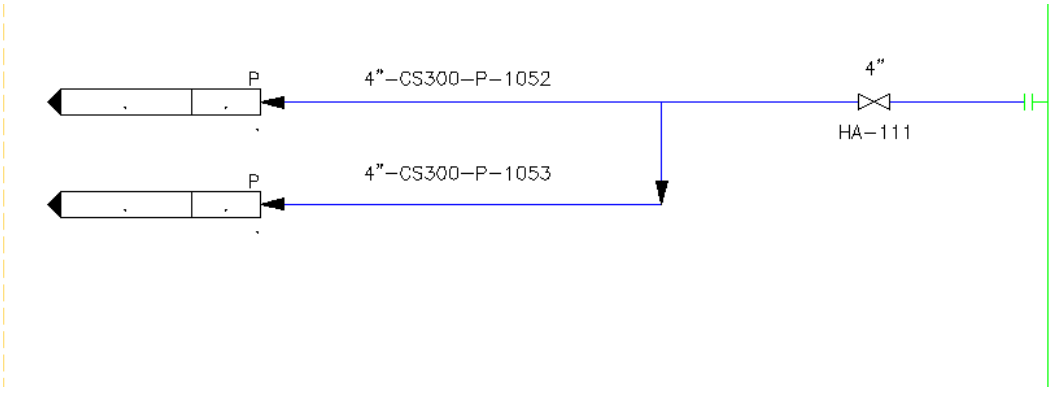
and create this:



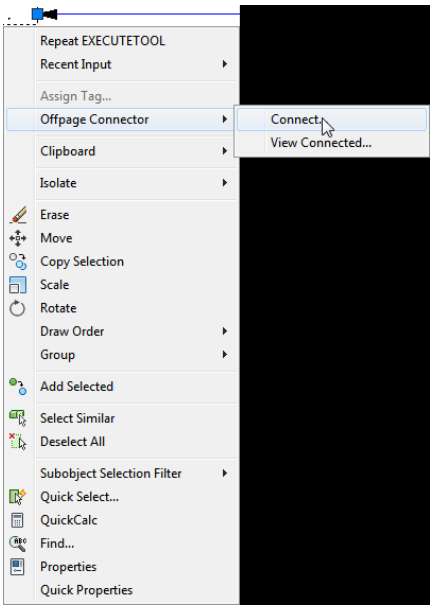
Points to address:

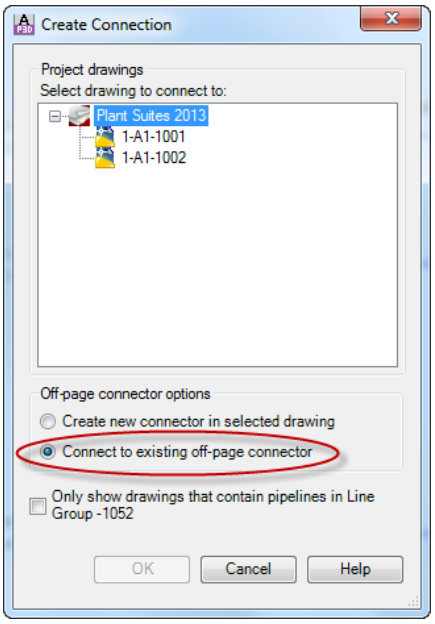
- Assign Tag – to pumps and to lines
- Valves break the lines and inherit sizes from the lines
- Check valves automatically follow the flow direction of the line (right click on the line and use the 'Schematic Line Edit >> Reverse Flow' command to demonstrate.)
- Crossing lines break automatically
- Move Pump **P-1001** to the left and watch the lines stretch to retain connection automatically.

4. Now we'll show how the off page connector is 'intelligent' and automatically updates line data:
   - Draw the lines '4"-CS300-P-1052' and '4"-CS300-P-1053' as shown above and then place an off-page connector at the end of them:



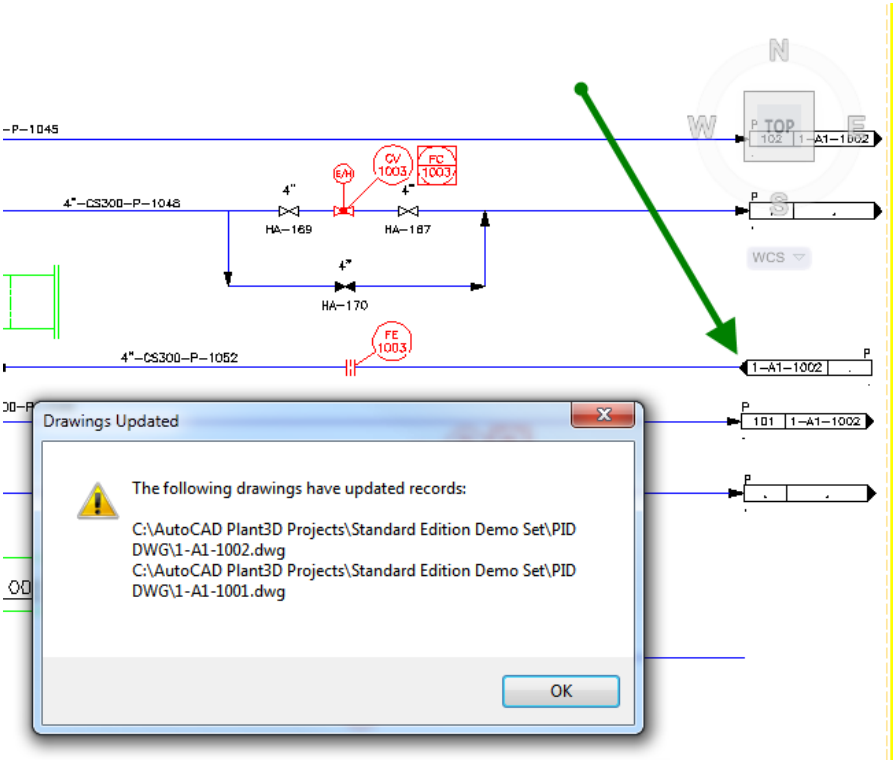
- Right click on a connector and select Offpage Connector >> Connect:





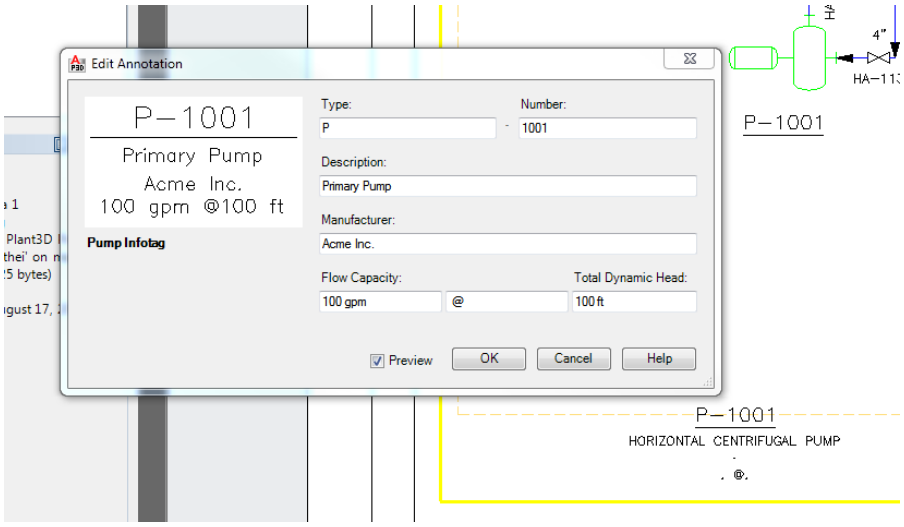
select P&ID 1-A1-1001 click on “Connect to existing off-page connector” and click OK

- The P&ID Opens – click on the 3rd line down on the right hand edge:



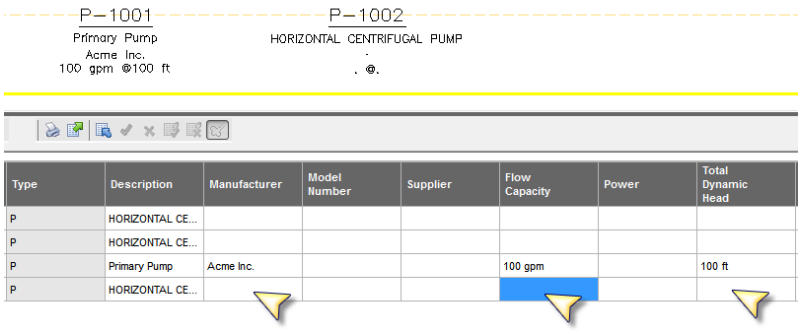
Note the line number is updated and the database records are updated.

5. We'll now demonstrate how the intelligence can be updated through updating the label, using the data manager and export / import to MS Excel.
    - Create an infotag annotation for the 2 pumps you placed earlier and update one through the labels by double-clicking on the Pump infotag:

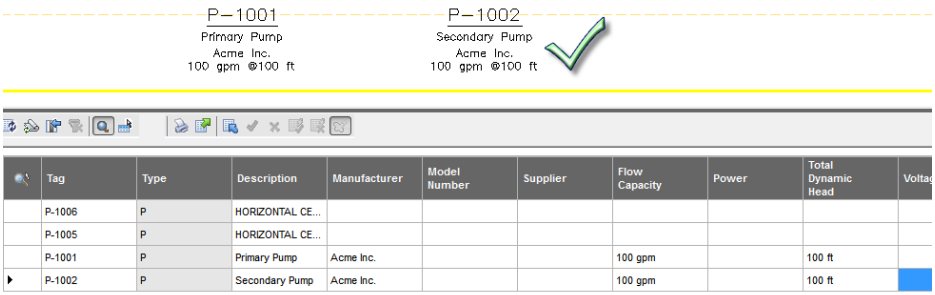


update the field and click OK – the label will update:

- Using Data Manager – update the pump P-1002:

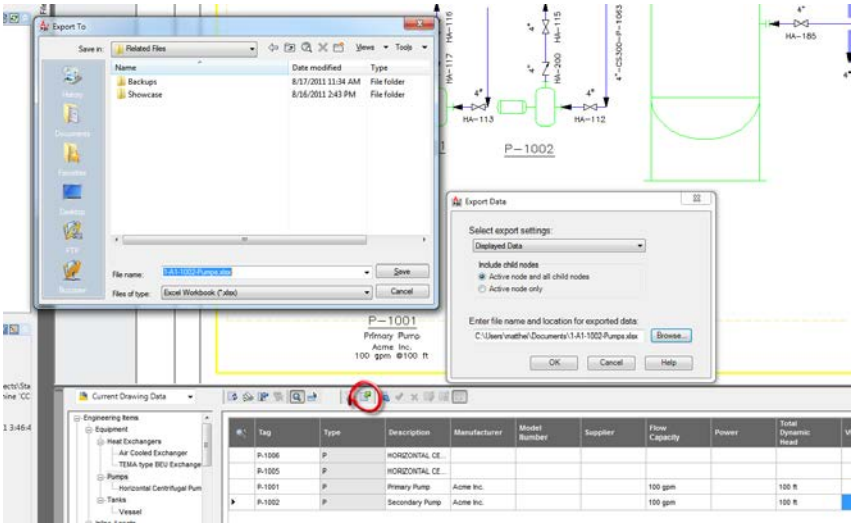


enter values as shown above to get:

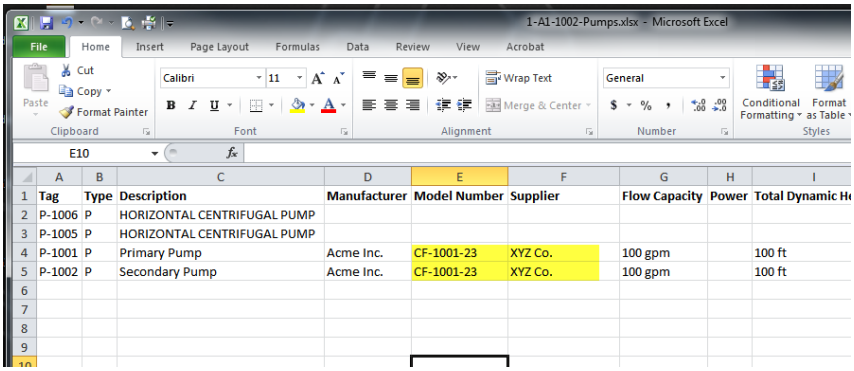


Tag	Type	Description	Manufacturer	Model Number	Supplier	Flow Capacity	Power	Total Dynamic Head	Voltag
P-1006	P	HORIZONTAL CE...							
P-1005	P	HORIZONTAL CE...							
P-1001	P	Primary Pump	Acme Inc.			100 gpm		100 ft	
P-1002	P	Secondary Pump	Acme Inc.			100 gpm		100 ft	

- Now use Export / Import to add model number and supplier by an external user through MS Excel. First export the data to Excel:

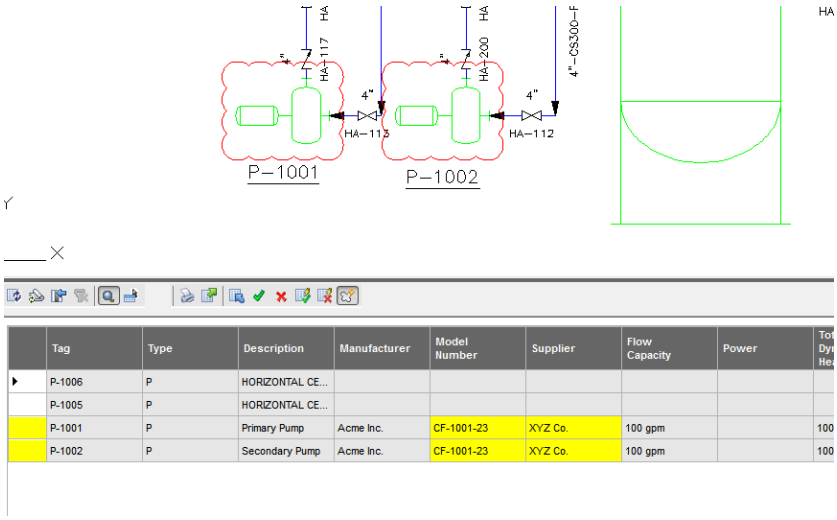


next open the Excel spreadsheet you just created and make the edits:



	A	B	C	D	E	F	G	H	I
1	Tag	Type	Description	Manufacturer	Model Number	Supplier	Flow Capacity	Power	Total Dynamic He
2	P-1006	P	HORIZONTAL CENTRIFUGAL PUMP						
3	P-1005	P	HORIZONTAL CENTRIFUGAL PUMP						
4	P-1001	P	Primary Pump	Acme Inc.	CF-1001-23	XYZ Co.	100 gpm		100 ft
5	P-1002	P	Secondary Pump	Acme Inc.	CF-1001-23	XYZ Co.	100 gpm		100 ft
6									
7									
8									
9									

save the spreadsheet and go back to the P&ID and import the same spreadsheet:

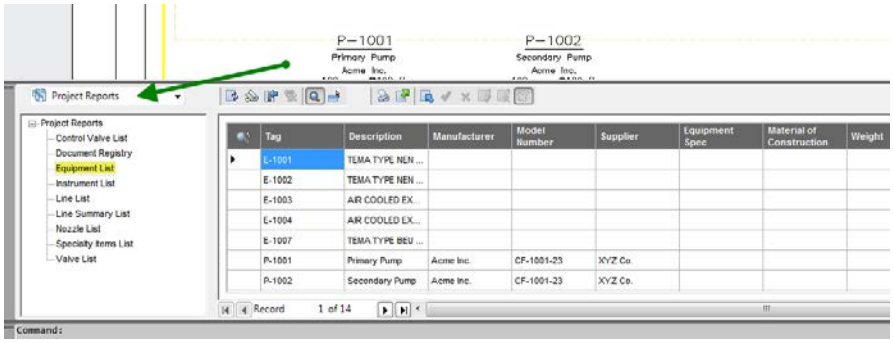


	Tag	Type	Description	Manufacturer	Model Number	Supplier	Flow Capacity	Power	Tot Dyn He
▸	P-1006	P	HORIZONTAL CE...						
	P-1005	P	HORIZONTAL CE...						
	P-1001	P	Primary Pump	Acme Inc.	CF-1001-23	XYZ Co.	100 gpm		100
	P-1002	P	Secondary Pump	Acme Inc.	CF-1001-23	XYZ Co.	100 gpm		100

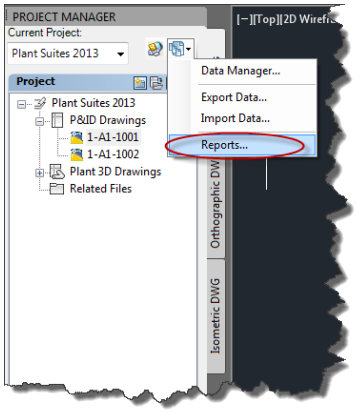
Changes in the Data and in the drawing are shown by highlights and revision clouds – accept the changes.

- Clicking on the object and then right-clicking ‘properties’ also allows you to modify data.

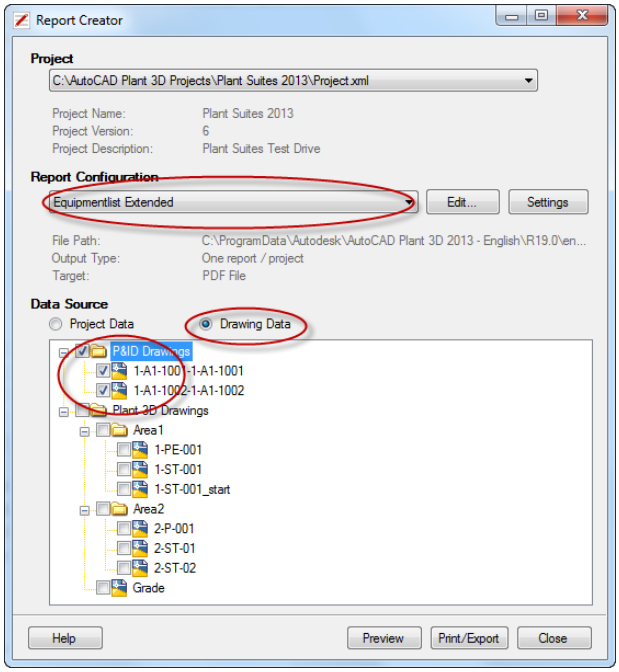
6. Now we’ll show reporting:
   - Using the Data Manager – select Project Reports in the pull-down:



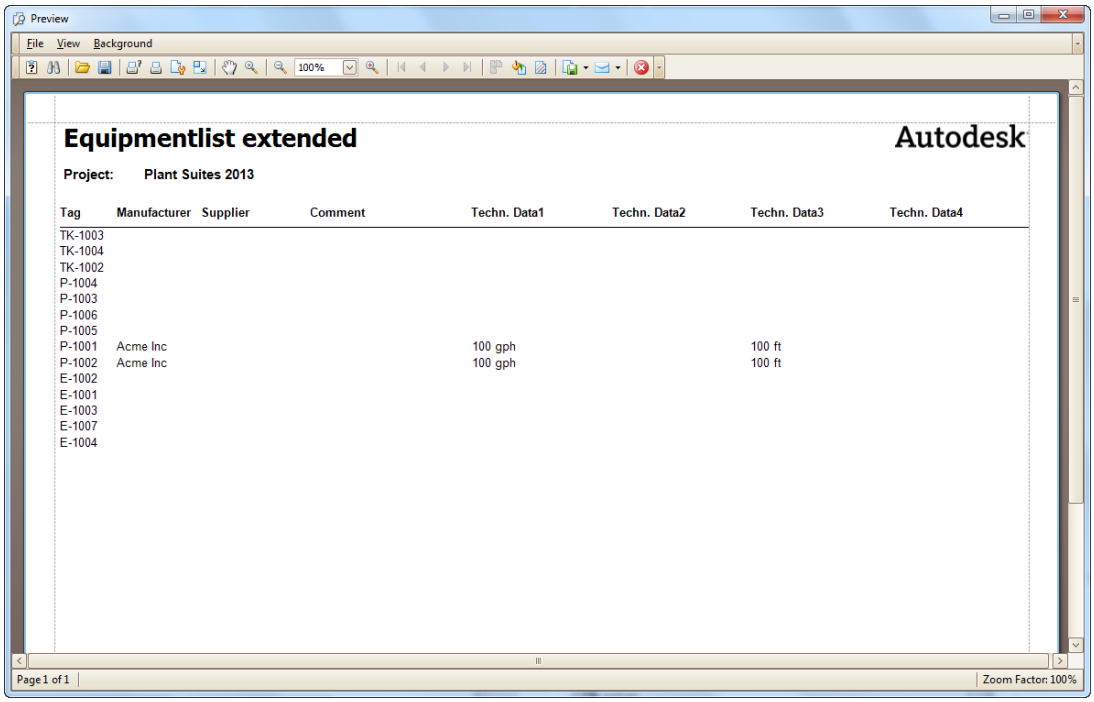
Or you can also select from the Project Manager



   - Using the AutoCAD Plant Report Creator 2013 – select the project and then select the extended Equipment List:



Use ‘Preview’ to review the report:



That concludes the P&ID Section

AutoCAD Plant 3D

If you did not complete the P&ID section, or to ensure data compatibility, you may need to replace the P&ID's we worked on with the two that are backed up in the 'Plant Suites 2013\PID Backup' folder. Copy the files:

- 1-A1-1001_complete.dwg and
- 1-A1-1002_complete.dwg

to the folder 'Plant Suites 2012\PID DWG' and rename the file '*1-A1-1001_complete.dwg'* to '*1-A1-1001.dwg'* and '*1-A1-1002_complete.dwg'* to '*1-A1-1002.dwg'.* Open both files and when requested to update the project database, accept this request.

Self-guided Tour

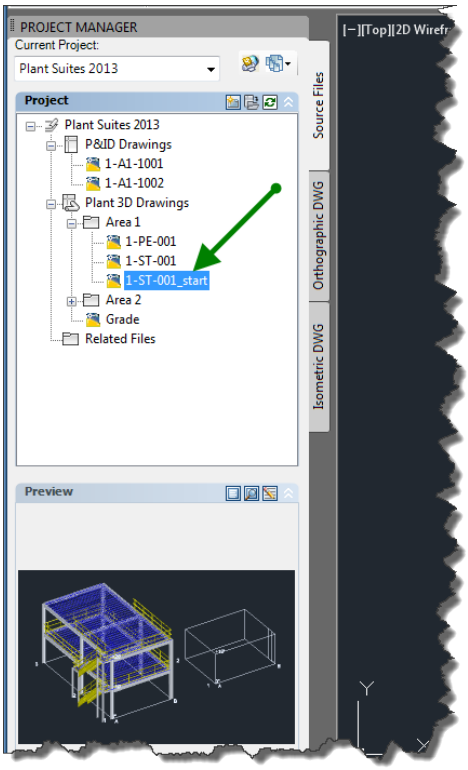
This will take you through a short Plant 3D (P3D) walkthrough and you will highlight the following:

- P3D is a simple-to-use comprehensive 3D modeler for performing plant design including structures, equipment and piping layout to create Piping Isometrics and orthographic drawings
- Piping Isometrics can be easily created using the AutoCAD Isometrics 2013 which has a graphical user interface for easy customization.
- AutoCAD Plant Report Creator 2013 can easily create reports from the 3D model
- Inventor models can be imported into the Plant 3D model as equipment and connected intelligently to Plant 3D piping
- P3D structural models can be imported into Revit Structure for detailed structural design and then into ASD for the steel detailing and fabrication drawings.

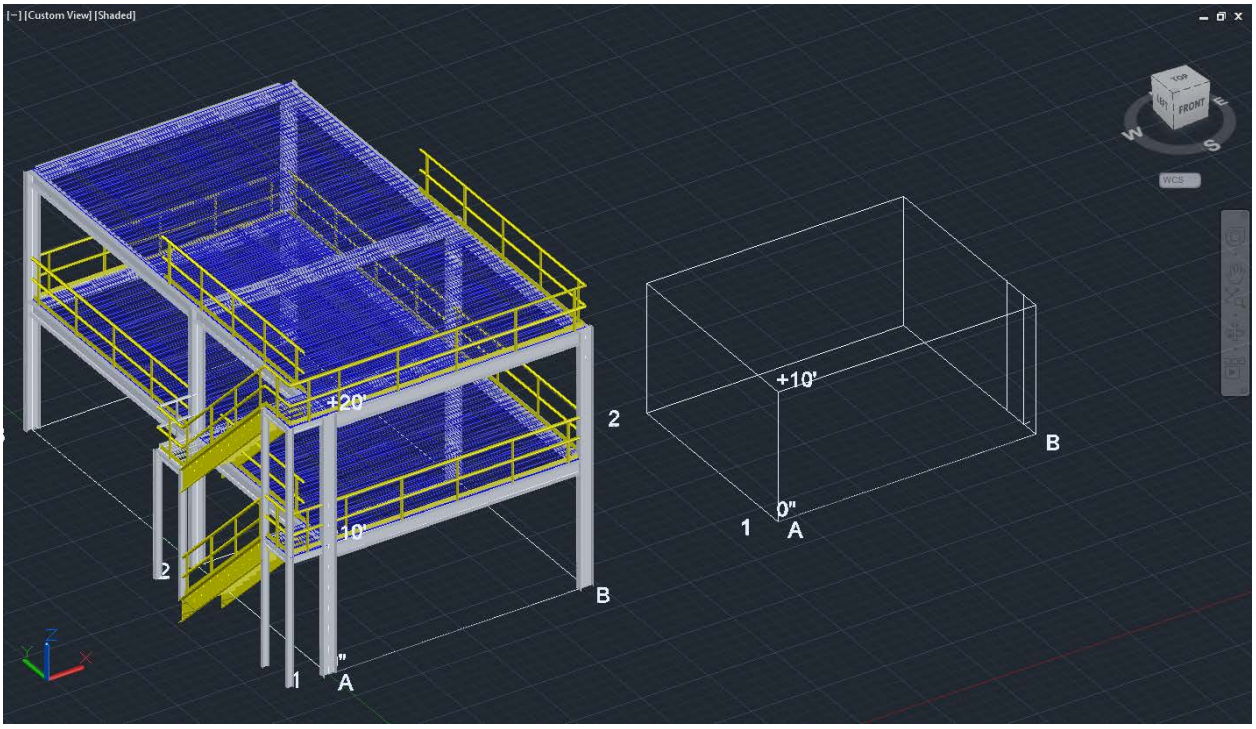
First we'll start with structural modeling

Structural Modeling

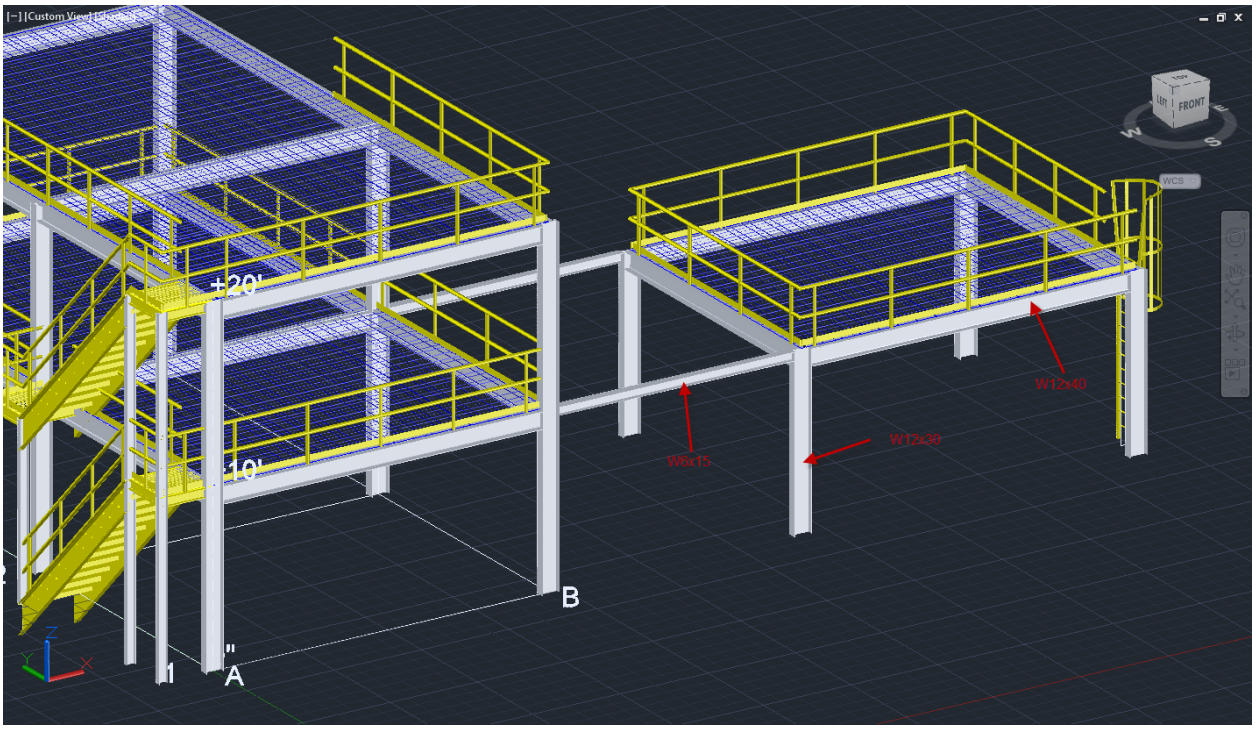
1. Open the structural model file – 1-ST-001_start:



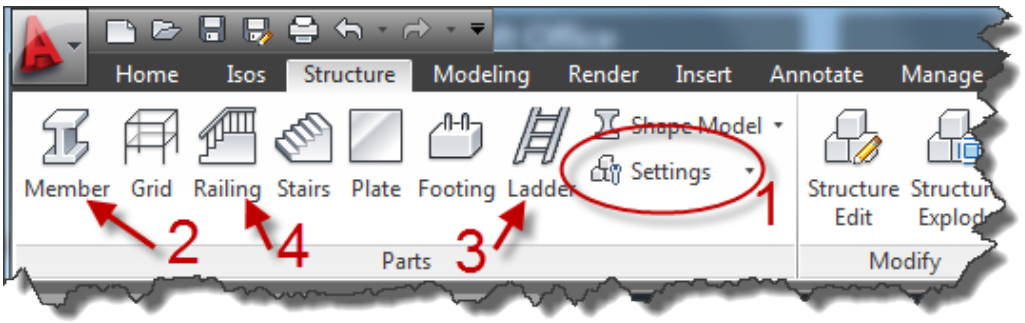
which will look like this:



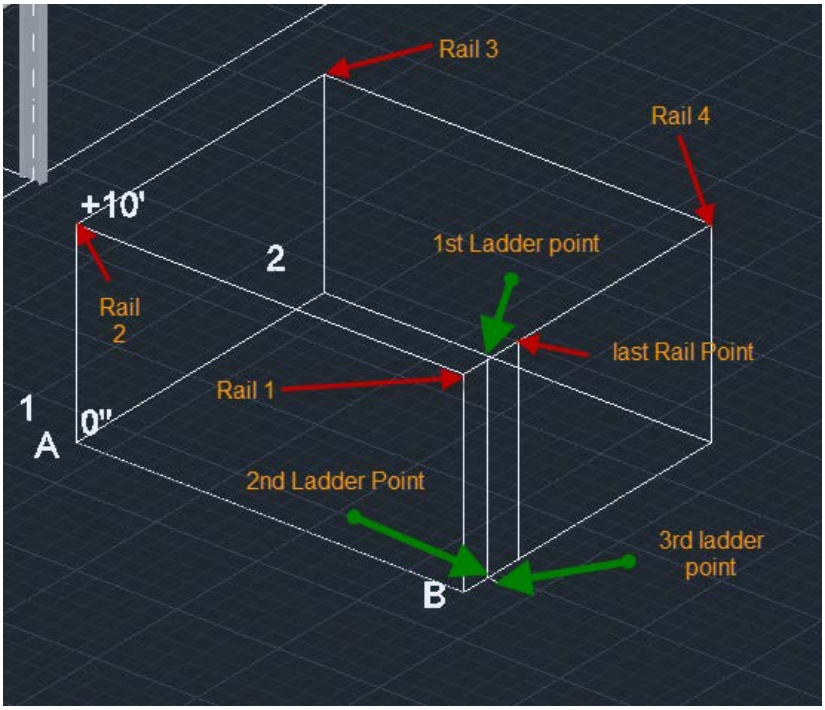
2. The completed model will look like this:



3. Start by placing the columns and beams. The columns are W12x30, The Beams are W12x40 and the beams between the structures are W6x15.
   TIP: After starting the 3D Piping workspace, select the Structure ribbon and select the Settings to select the members or set parameters for railings and stairs:



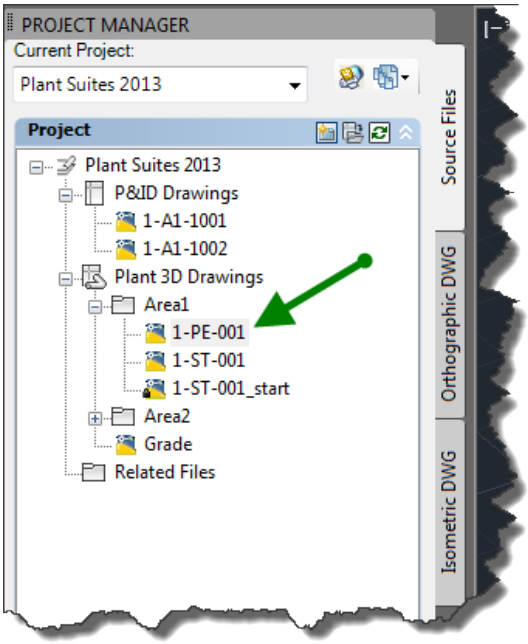
4. Next place the ladder, the railings and the grating (Plate). Use the default settings for the ladder, railings and plate.
   TIP: Use these construction lines for the ladder and railing:



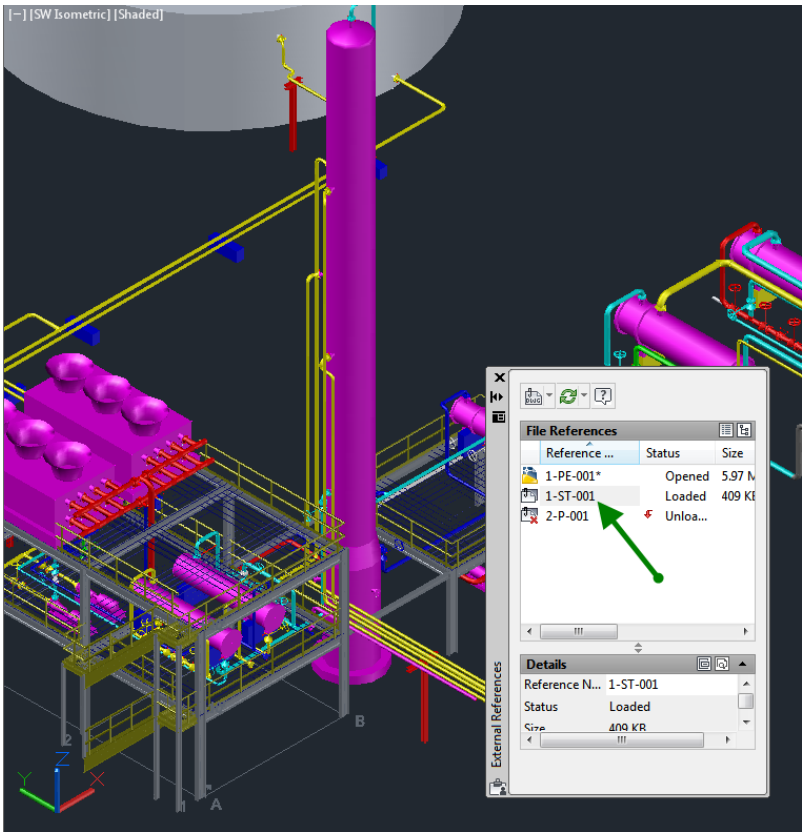
Equipment Modeling

We'll place 2 pumps and then pipe up the pumps. (These are the same pumps we placed in the P&ID):

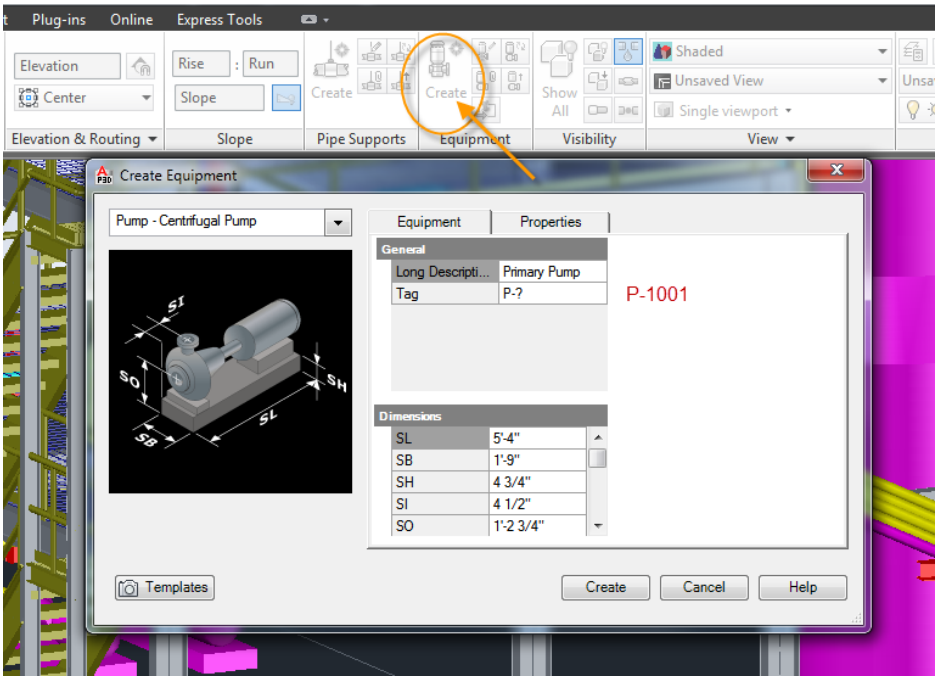
1. Open file 1-PE-001 in Area 1:

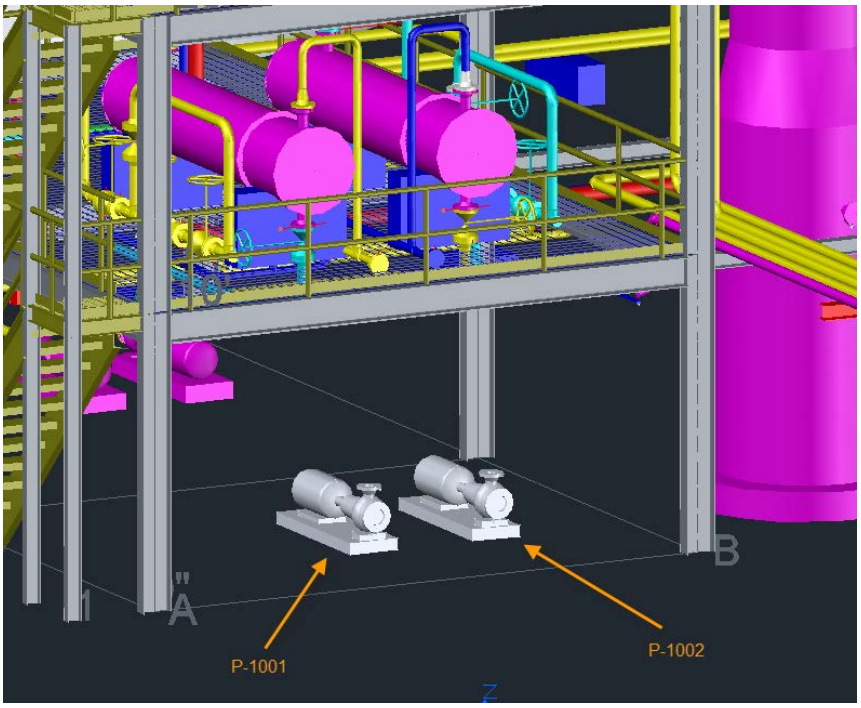


and then attach the structural model as an Xref:



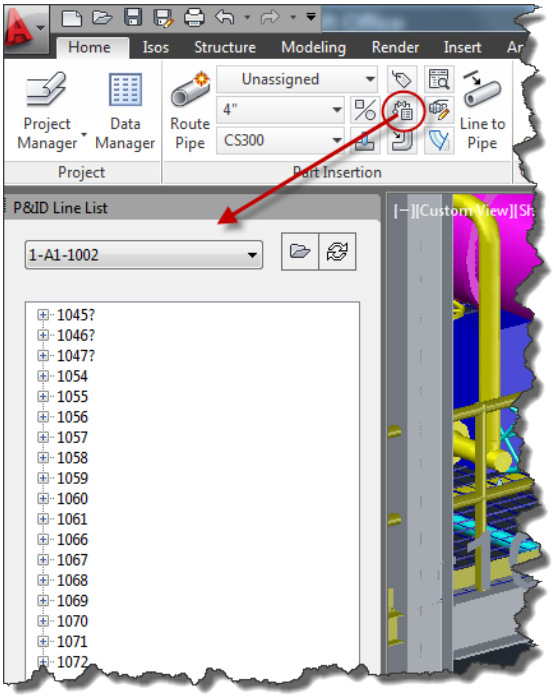
2. Place Pumps P-1001 and P-1002 using default values at the following plant coordintates:
   P-1001 X:10’ 6”, Y:28’ 9”, Z:0”
   P-1002 X:15’ 6”, Y:28’ 9”, Z:0” (You can either copy or place new equipment)


Plug-ins
Online
Express Tools
Elevation
Center
Elevation & Routing
Rise
Run
Slope
Slope
Create
Pipe Supports
Create
Equipment
Show All
Visibility
Shaded
Unsaved View
Single viewport
View
Create Equipment
Pump - Centrifugal Pump
Equipment
Properties
General
Long Descripti...
Primary Pump
Tag
P-?
P-1001
Dimensions
SL
5'-4"
SB
1'-9"
SH
4 3/4"
SI
4 1/2"
SO
1'-2 3/4"
Templates
Create
Cancel
Help

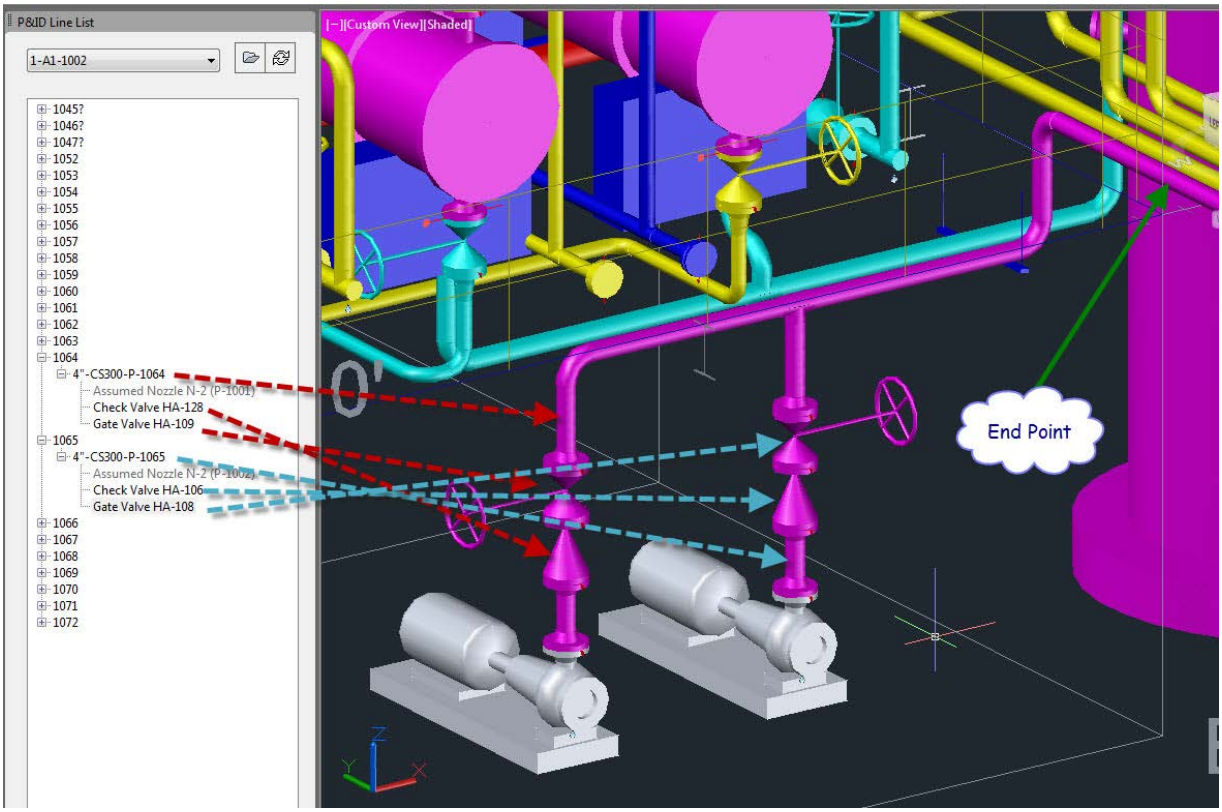

P-1001
P-1002

Piping

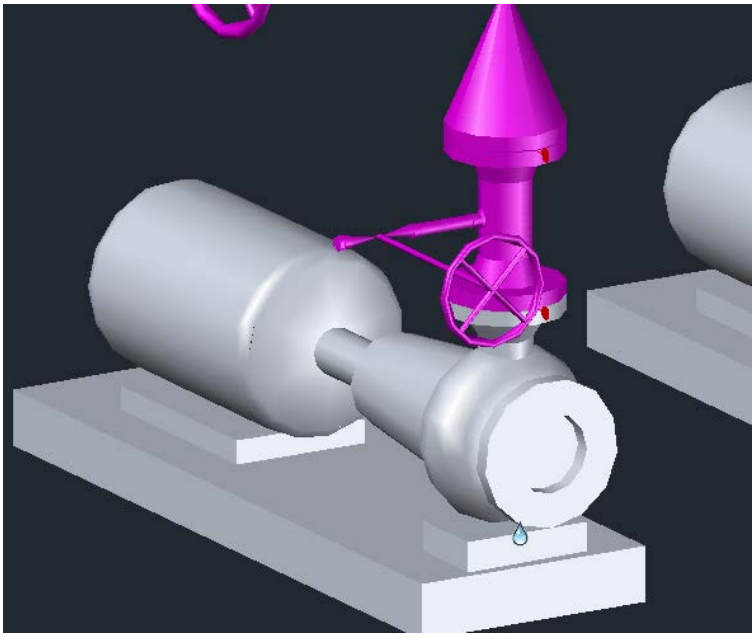
1. Unload the Structural XREF and connect piping as below: (you can use the P&ID Line List to show the P&ID link)



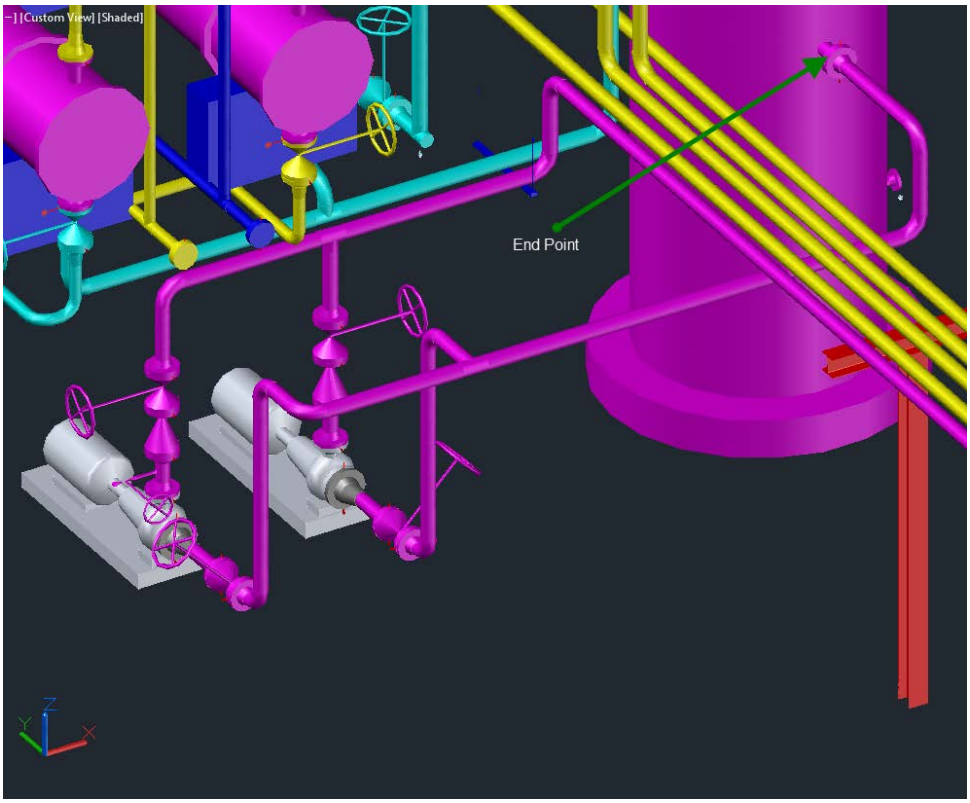
The first line is 4”-CS300-P-1064 which starts at P-1001 and ends at the disconnected elbow shown. 4”-CS300-P-1065 starts at P-1002 and ties into the first line with an inserted tee.



2. Optional – add 3/4” drains to the lines you just modeled. The spec CS300 branch table is set to automatically place a threadolet. You can then place a 6” pipe or a 3” nipple – select the nipple, gate valve and plug from the piping spec palette:

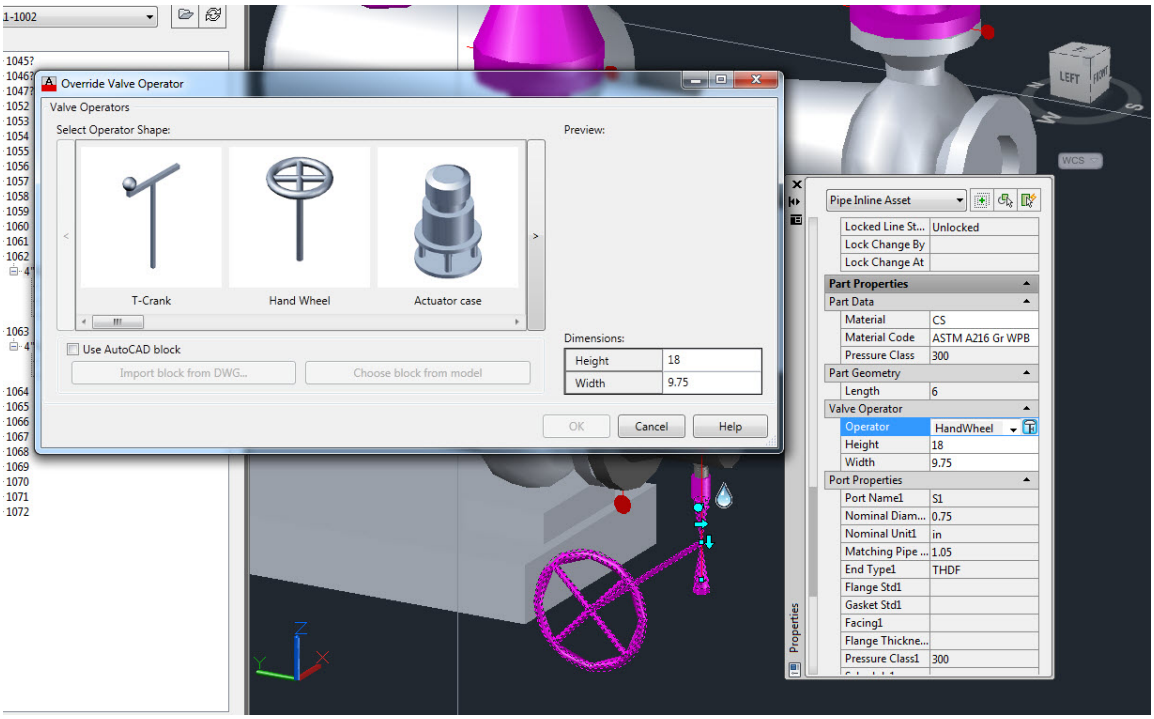


3. Optional – route lines 4”-CS300-P-1062 and 4”-CS300-P-1063 as shown below:

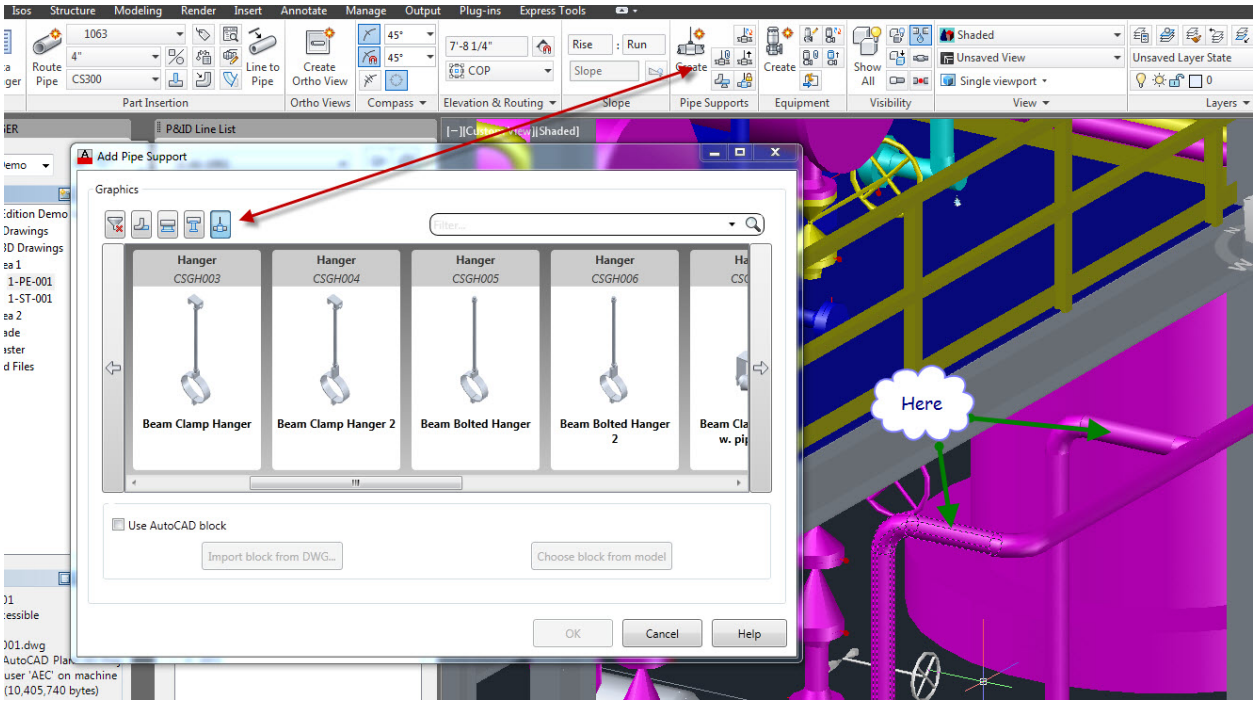


Place a ¾” threadolet on the bottom of the eccentric reducer and then replace the

default handwheel on the ¾" gate valve with an 'L' lever:



Place hanger supports on the pipes as shown:



Structural Workflow

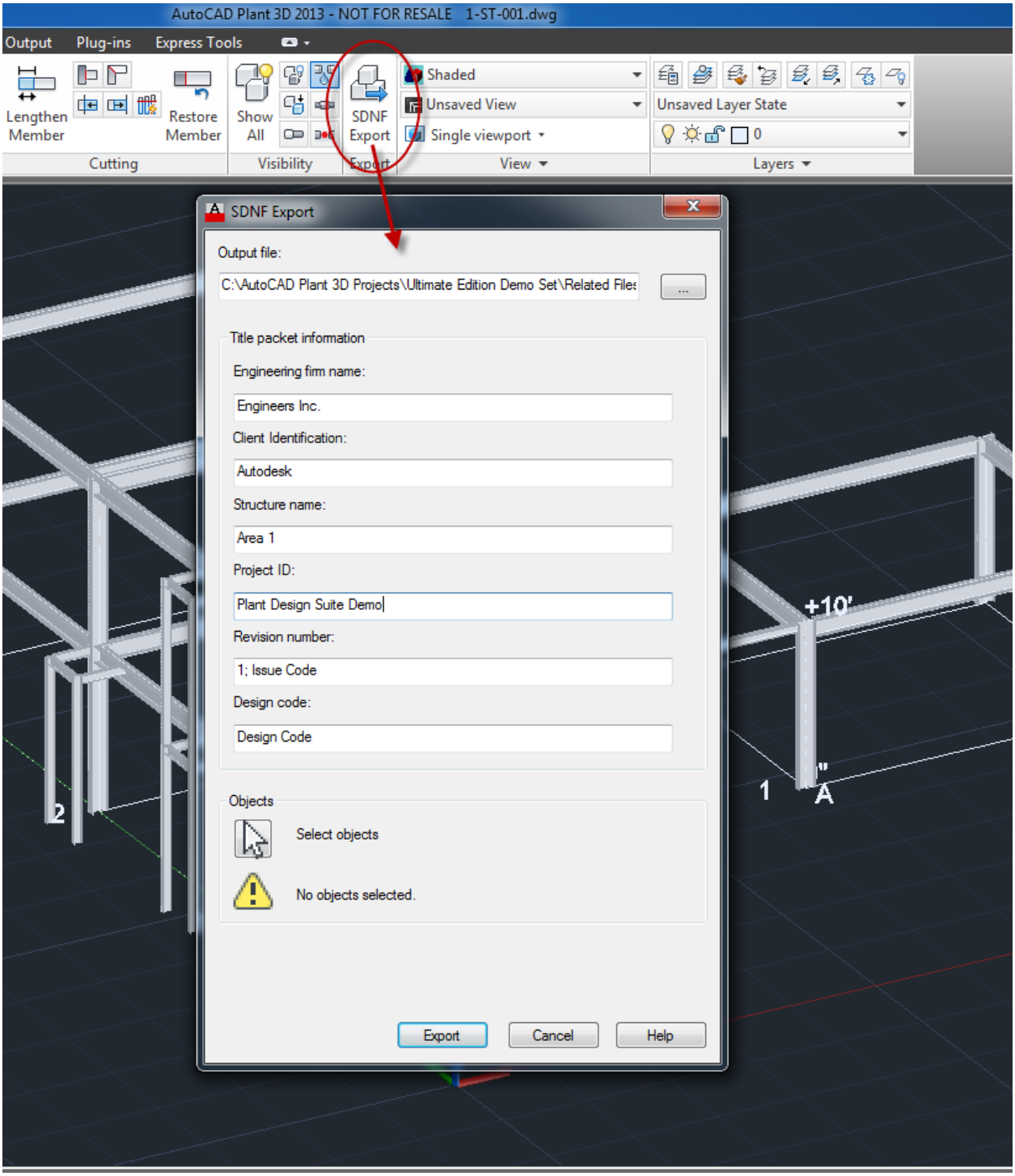
As an Autodesk Subscription user, you would normally be able to download the Revit Extensions which allows Revit users to import SDNF files which can be created in Plant 3D. That would allow users to transfer the structure created in Plant 3D to Revit Structure and thence to AutoCAD Structural Detailing.

The steps for the workflow are:

1. Create the Structural Detailing Neutral File (SDNF) in AutoCAD Plant 3D
2. Create a project in Revit Structure (RST) and import the SDNF file. (Note that Revit Extensions are needed to import the SDNF file – the Revit Extensions are available to all Revit Subscription users.)
3. After continuing to design and engineer the structure, the Revit Extensions allow users to directly send the structure to AutoCAD Structural Detailing (ASD), where the structure can be detailed for fabrication. The ASD model is an AutoCAD model and can be used in the Plant 3D model for more fully integrated Plant Design, and can also be used in Navisworks for detailed clash detection.

We will now go through these steps.

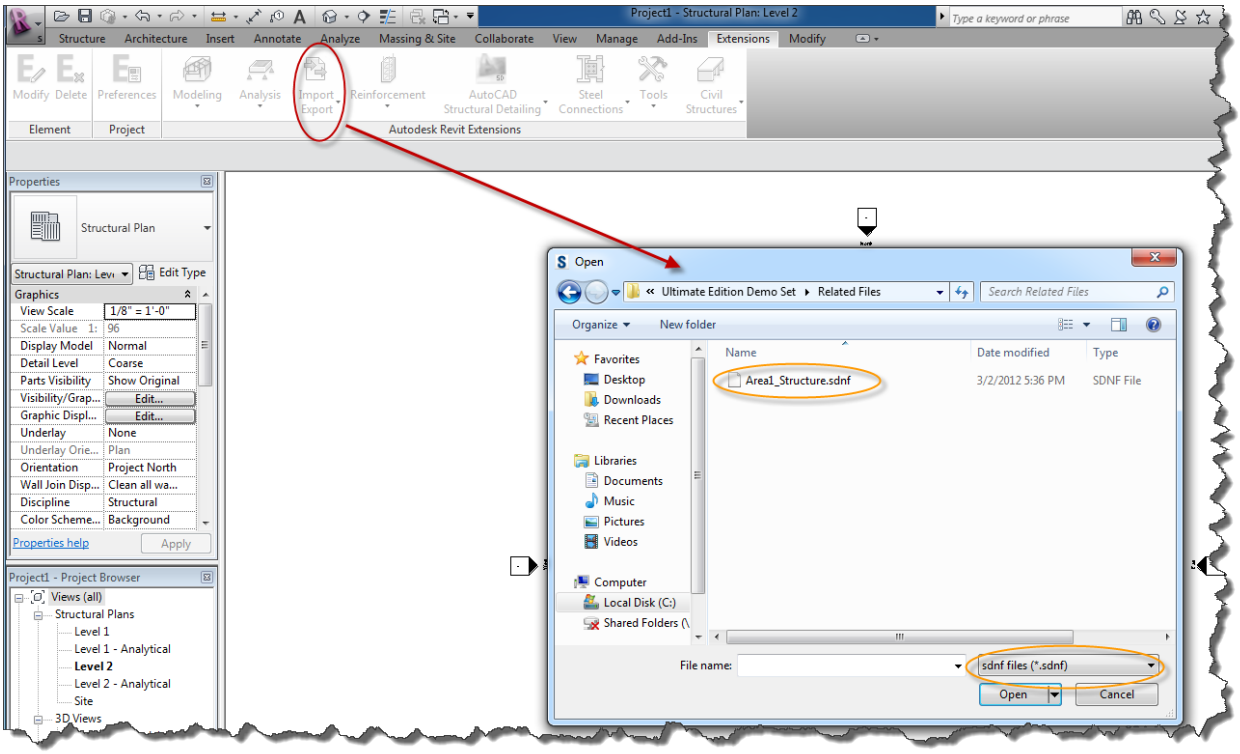
First we will export the file so we can use it in Revit Structure:
First turn OFF the 'Grating' and 'Stairs & Rails' layers, this will leave you with just the columns and beams. Then select the SDNF Export command in the Structure ribbon and enter the data as shown below. (**Note -** You will need to select the structure by clicking on the 'select objects' button BEFORE clicking on 'Export'):



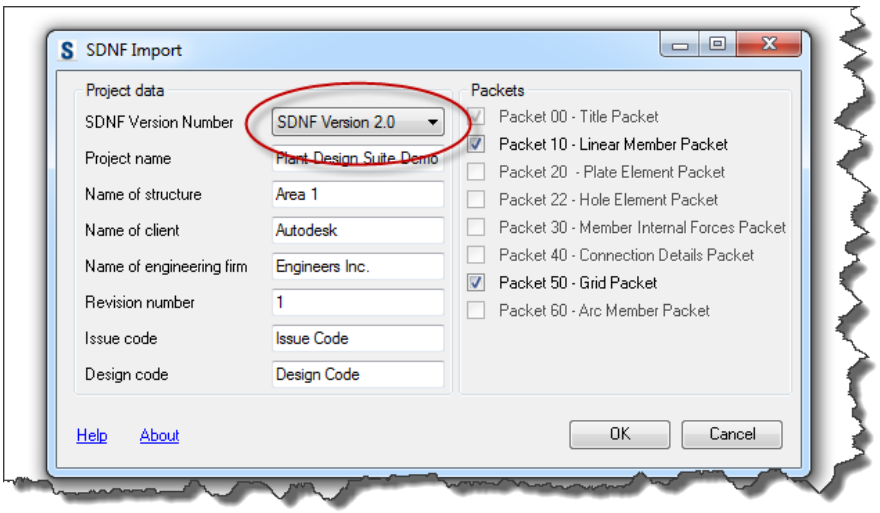
The export file will be ‘Area1_Structure.sdnf’ and should be located in the project Related Files folder.

Revit Structure

Open RST and create a new project, then select the 'Extensions' ribbon and select the 'Import Export' command and then select 'SDNF Import'. Select the SDNF file you created earlier in the Plant 3D Project\related Files folder. **Note -** make sure you select 'SDNF Version 2' as the SDNF version number.

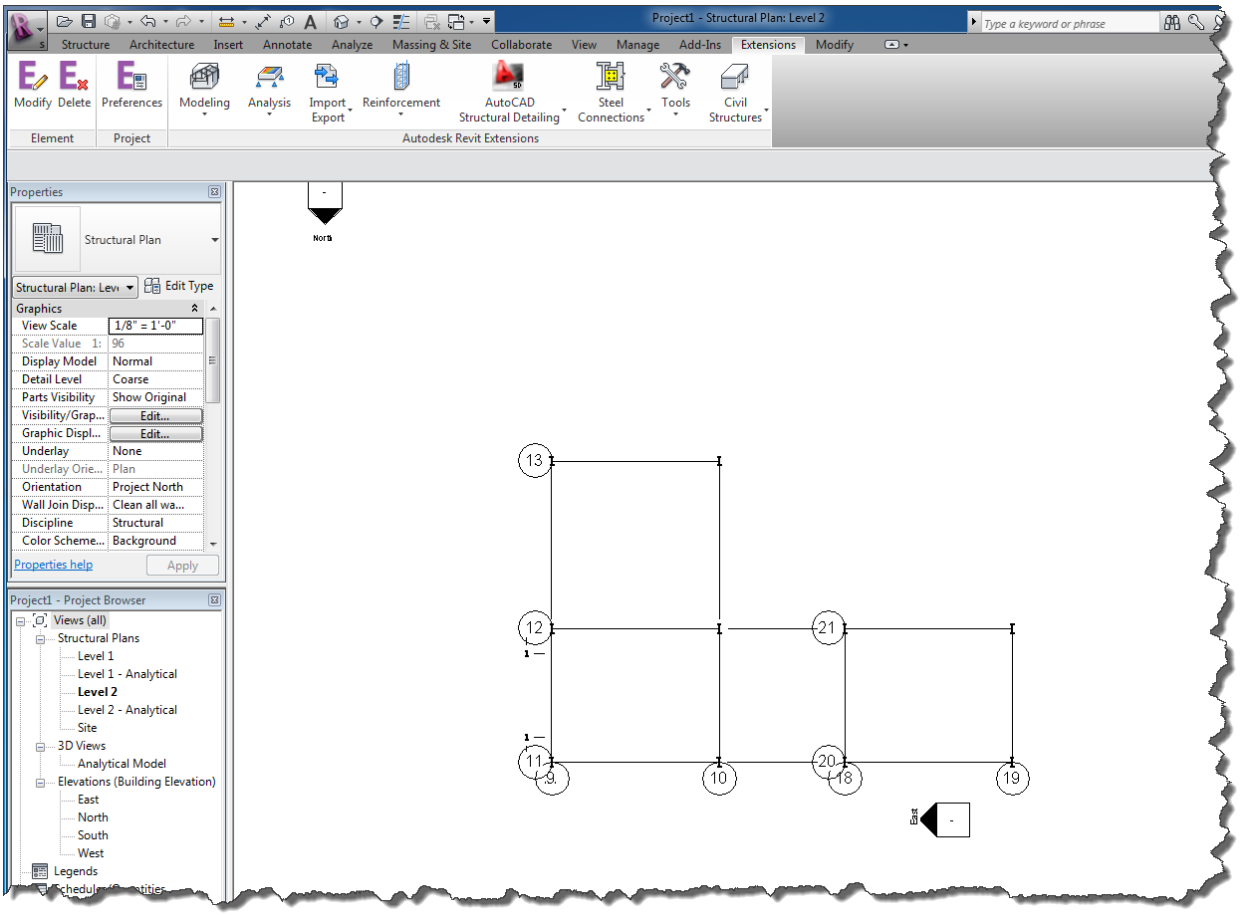


The dialog box will open showing the project parameters that you keyed in in Plant 3D. **Note -** make sure you select 'SDNF Version 2' as the SDNF version number.



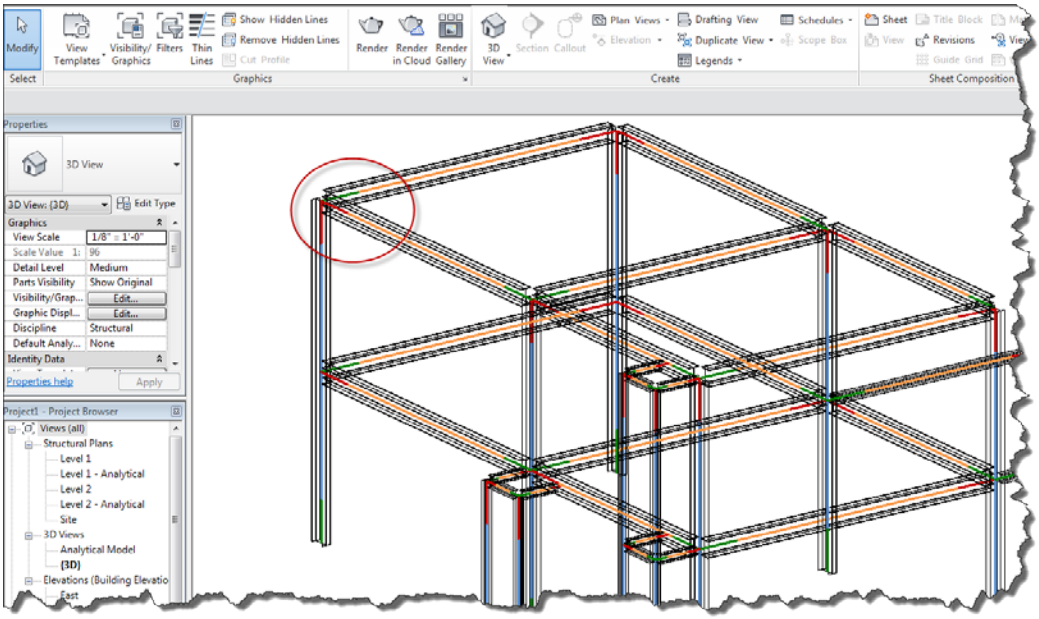
During the import process you will be asked to fix some mappings, for example A242 to STEEL A242-42.

Once complete the Revit model will look like this:



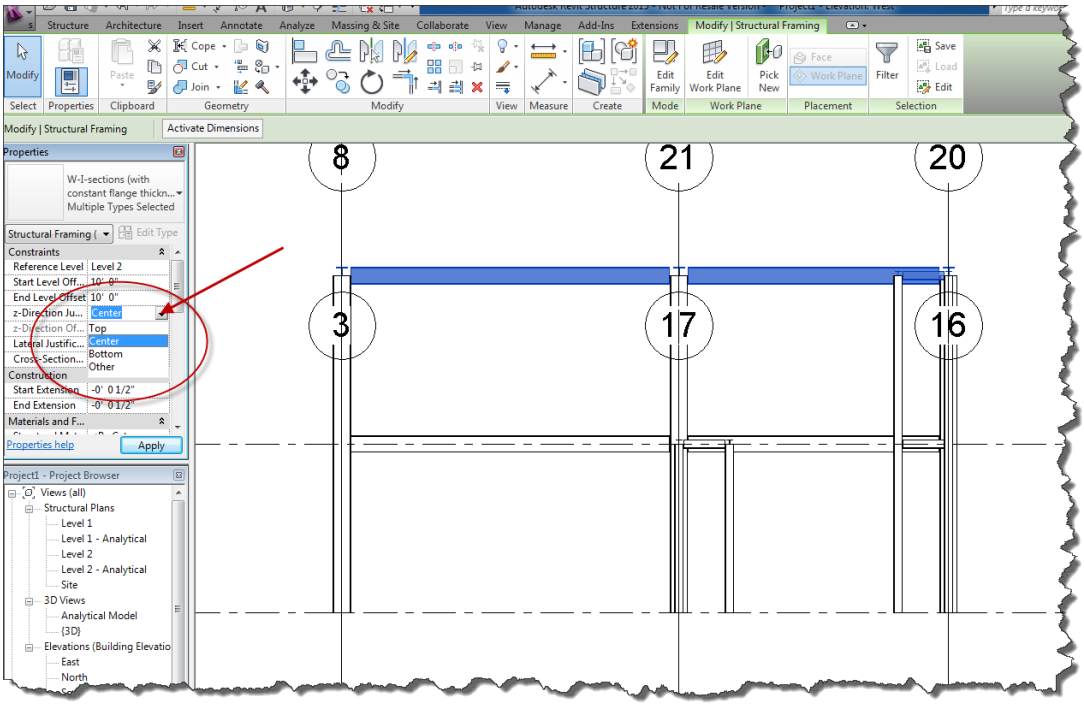
You can now start to learn Revit Structure.

First switch to a 3D view and look carefully at the beams.



Note that the beams are placed by center and not by top-of-steel. This can be corrected very quickly as follows:

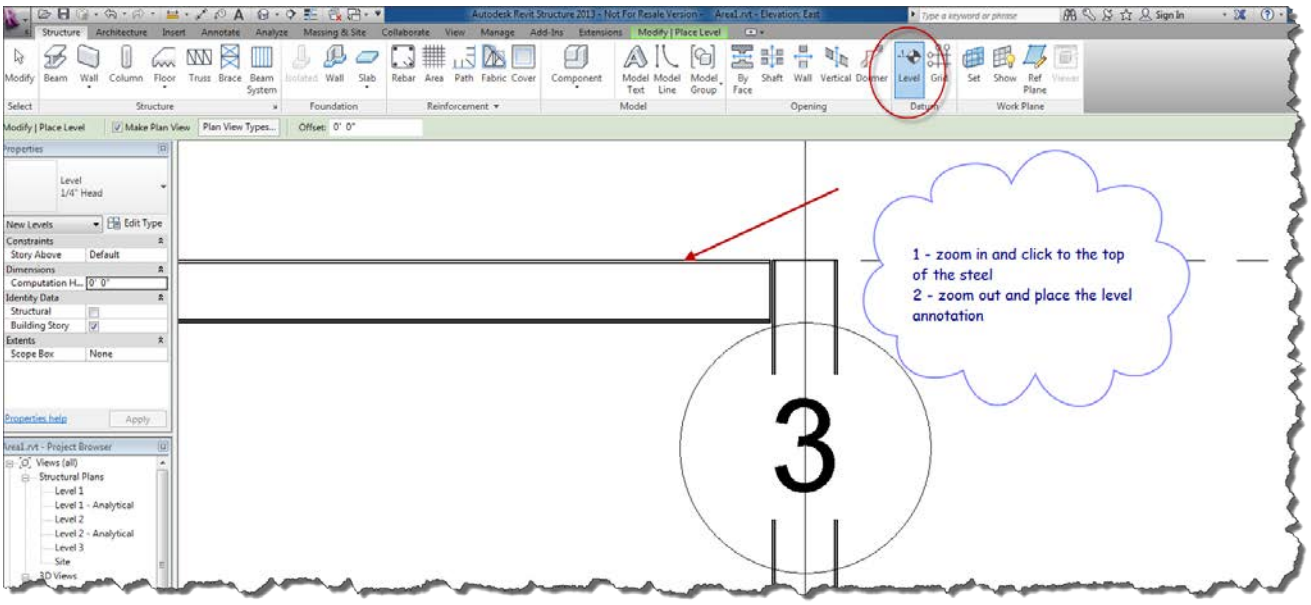
Select an elevation view (e.g. west), window the beams at one level, then in the properties window click on the drop-down field for the ‘z-direction justification’ and select ‘Top’ and click ‘Apply’:



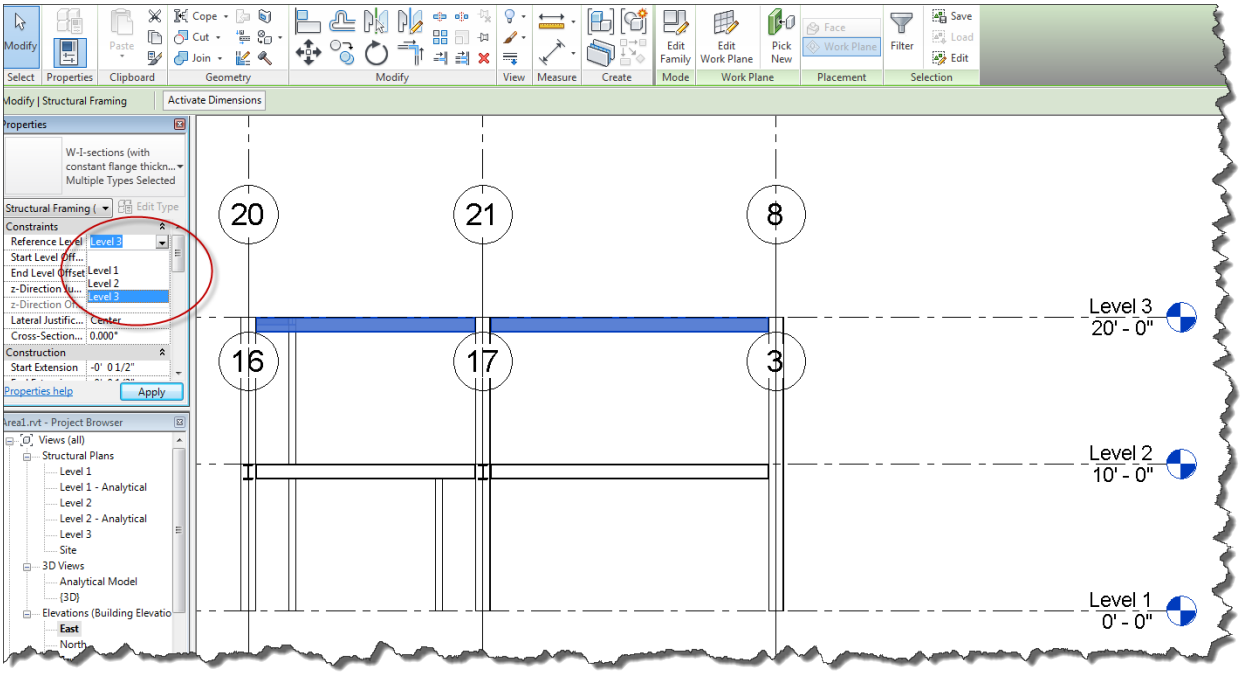
Repeat for level 1.

Now save the project as Area1 in the C:\Revit Projects folder.

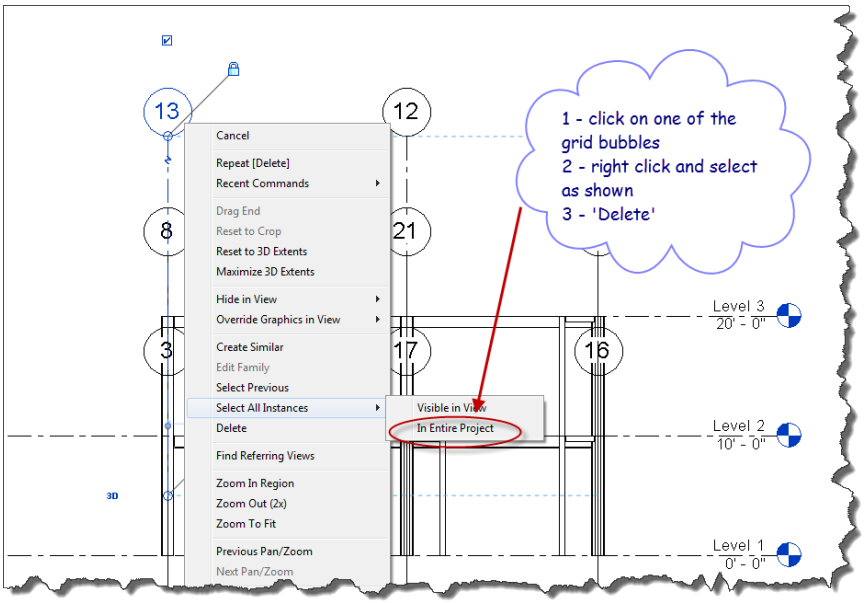
Now we assign a level to the top of the structure:



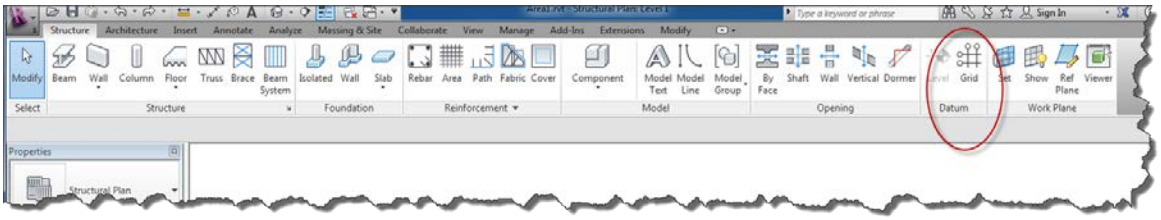
And now we need to associate the top level beams to level 3:



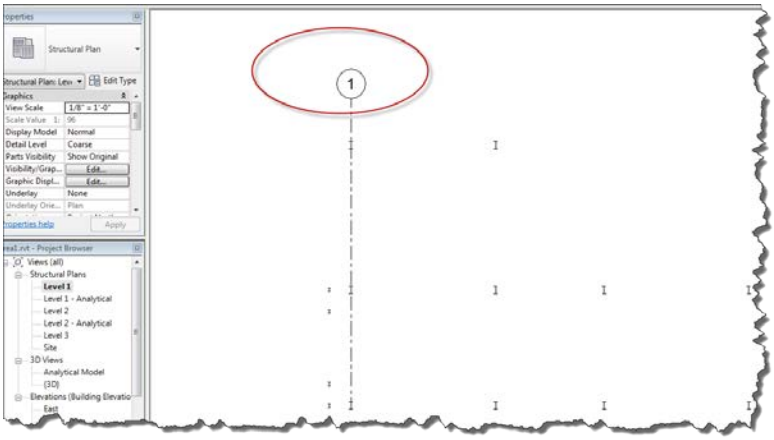
Now we will delete the grid that was created during the import and create a 'proper' one – first delete the initial grid:



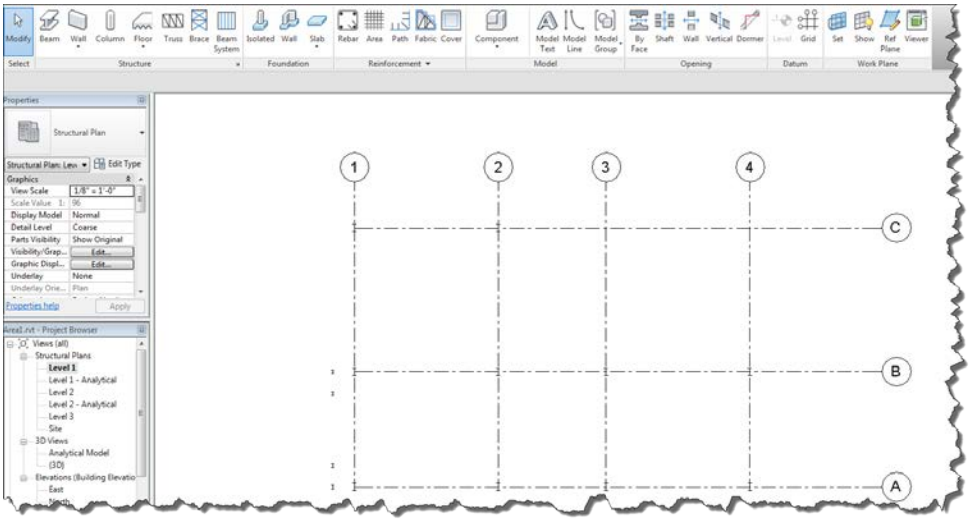
Now create a new grid. Start by opening Level 1 plan and select the Place Grid command:



And place the first n/s grid line by starting in the middle of the bottom left column and extending the grid line past the top left column. Then click on the text inside the bubble and reset the grid number to 1:

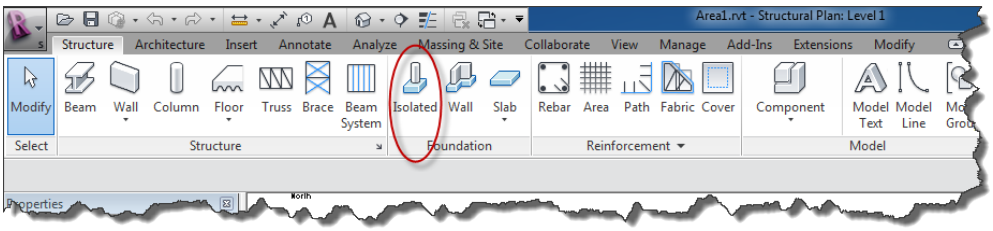


Repeat the process for the rest of the columns along both axes until you have the following:

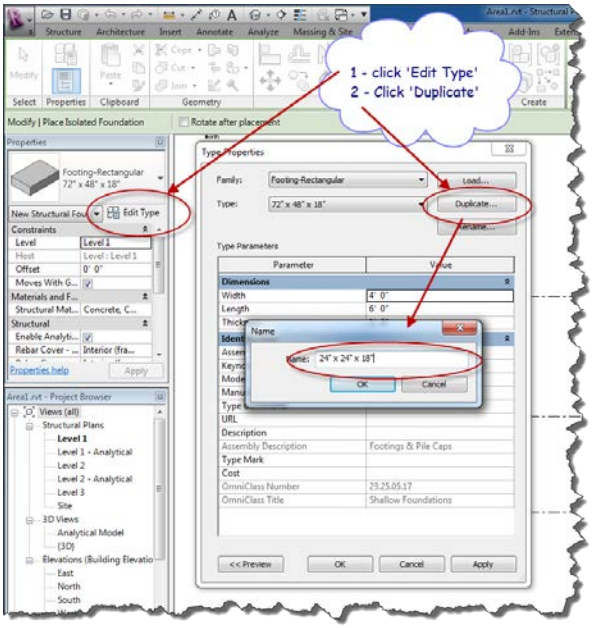


Next we will place concrete footings at the bottom of the main columns:

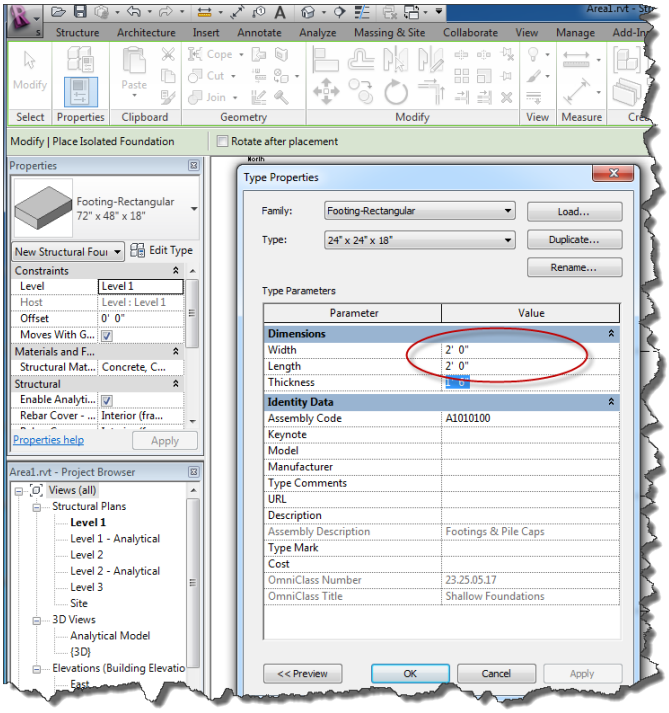
Using the Level 1 View, select the Isolated Foundation Command in the Structural ribbon:



Next set the type of foundation we want to place (24”x24”x18”):

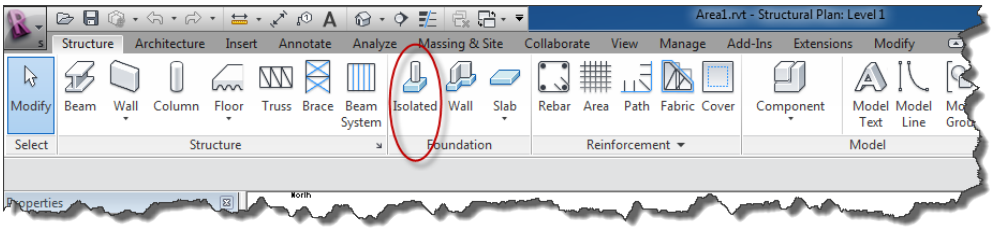


Edit the width and length (24” and 24”) and then click OK:

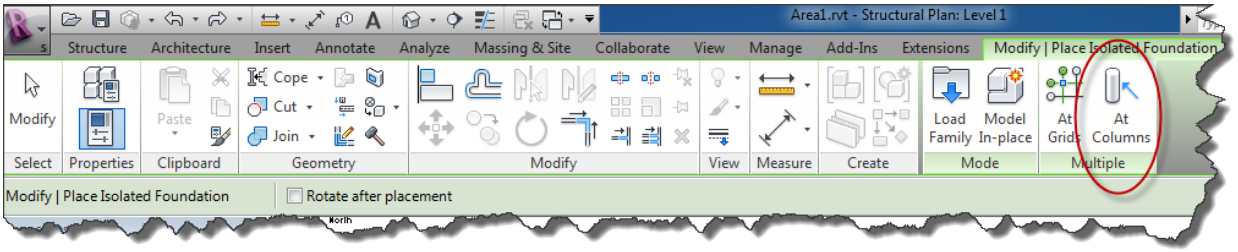


Now we can place the footing on each of the primary columns. The steps are as follows:

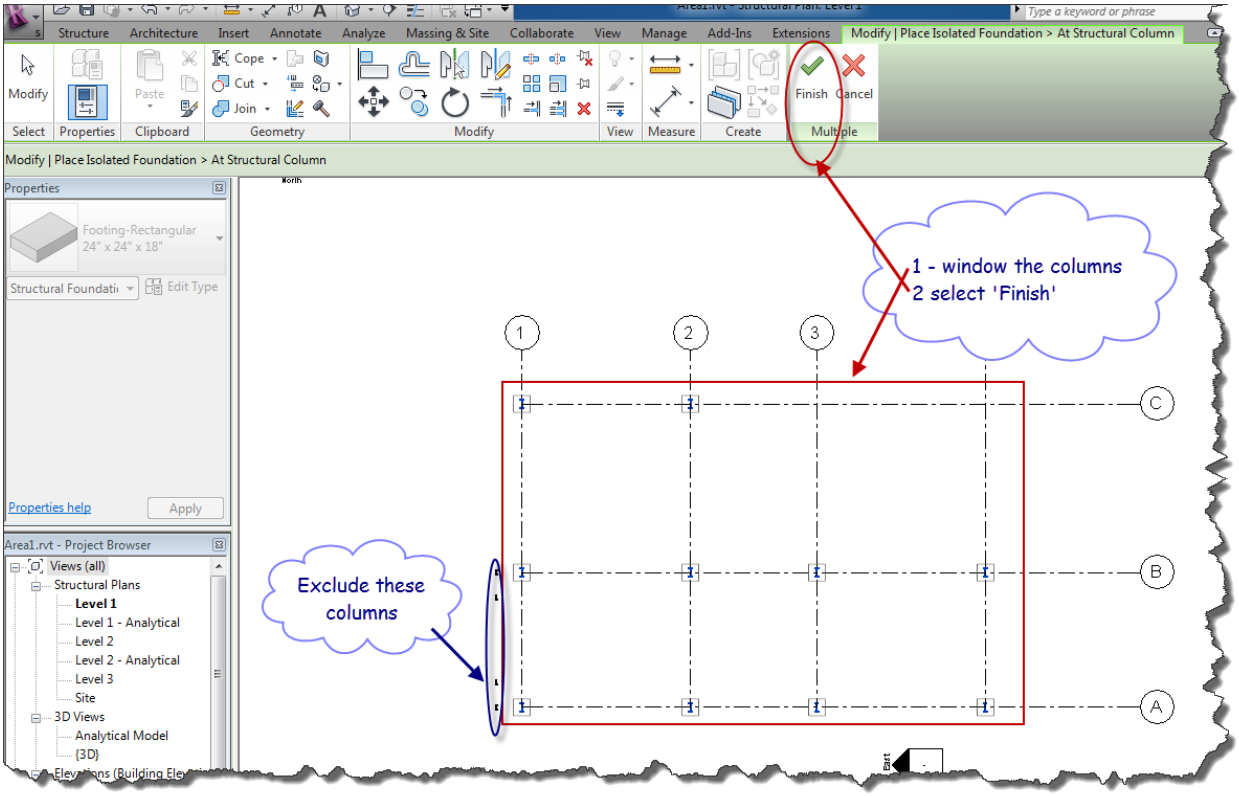
1. Select the Isolated Foundation command:



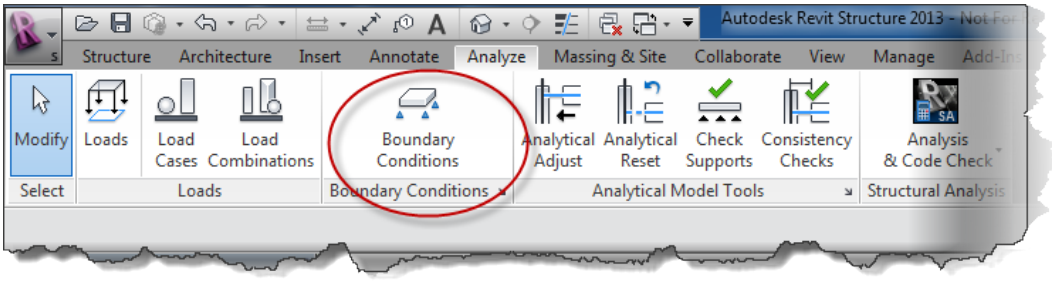
2. Click on Multiple / At Columns:



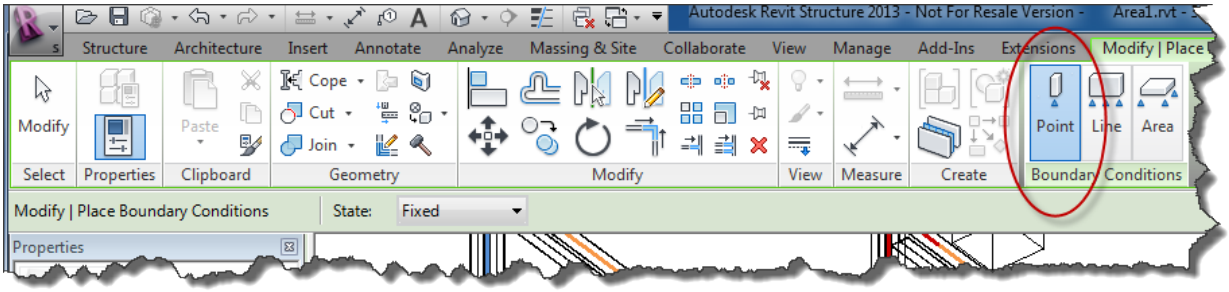
3. Window the MAIN columns (at the intersections of the grid), then select 'finish' – make sure you do not include the stairs supporting columns:



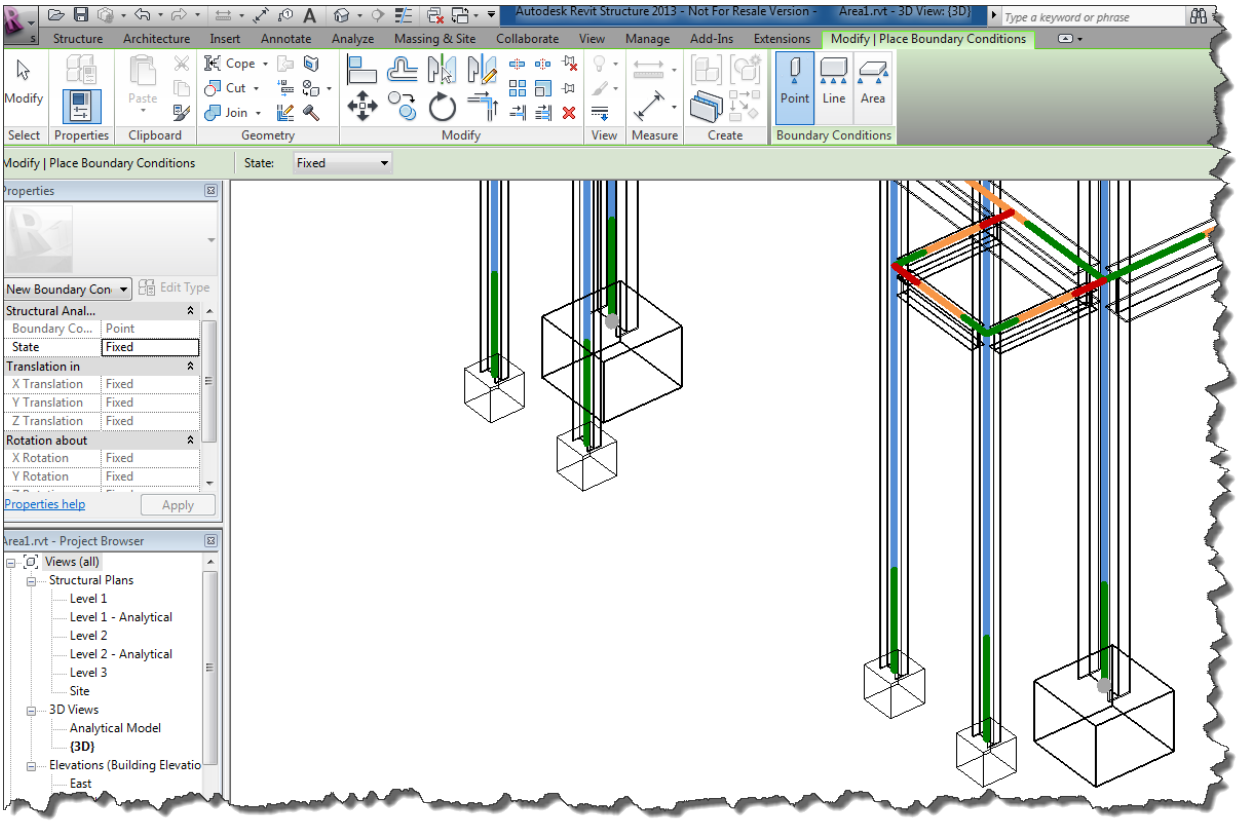
4. Switch to 3D view to see the foundations.
5. (Optional) – for analysis, the bottom of the stairway columns need to be anchored, but they would probably be supported in the stairway slab – so we just need to place point boundary conditions at the ends of these columns. This is found in the 'Analyze' ribbon:



opens this ribbon:

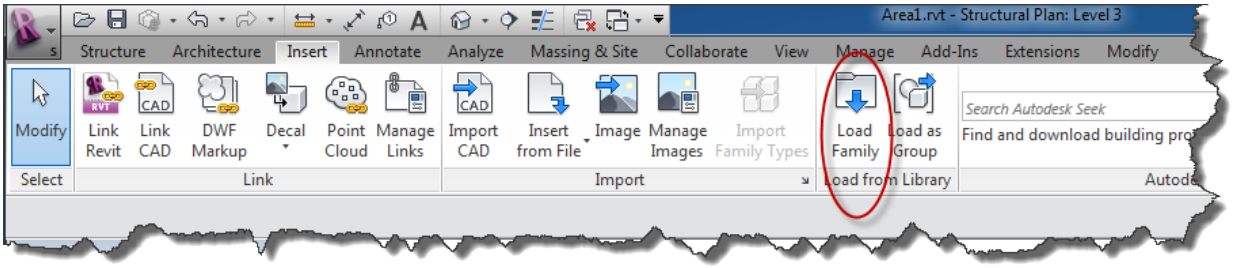


select the ends of the columns (click on the green lines) and the boundary points will be place. Click <esc> to end placement.

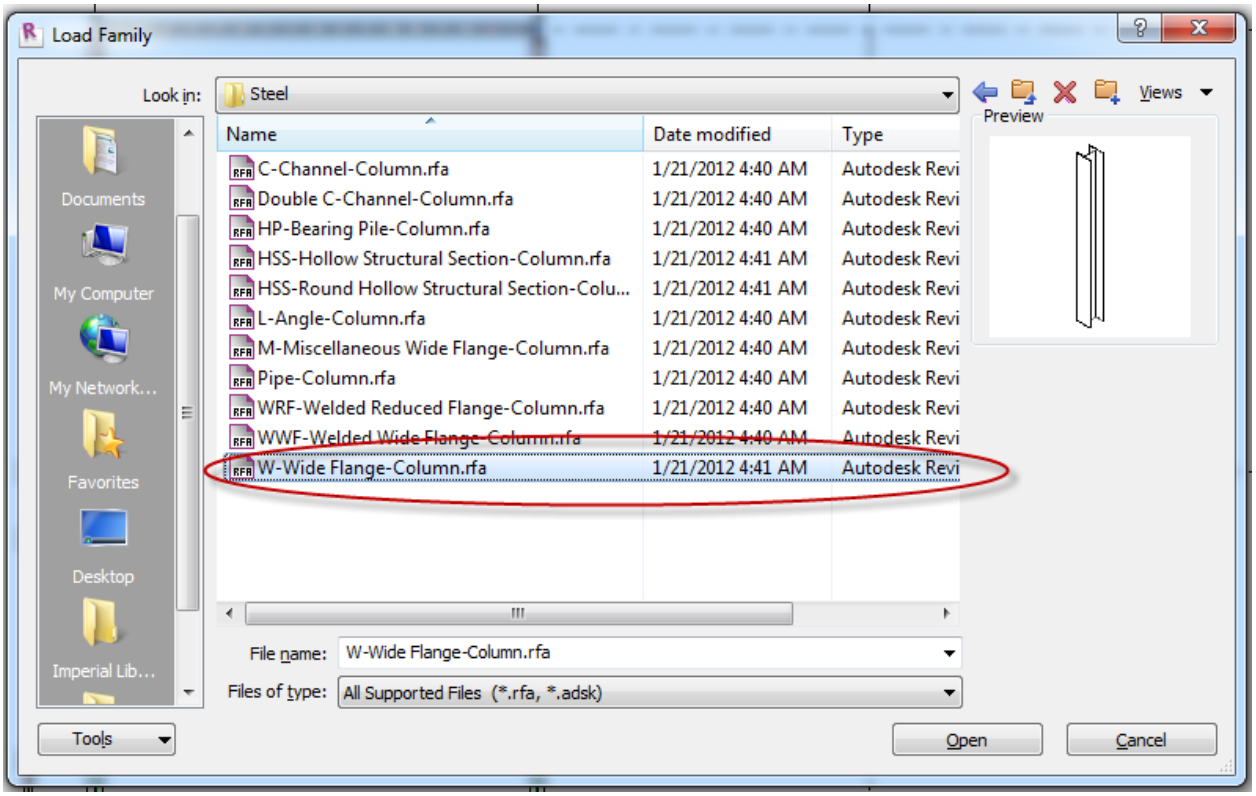


Now we will place secondary steel on level 2. This is called a 'beam system' in RST. However, first we will need to make sure that the beam sections we want to place are already available in this project – they are not! So follow these steps to pre-load the member section:

1. Select 'Load Family' in the Insert ribbon:

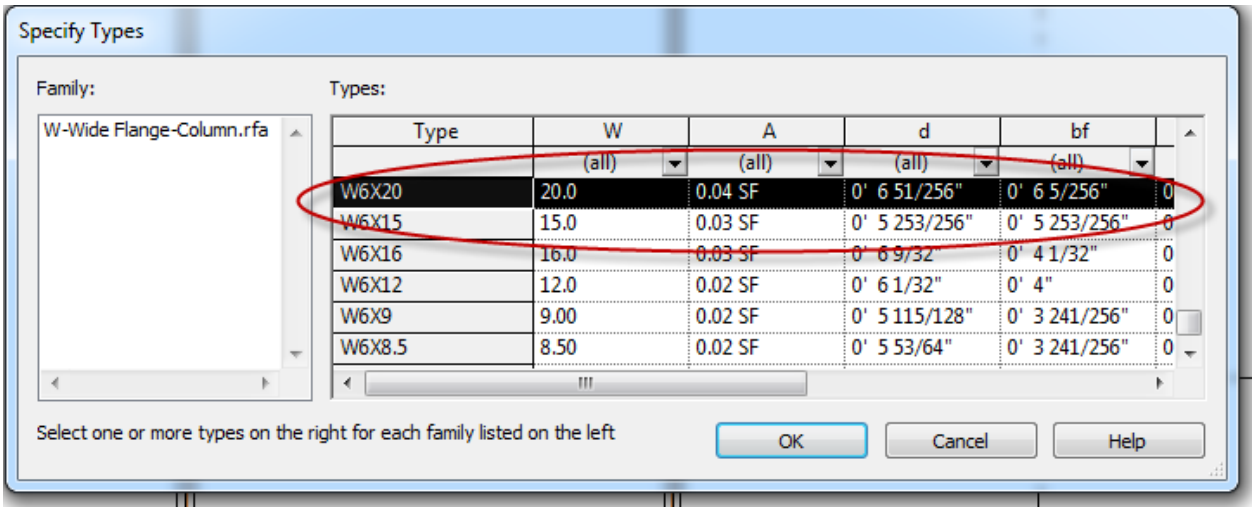


2. Select the US libraries from the …\Program Data\RST 2013\Libraries\US Imperial\Structural Framing\Steel folder and select W-Wide Flange-Column.rfa:



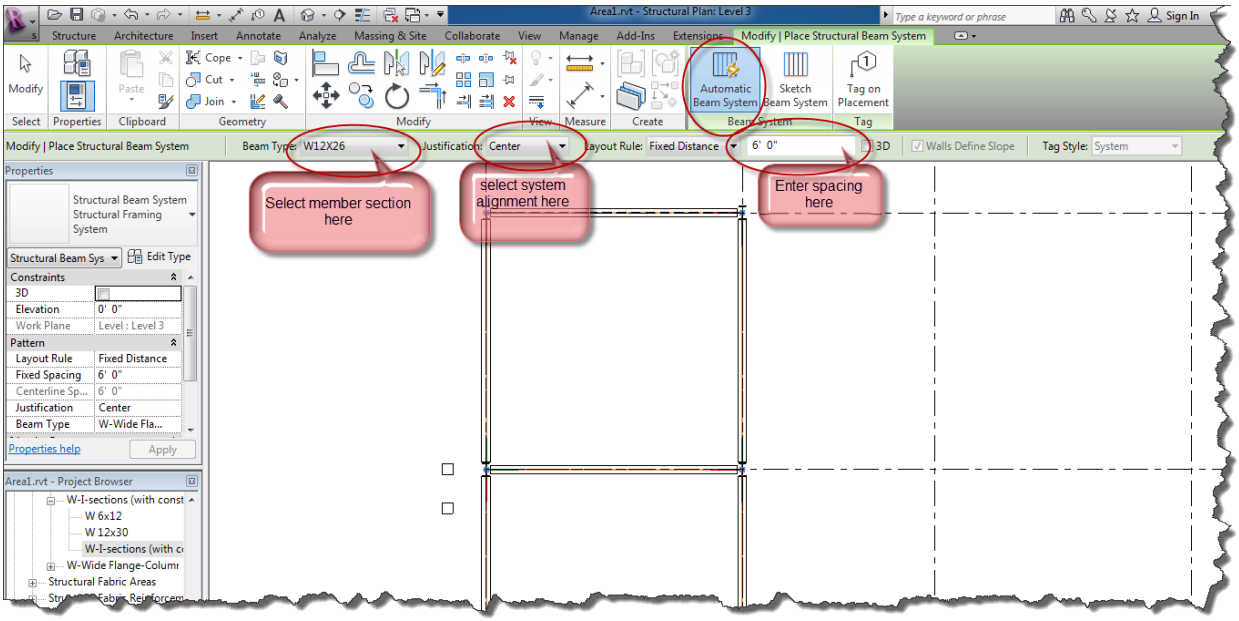
and click 'Open'.

3. Select the section (W6x20):



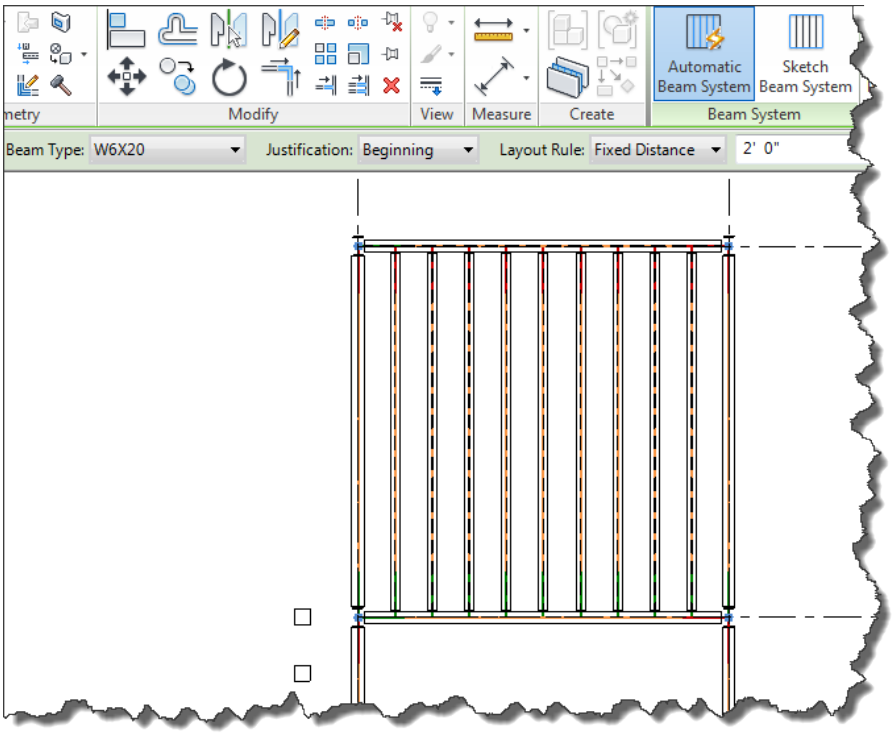
   click 'OK'. (You can select many sections at the same time)
4. The selected sections are now loaded into the project.

We can now place the secondary steel on level 3 – select 'Beam System' in the structural ribbon. A new ribbon appears and the parameters are entered here:

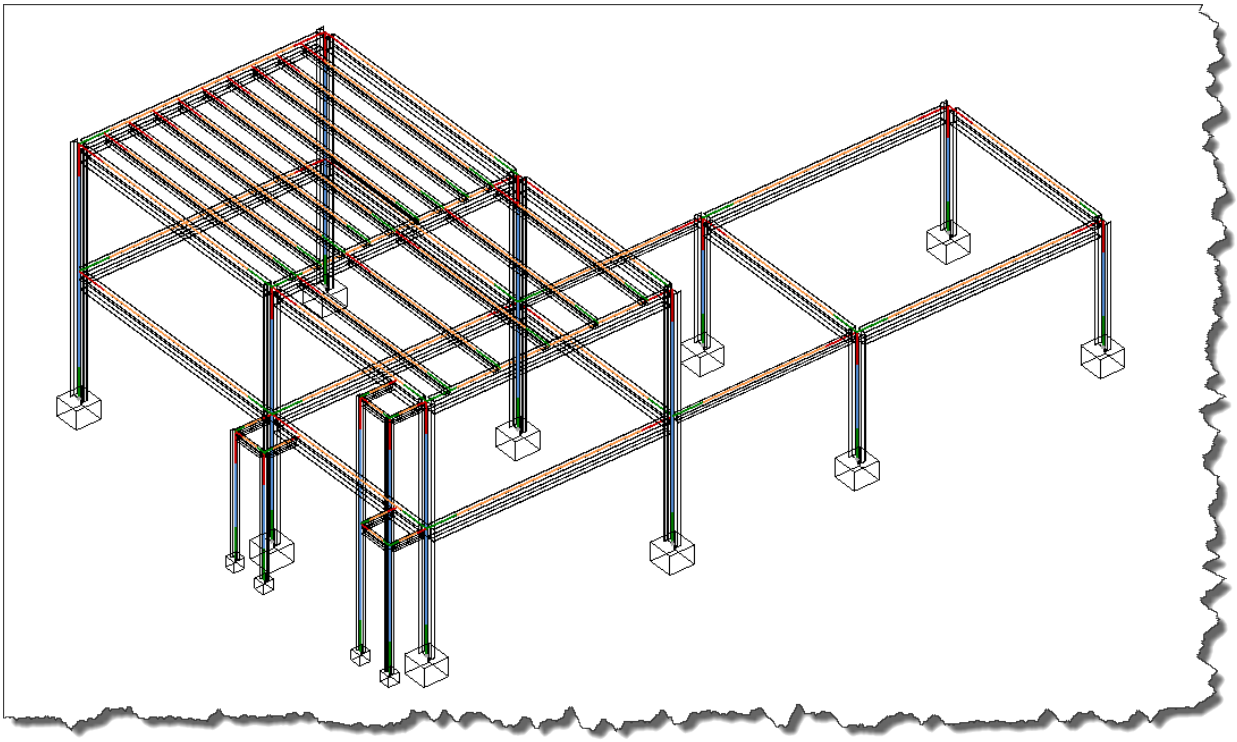


The values to be entered are:
- Beam Type: W6x20
- Justification: Beginning
- Layout Rule: Fixed Distance – 2' 0"

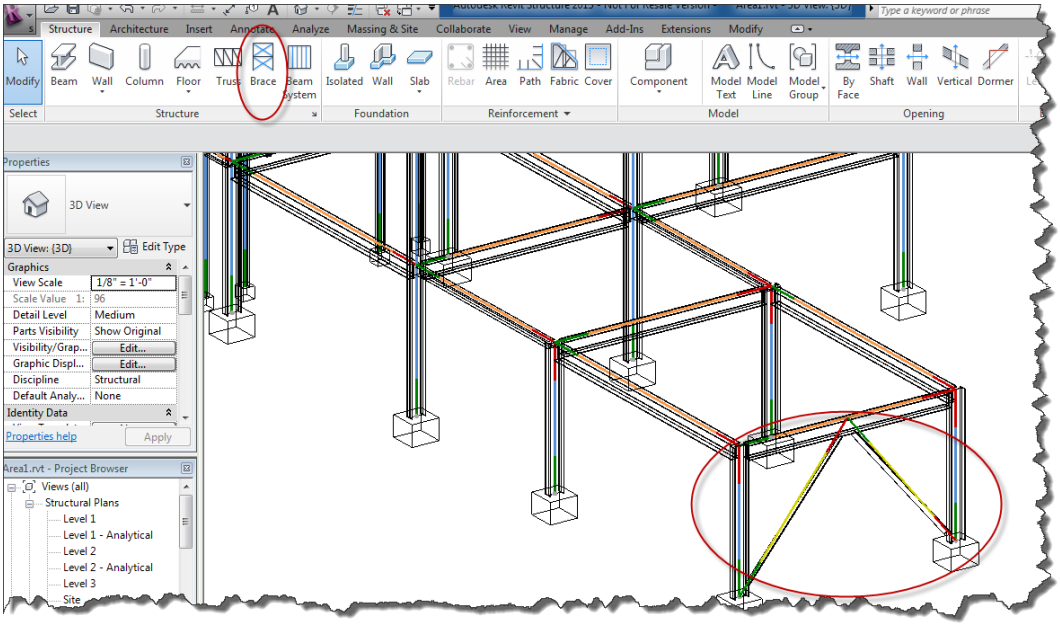
And now place the cursor against the top beam and then the left beam in the level 3 view – note how the beam arrangement changes. Click against the upper left beam – the result will be:



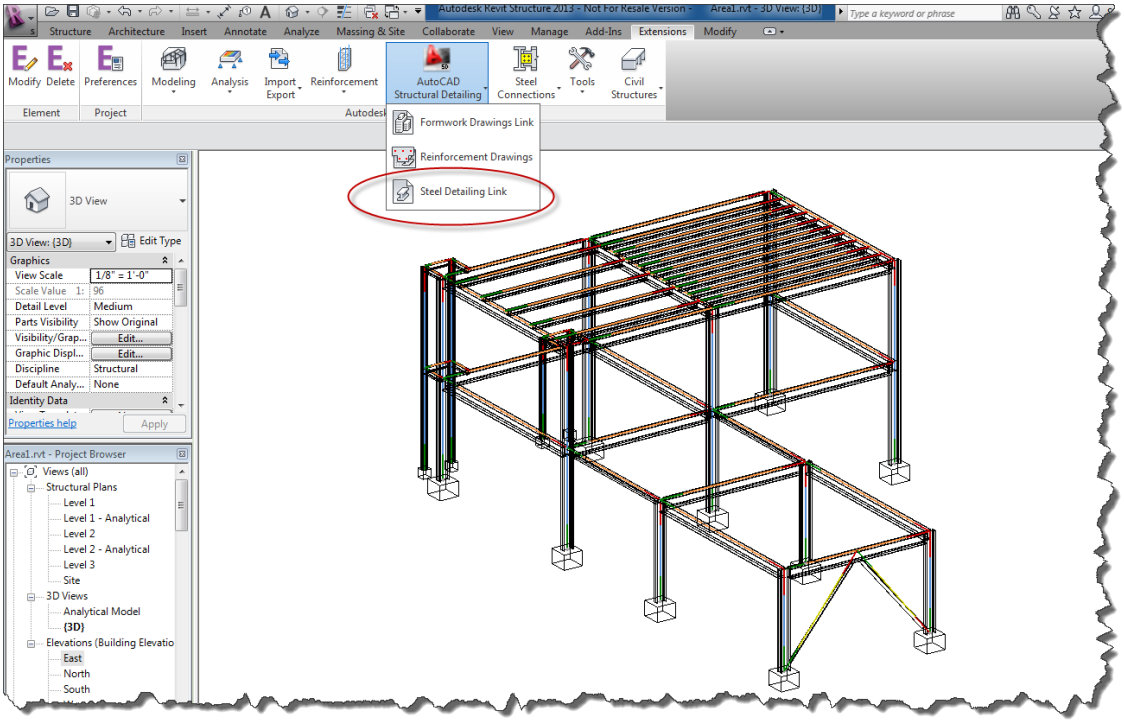
Now we will place secondary steel in the other bay on level three. This time the spacing will be 4 feet with the same section. Once complete the structure looks like this in 3D:



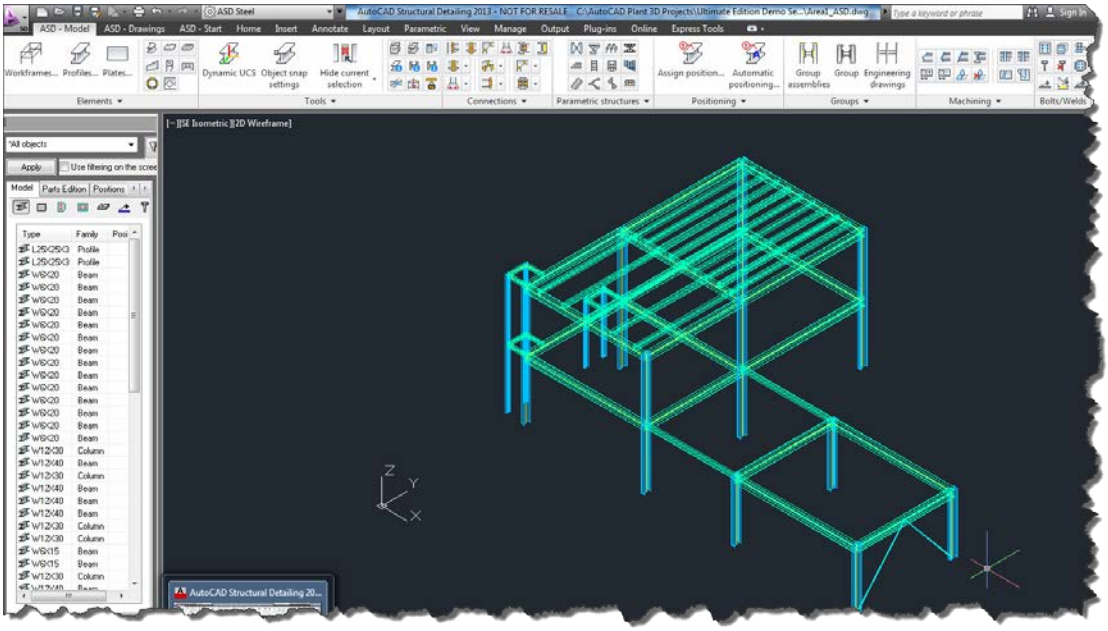
Finally (optional) we will place bracing using angle section L4x4x1/2. Use the command 'Brace' in the Structural ribbon. (Hint – keyin 'S' then 'E' to snap to the bottom of the columns and 'S' and 'M' to snap to the midpoint of the beam. The result will be:



Save the project and let's demonstrate Steel Detailing. We do this by transferring the model to AutoCAD Structural Detailing. Again using the Extensions Ribbon, simply select the AutoCAD Structural Detailing >> Steel Detailing Link command. (**Tip** – Open ASD before you execute this command):



Select the option to 'send model to AutoCAD Structural Detailing'. The process may take a short while, but once complete ASD will be opened and the model can be viewed in ASD.

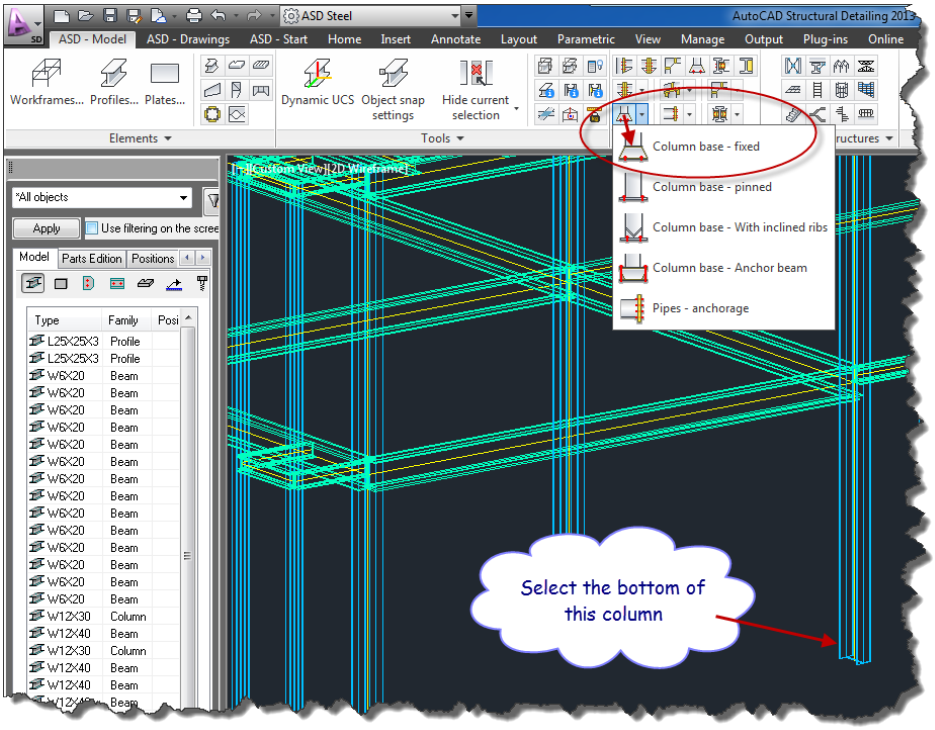


Save the file and let's continue to AutoCAD Structural Detailing (ASD).

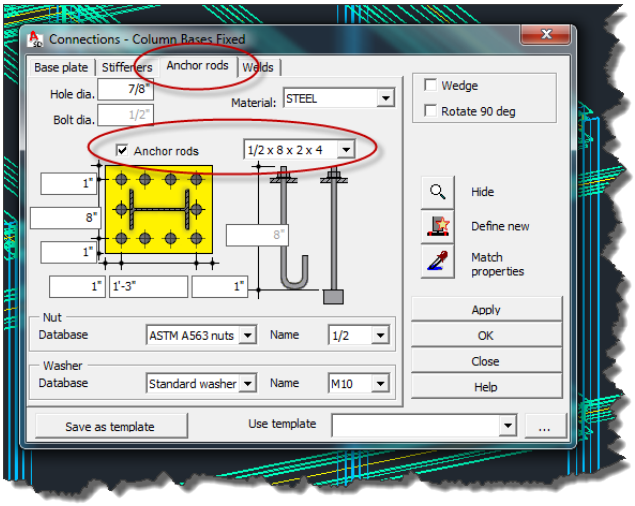
AutoCAD Structural Detailing

We will create and copy connections. First we will do the end connection to attach the base of the columns to the foundations we added in RST. (Note that the foundations do not come through to ASD as they are concrete)

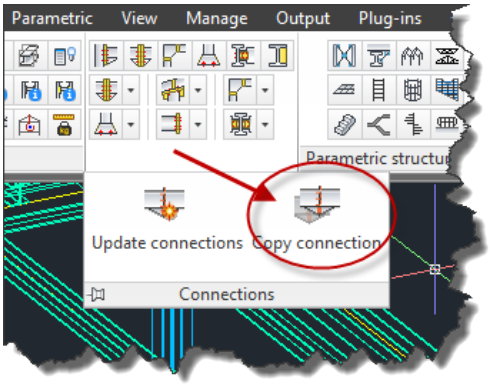
1. Select the ‘column base – fixed’ connection type in the ASD Model ribbon and then click near the bottom of the column as shown:



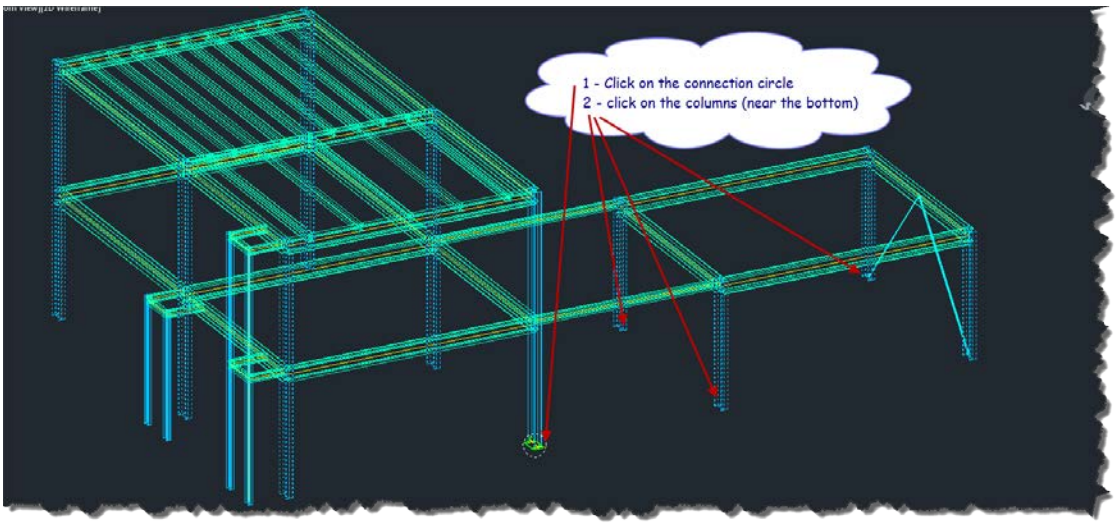
2. Enter the parameters for the connection and place the connection on the beam. (Note – you can adjust all the parameter values. If you enter something invalid, the field will become red and you will not be able to accept those parameters. Also, place anchor rods to affix the connection into the foundation):



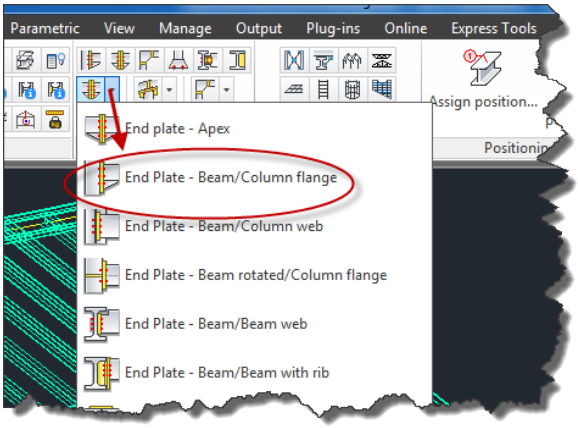
3. Click OK and after the connection appears, we can copy this onto the rest of the main columns (Note if the circle around the connection is too large or too small to be visible, reset the size by clicking on Preferences >> Structural Detailing>>Steel>>Connections and setting the size value to a suitable size) :



Then click on the connection circle and then the columns (dashed below):

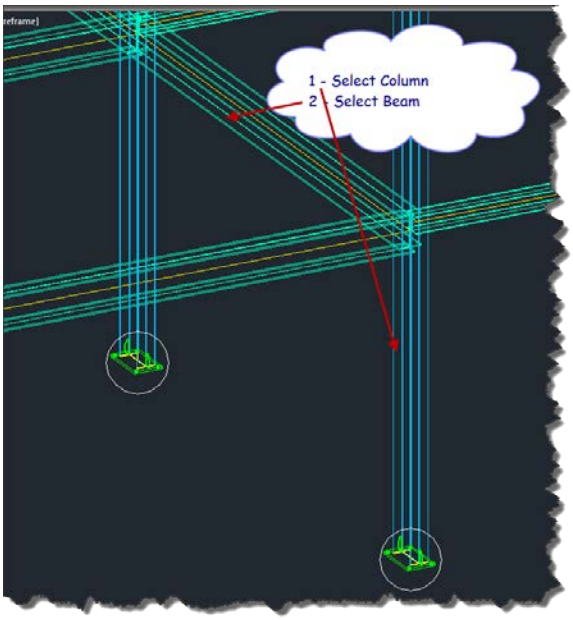


4. Now we will do the Beam to Column connections. There are many different types of connections depending on whether it is a beam to flange or beam to web connection. We will do a simple example. Select the end plate – Beam/Column flange connection:

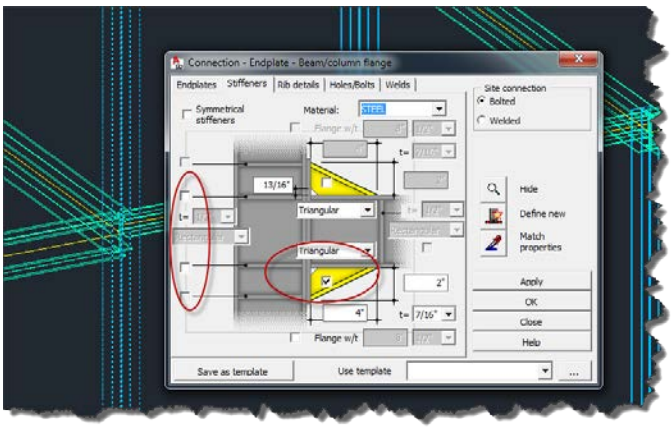


Next select the column (the same one we put the end connection on) the a connecting

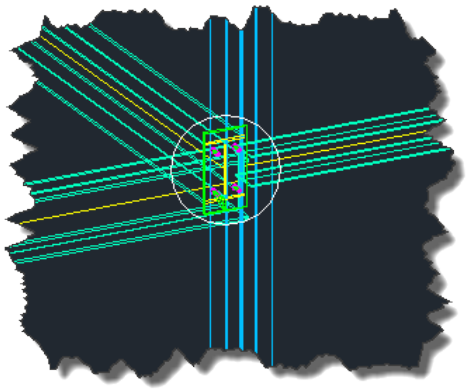
beam:



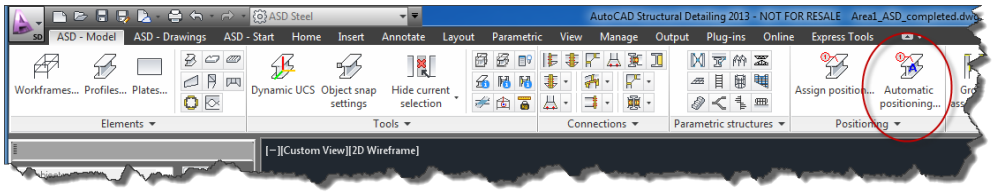
5. In the connection dialog box select the default values but in the stiffener tab, select a triangular stiffener under the connection and remove the ribs in the column. Apply will show you a preview and OK will place the connection:



The connection should look something like this:

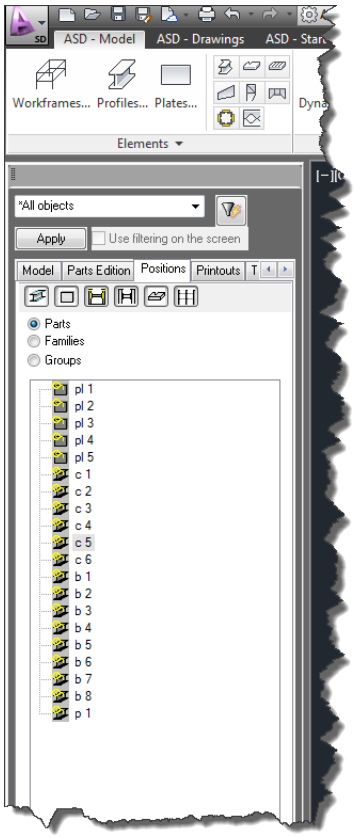


6. You can now copy these connections in the same way as we copied the end connections.
7. Next step is to ‘position’ the connections. This process identifies all the same type of detail connections for beams, columns etc. We can do this automatically as follows:
    a. Select the ‘Automatic Positioning” command in the ASD-Model ribbon:



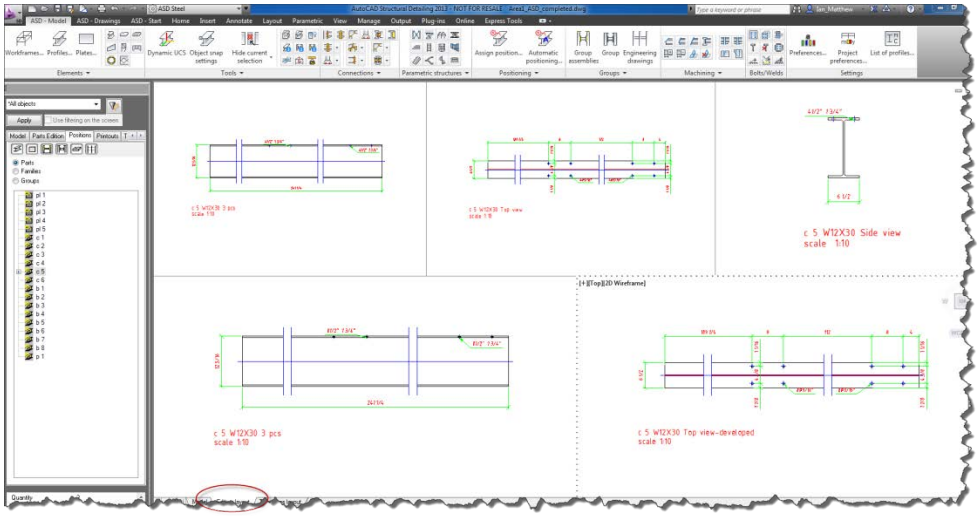
    b. Window the structure and when the dialog box appears, accept the default setting and click ‘Run’

c. The connection positions are now listed in the ‘positions tab’:



d. Right-click on position ‘c5’ and click ‘attach document’ then click on ‘Profile-bent 1:10’ in the Select Template dialog and click OK

e. A Detail Drawing template will appear in the Edition Layout tab:



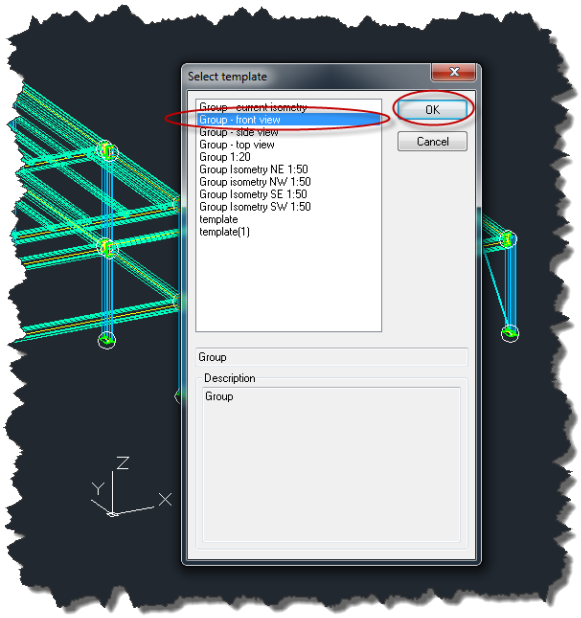
f. This can be repeated for other beams and columns.

8. Now let’s create an engineering drawing.

a. We start by creating a group:

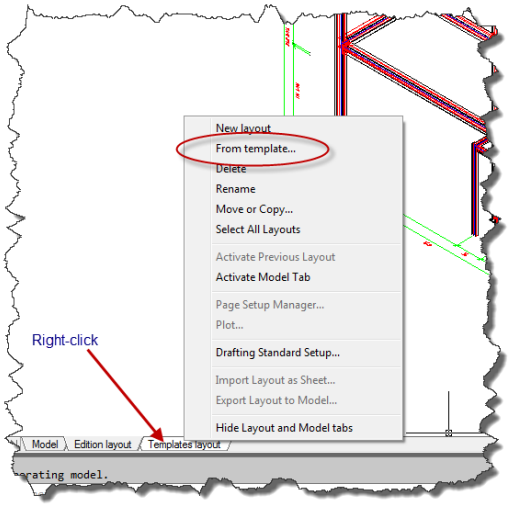
Window the complete structure, select group type as ‘Standard’ (Keyin Enter), give the group the name ‘S1’ and then hit Enter to select the WCS coordinate system.

b. In the Positions Tab, right-click on the new S1 group and select ‘Attach Document’ as we did above. Then select the ‘Group - front view’ in the Select template dialog and click ‘OK’:



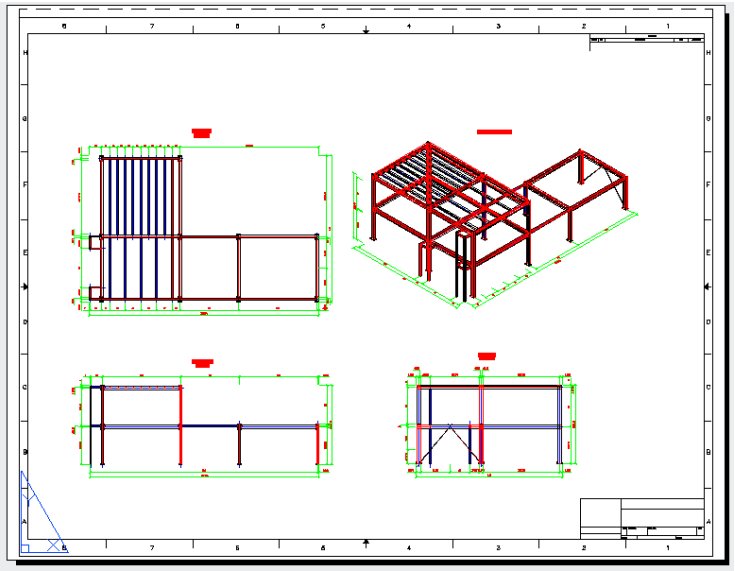
c. Repeat for a top view and for a side view and finally for a ‘Group Isometry SW 1:50’ view

d. Now create the drawing (Printout) by right-clicking on the Templates Layout tab:



and selecting a drawing template – ANSI E ASD 001.dwt. A new drawing tab will appear at the bottom. Open this drawing.

e. Now select the S1 position and select each of the views you just created and right-click on each one and select 'Add as a block to current Printout' and position the view in the drawing:



f. And finally we'll add a list of profiles table:

and position it in the drawing.

That concludes the ASD exercise.

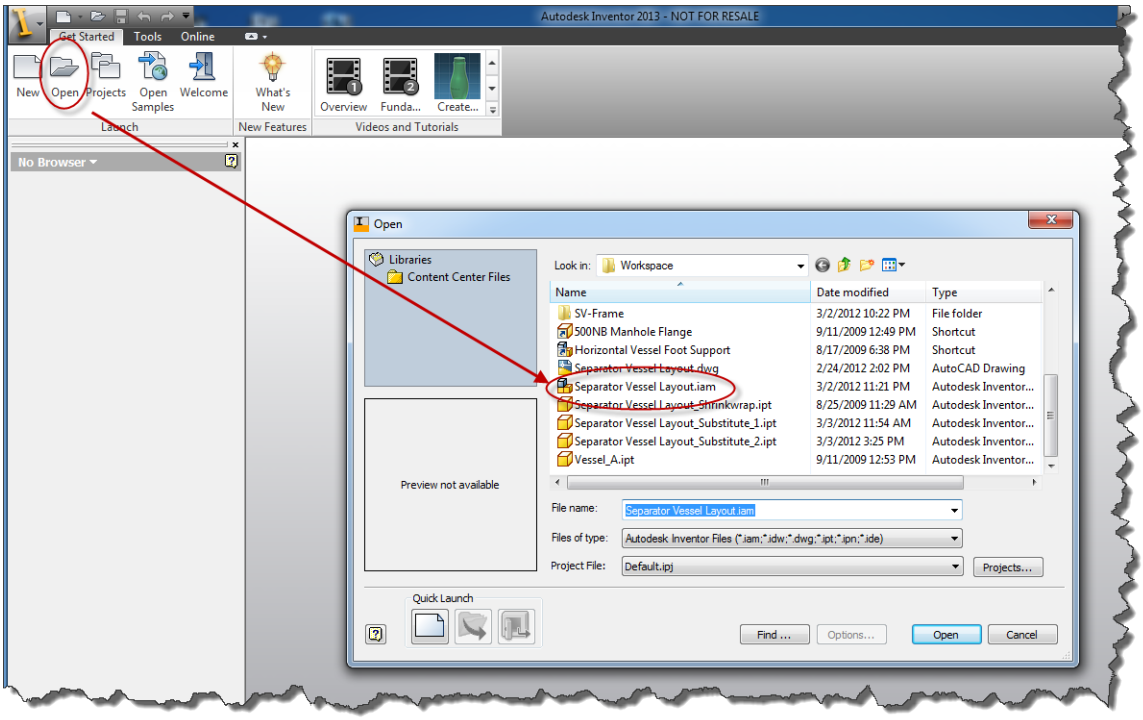
Equipment Workflow

Using Autodesk Inventor in the Plant Design Suite - Ultimate, you can get the special equipment or skid units design directly from the supplier and import it directly into Plant 3D. This section shows how to take an Inventor project and convert it for use in AutoCAD Plant 3D without losing any dimensional data.

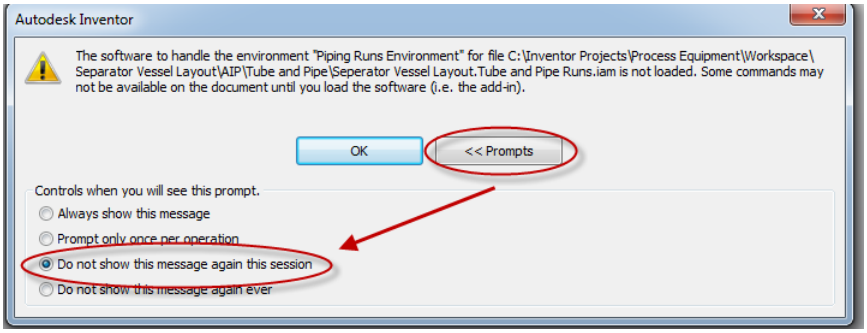
A demo Inventor model is included in the demo set. It should be stored in the folder 'C:\Inventor Projects'. The model that will be used is:
C\Inventor Projects\Process Equipment\Workspace\Separator Vessel Layout.iam

Working in Inventor

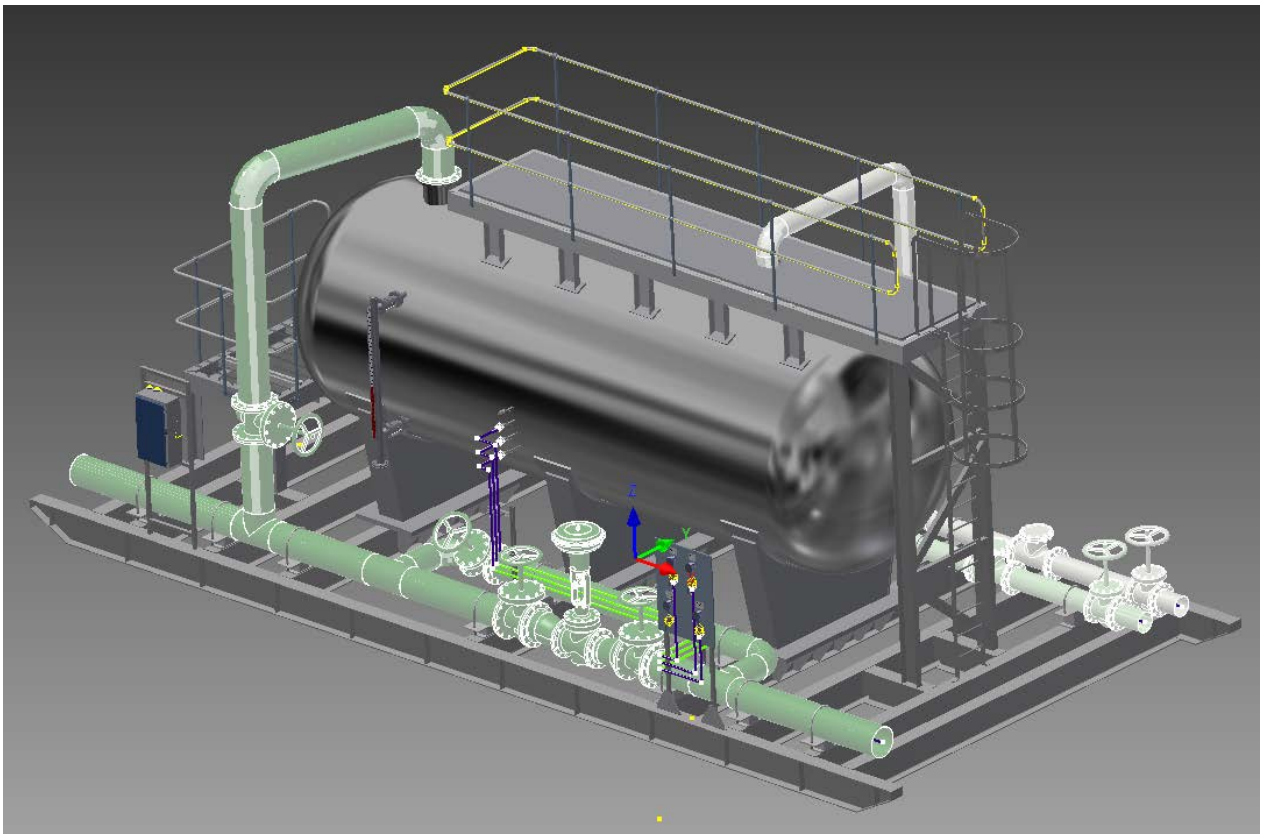
Open this assembly model in Inventor:



As the model opens, a number of error messages will display since the model was created with Inventor modules that are not included in the Plant Design Suite Ultimate. You can suppress these messages by clicking on 'Prompts >>' and then selecting 'Do not show this message again this session':



The model will open and will look like this:

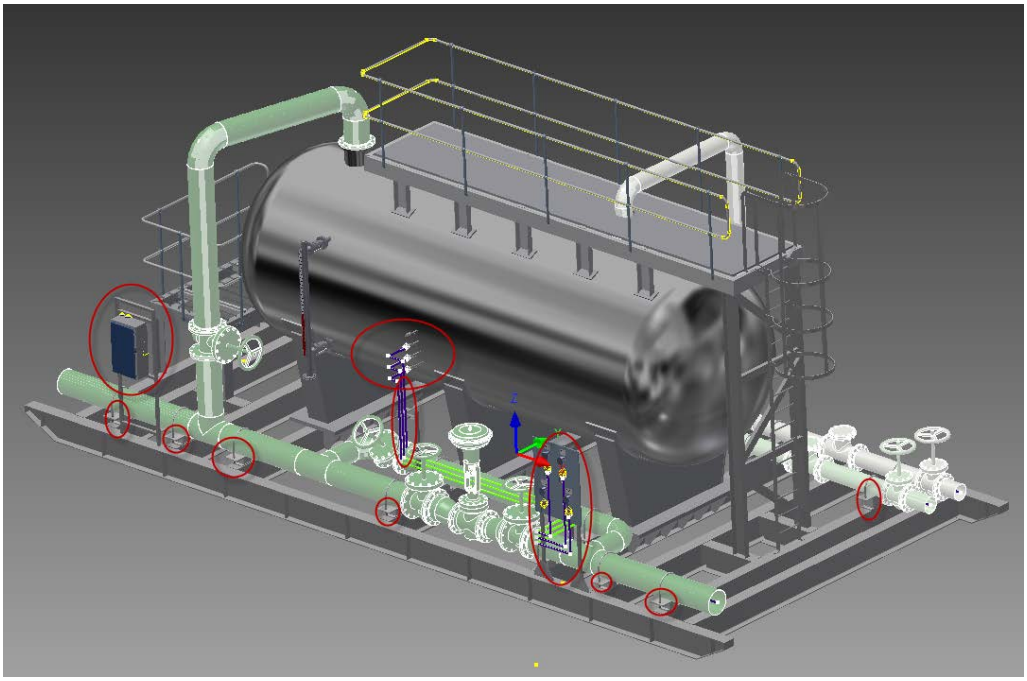


To prepare this Inventor Model for Plant 3D there are 4 steps to take:

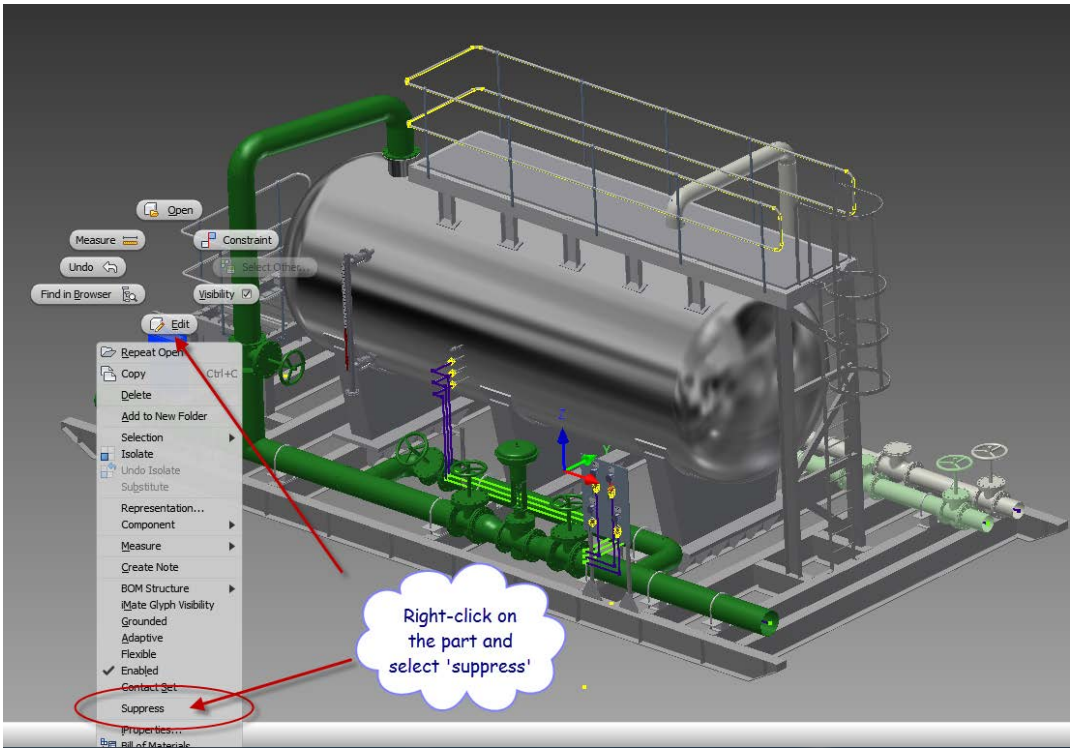
1. Suppress the parts that are not needed for Plant 3D (e.g. instrument panels and lines)
2. 'Shrinkwrap' the assembly to create one single 'part' of lower complexity
3. Add pipe connections so that Plant 3D piping will connect intelligently
4. Export to '.adsk' format

These steps are not complicated and are performed as follows:

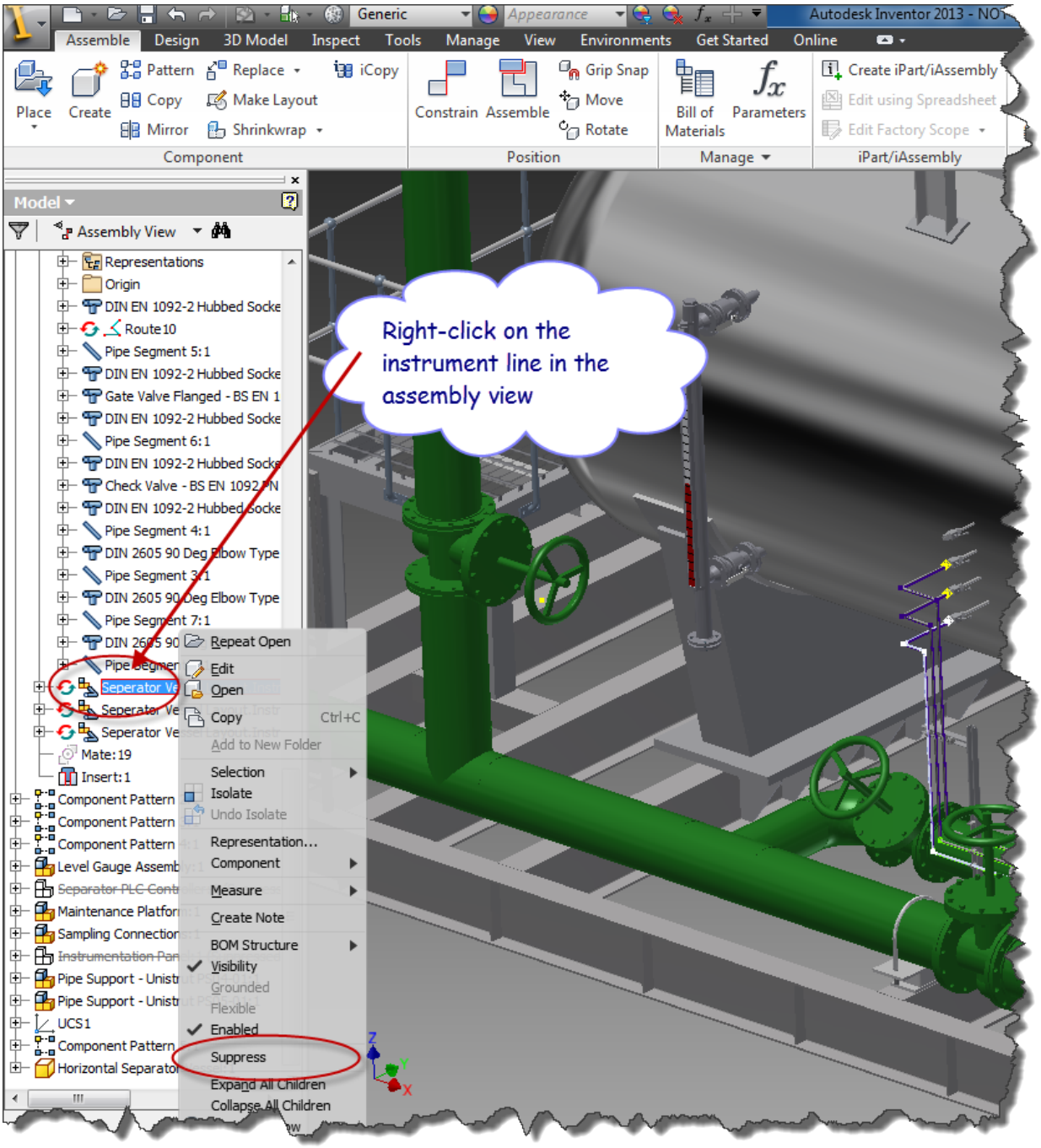
1 – Suppress Parts:



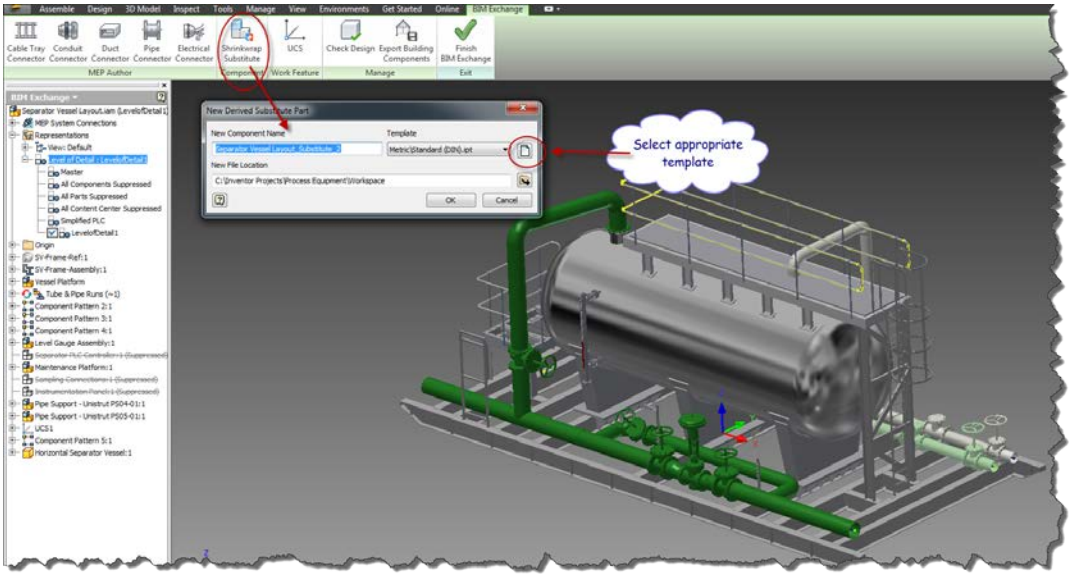
We will suppress the control panel, the instrument panel, piping clamps and instrument taps and piping. Right click on the control panel and select ‘Suppress’:



Repeat this for the piping clamps and instrument panel. Instrument lines are suppressed differently because the Inventor module is not in the suite:

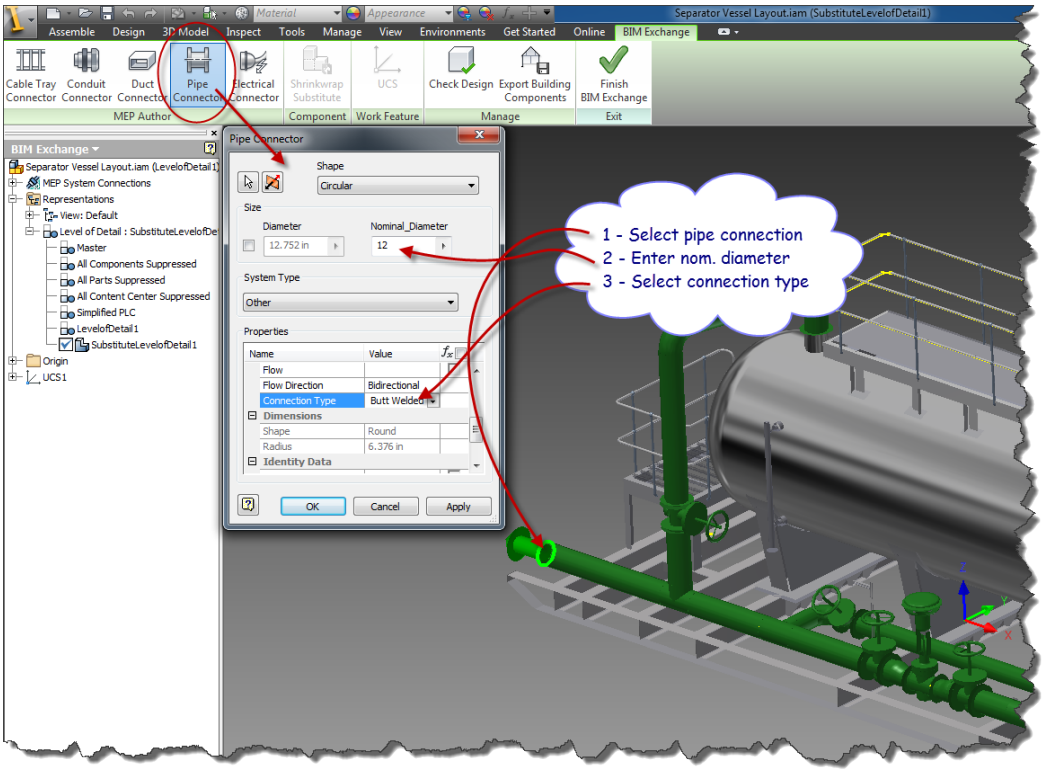


Once all the small parts are suppressed, you are ready to shrinkwrap the assembly. Click on the 'BIM Exchange' command in the 'Environments' ribbon:



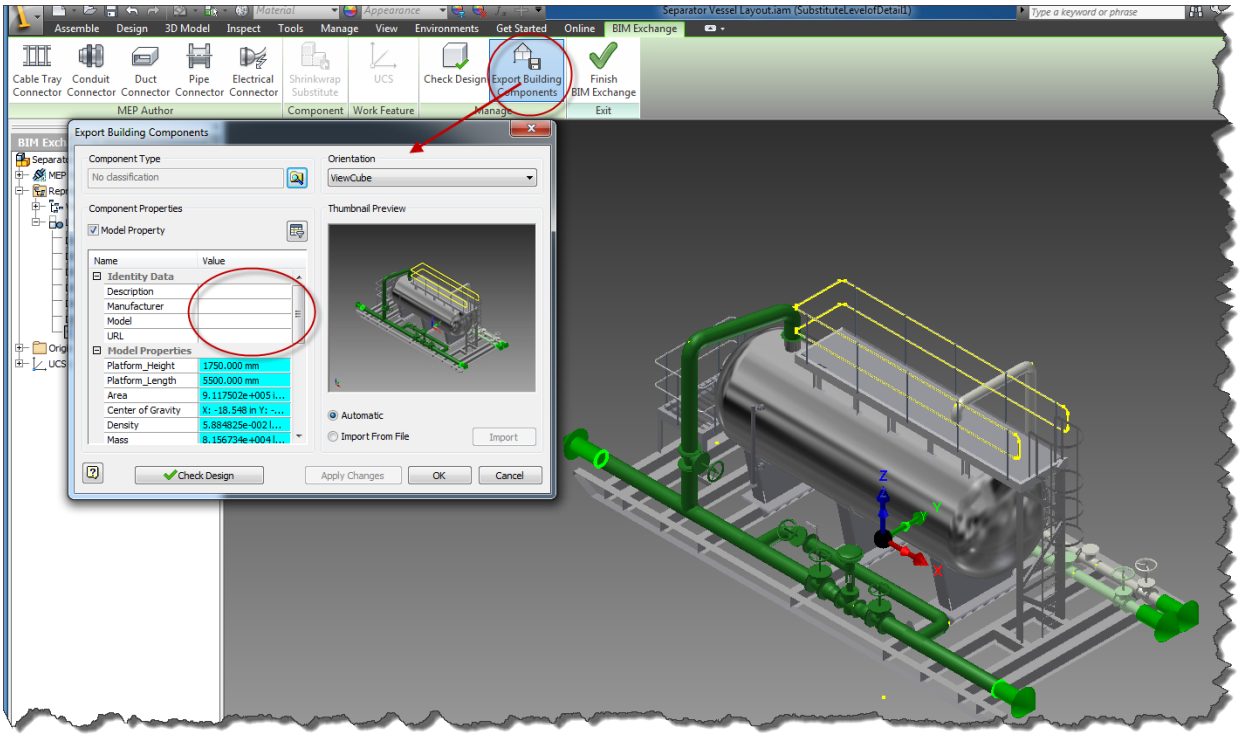
Select the correct template in order to ensure the correct UCS is used for Plant 3D. The correct template is 'Standard (DIN).ipt' in the 'Metric' tab, which can be found by clicking on the icon alongside the template pulldown. Click 'OK' to start the shrinkwrap process.

Now we need to add intelligence to the nozzles. Use the 'Pipe Connector' command:



The nominal diameter should be rounded down to the appropriate diameter (12” and 8”) and the connection type should be set to ‘butt welded’ in the properties section. Do this for all the pipe ends.

Now we are ready to export to Plant 3D. Select the ‘Export Building Components’ command:



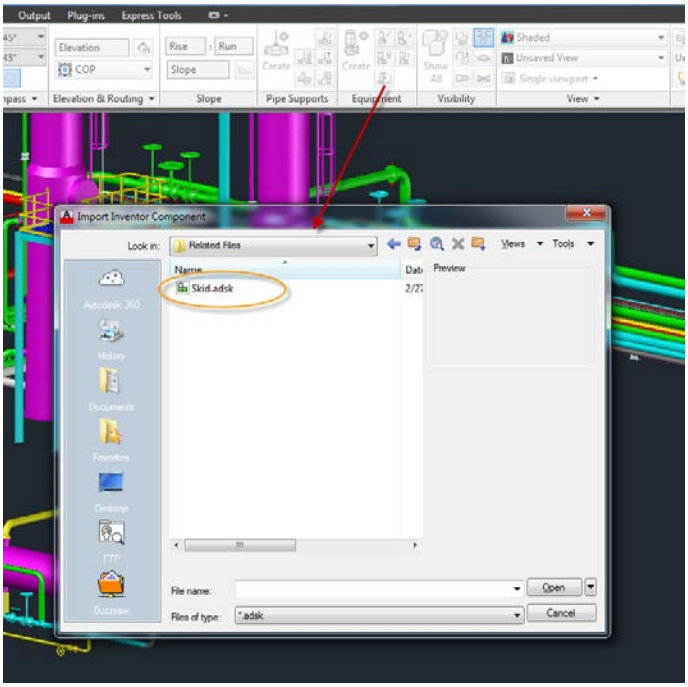
Enter some properties and click OK. Save the model in the ‘Related Files’ folder in the Plant 3D project.

When we started, the original full Inventor model was 193MB. If we were to export the full model without suppressing and shrinkwrapping, the .dsk file is 28MB. By following the above process, the final .adsk file is 1MB!

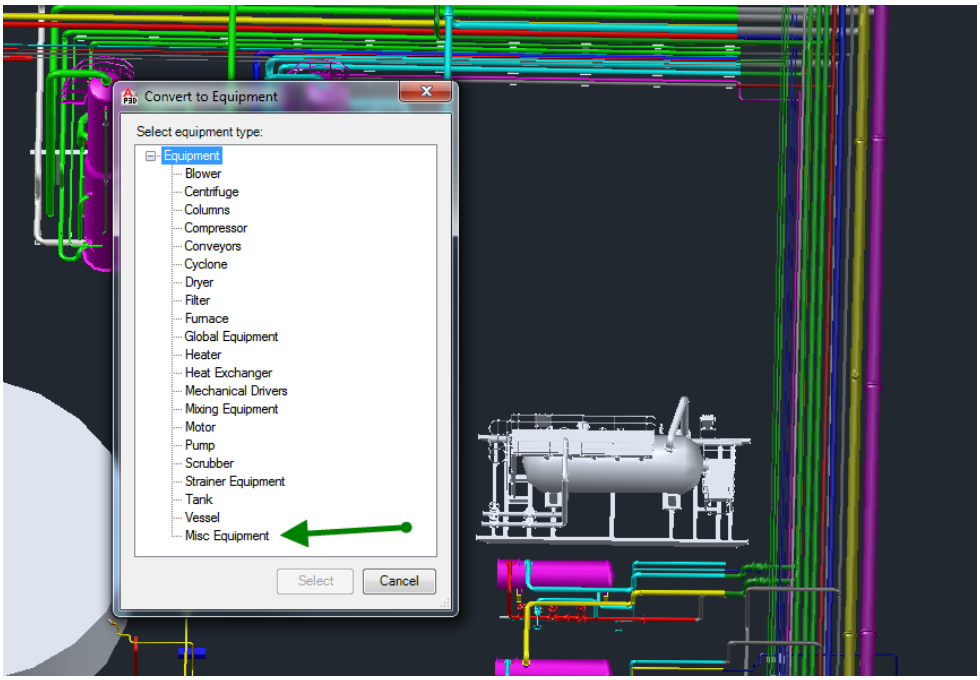
Importing Inventor Models into Plant 3D

Now let’s show how an inventor shrink-wrapped object can be imported into P3D as an equipment item. (We’ll show you later how this is created.):

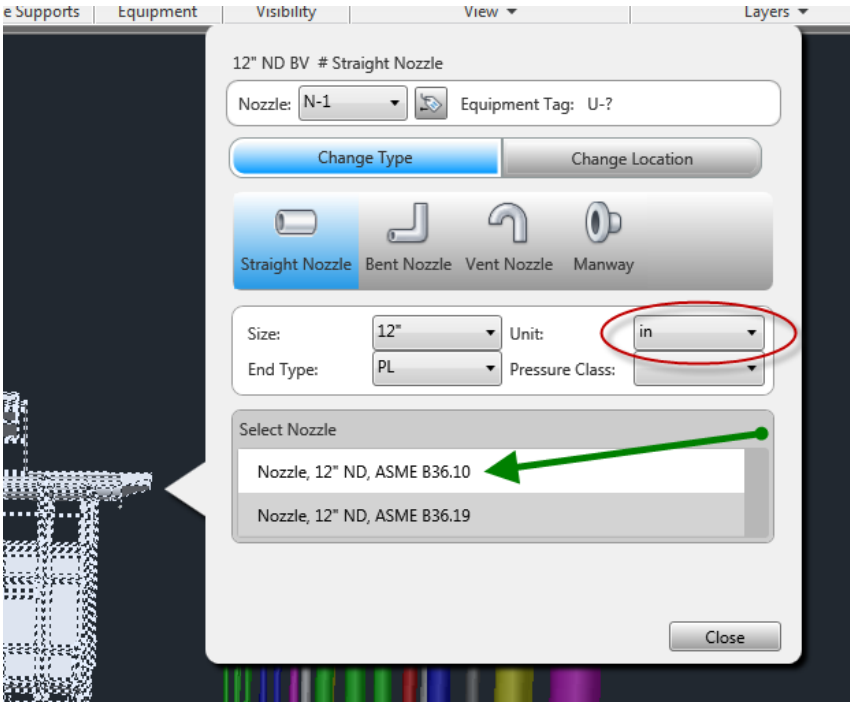
1. Reload the XREF files from Area 2 and then select the ‘Create Equipment from Inventor‘ command in the Equipment tab. Select the Skid.adsk file in the project ‘Related Files’ folder:



The coordinates for the equipment item are X:115', Y:30', Z:14"

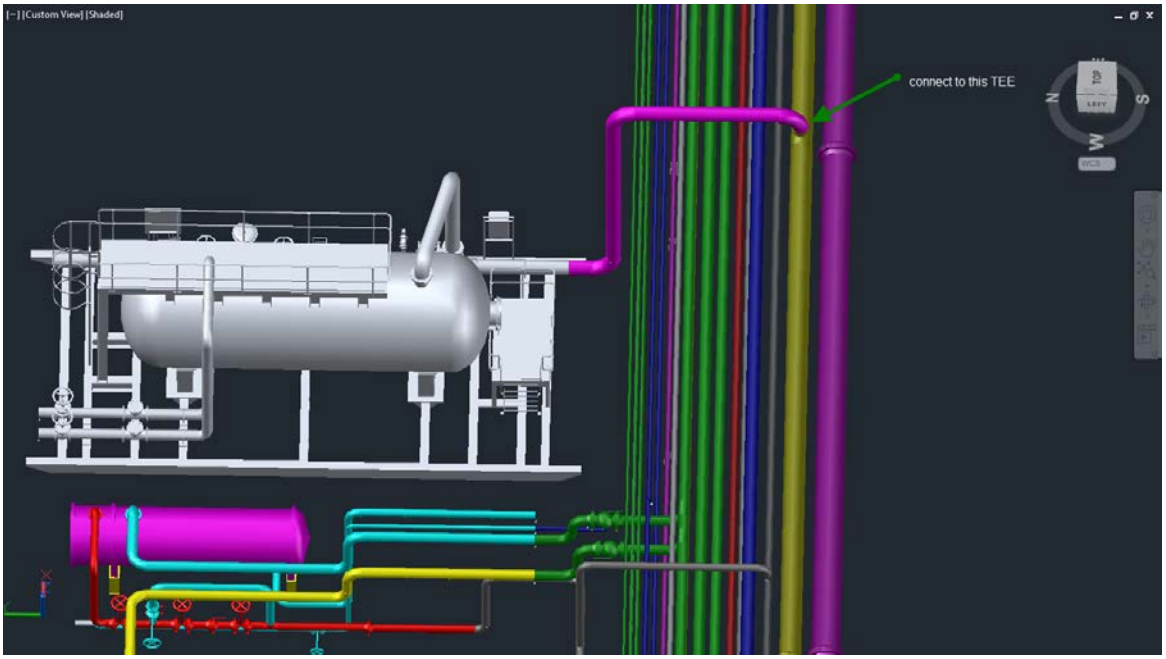


2. Now give the equipment a tag and then select nozzle N1 and click on “Nozzle, 12” ND, ASME B36.10”:



If the ADSK model has flanges, select the appropriate end type and rating (150#)

Now you can pipe it to the tee in the rack as shown – 12” pipe, spec CS150:

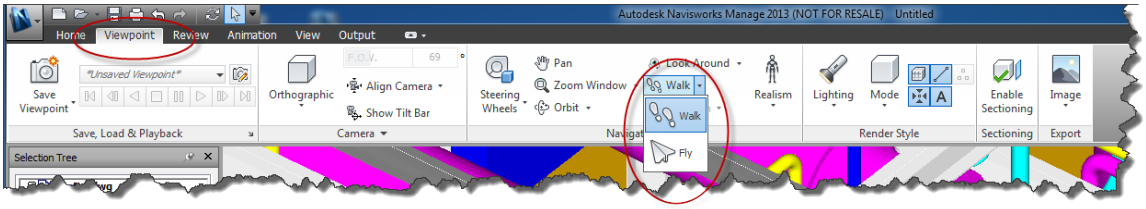


Project Collaboration and Construction Planning

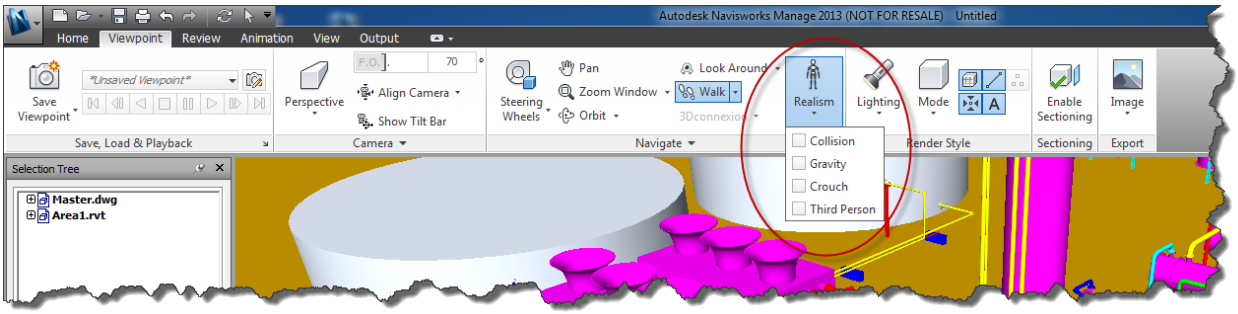
For this exercise we will use Autodesk Navisworks Manage 2013.

Project Review

You can use the 'Fly' and 'Walk' commands to review the project:



In 'walk' mode you have various types of realism:



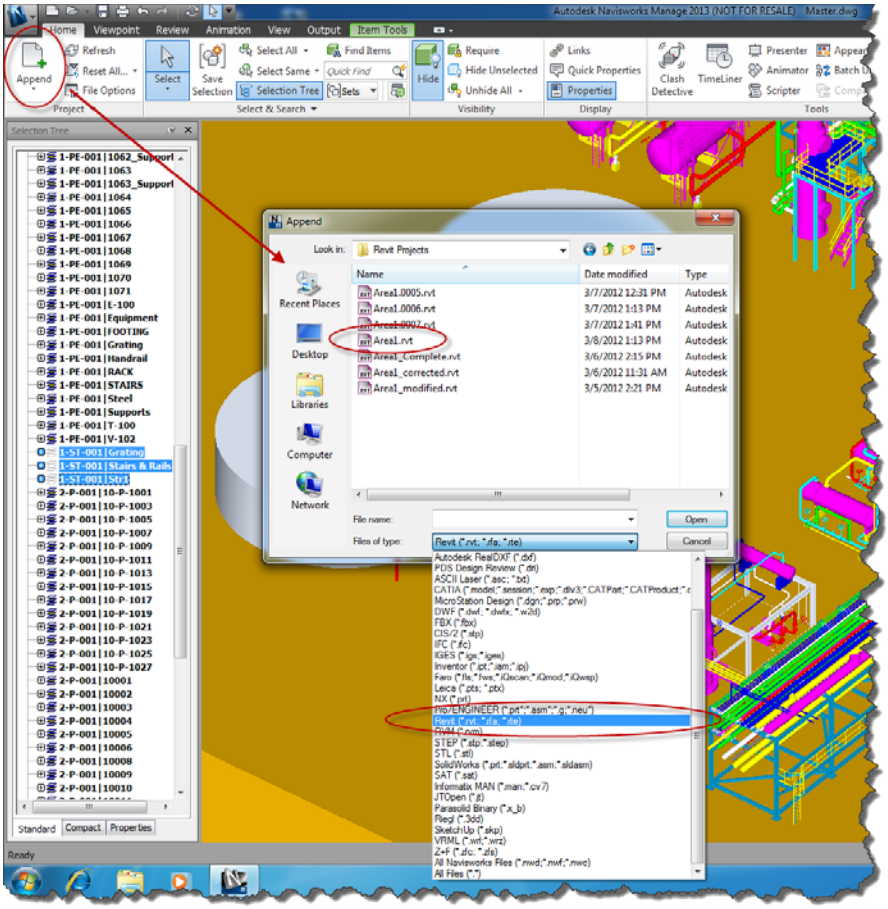
- With 'Collision' ON – you will not be able to walk through objects
- With 'Gravity' ON – you will walk on solid objects such as floors and stairs
- With 'Crouch' ON – you will attempt to crawl under or jump over objects in your path
- With 'Third Person' ON – you will look over the shoulder of an avatar
- Use the mouse wheel to look up and/or down.

Clash Detection

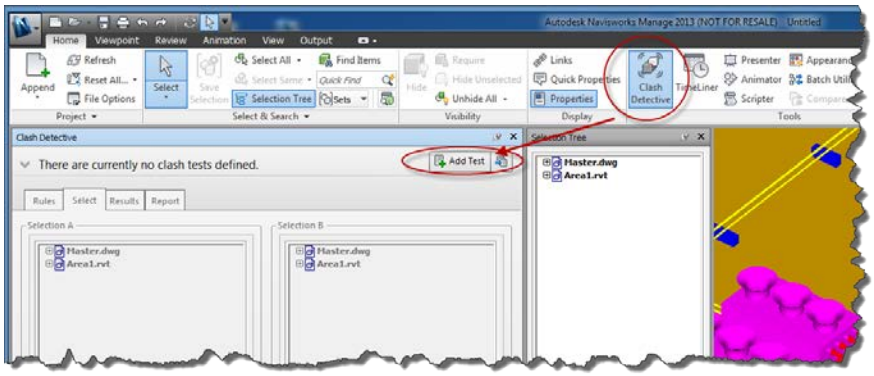
We will check piping against the Revit Structure. Open Navisworks Manage and then open the Master.dwg in the demo project. Next HIDE the 1-ST-001 objects:

1. Ensure the Selection Tree is displayed – click on Standard or Compact, then select the sets that start '1-ST-001|…' – right-click and select 'hide'. The plant 3D structure should disappear.

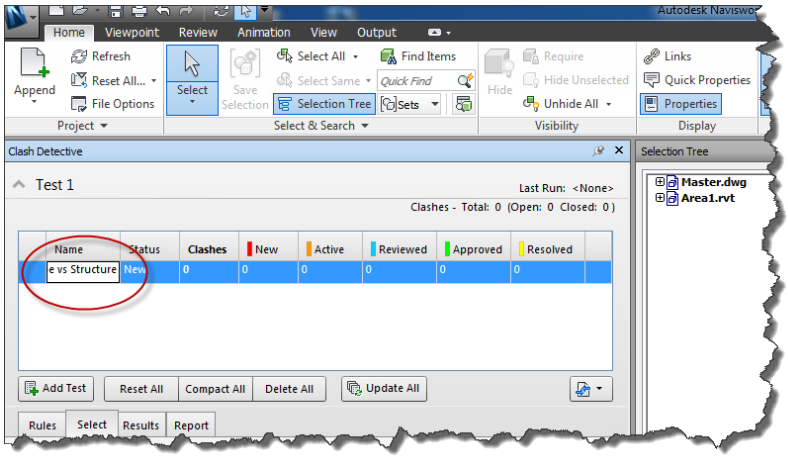
2. Append the Revit model by clicking on the ‘Append’ command, select ‘revit’ file type and then point to the Revit Projects folder and select ‘Area1.rvt’:



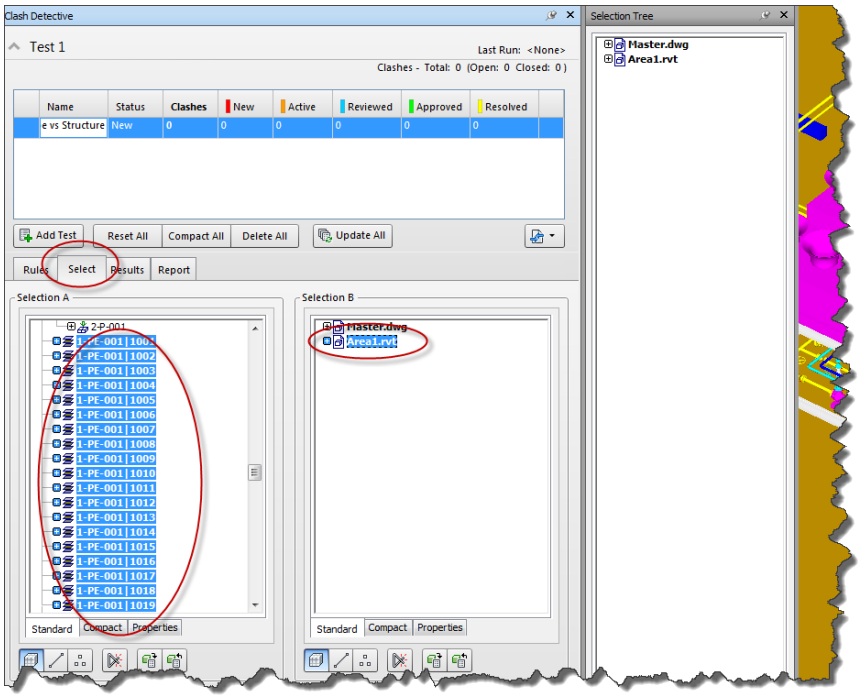
3. Now we will check piping against the Revit structure:
    a. Select Clash Detective in the Home ribbon, and then click on ‘Add test’:



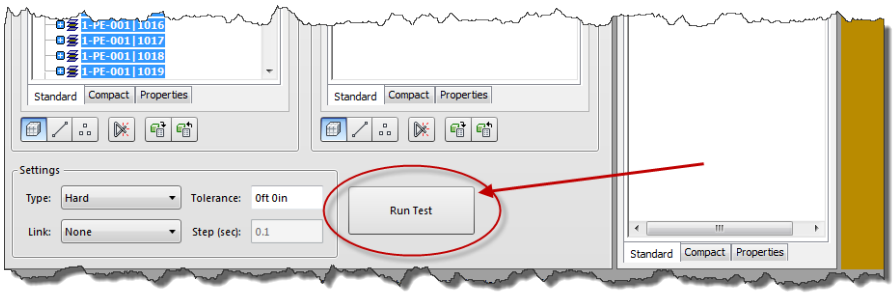
b. Give the test a name ‘Pipe vs Structure’:



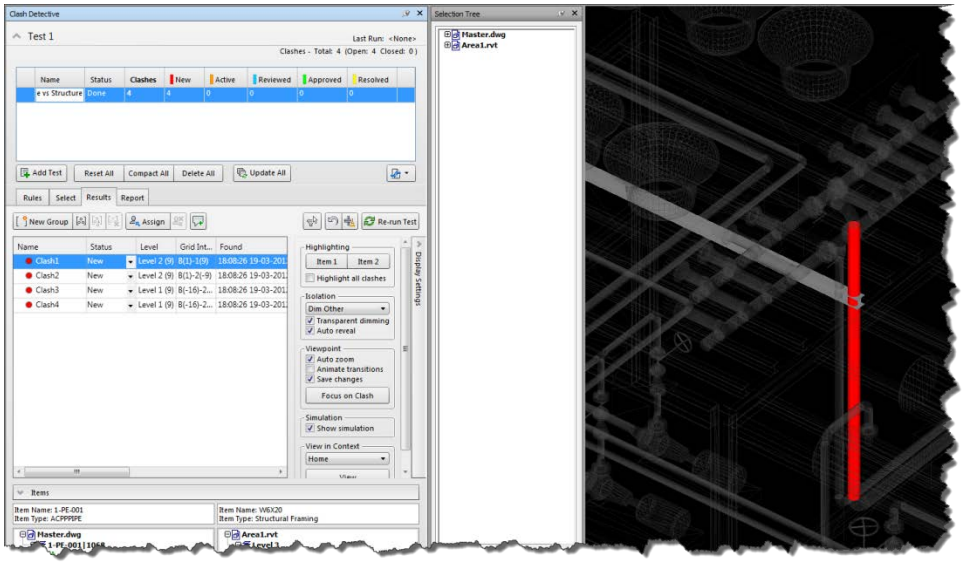
c. Now define the sets we will clash against. In Selection A use Shift and CTRL to select all the piping in 1-PE-001.dwg by layer. In Selection B click on Area1.rvt:



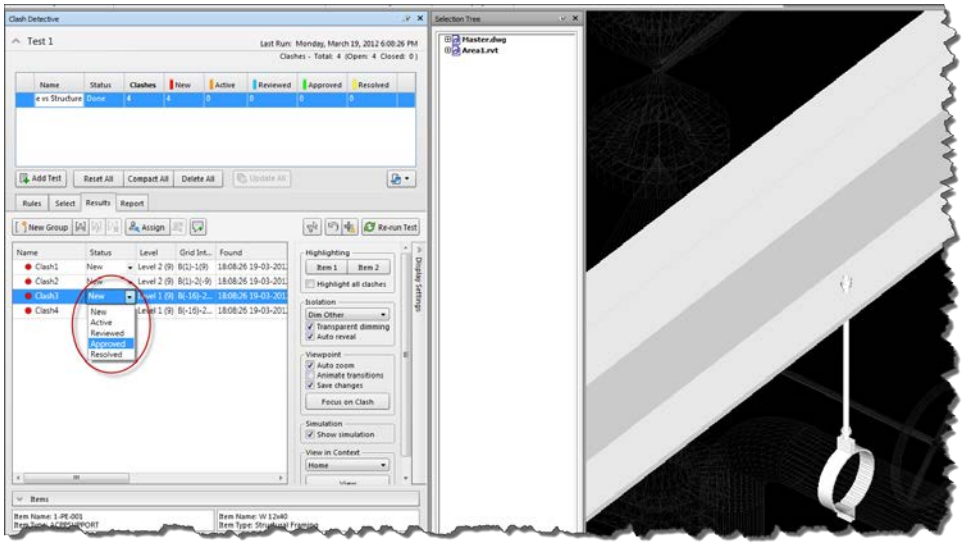
d. Now we have defined the selection sets, click on ‘Run Test’ to perform the Clash Detection:



e. Once the test has completed, the results will be displayed in the ‘Results’ tab:



f. Click on each clash listed to review each clash. There will be two clashes that are real and two that are due to the supports being attached to the structure. You can ignore these by selecting ‘Approved’ in the pull-down under status:



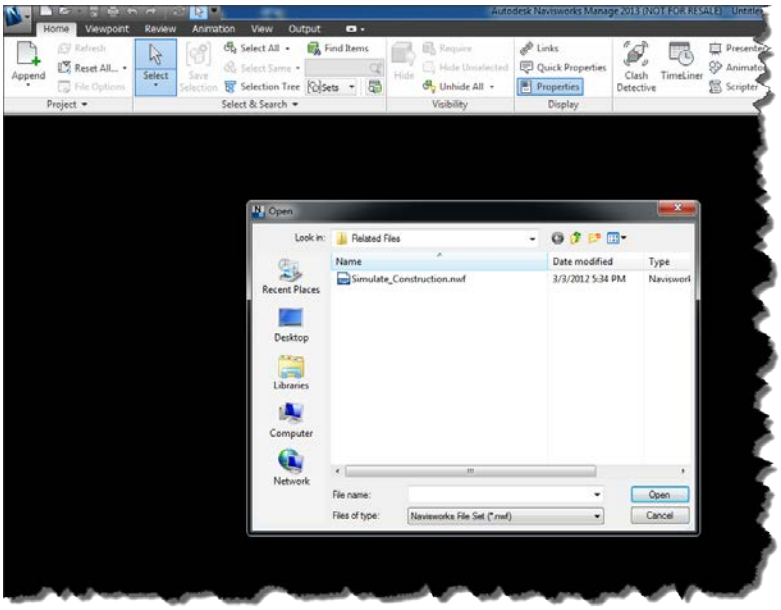
The real clashes need to be fixed!!

g. A clash report can be created under the ‘report’ tab.

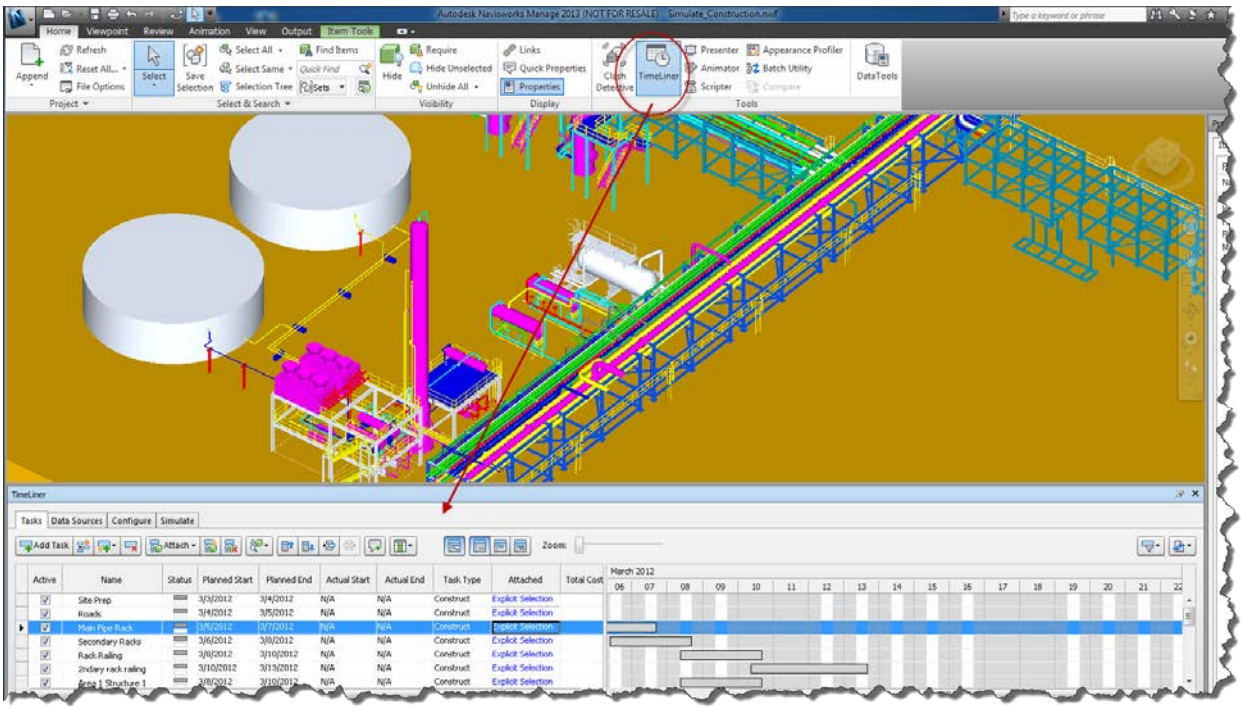
Construction Simulation

You can use the TimeLiner function in Navisworks Manage and Navisworks Simulate to demonstrate Construction Planning. TimeLiner allows you to associate a start time and an end time with Selection Sets as well as a status so that you can show how the sets can be sequenced to plan construction.

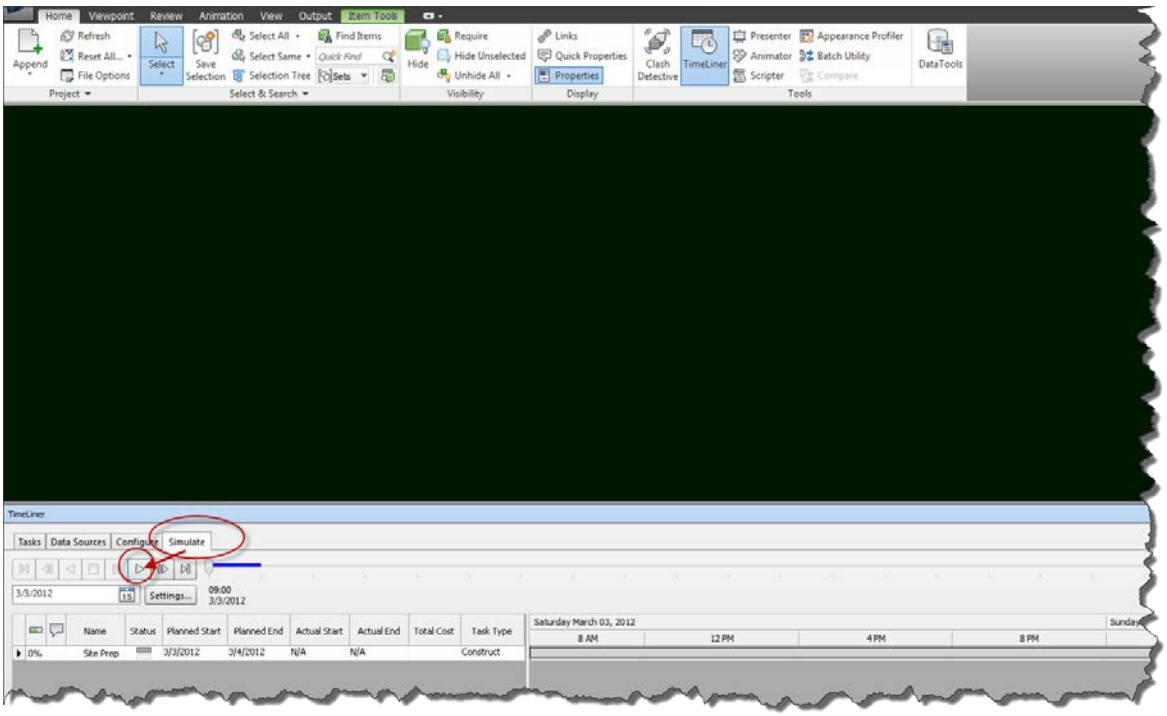
In order to get you started quickly, there is a nwf file saved in the ‘Related Files’ folder that has a number of sets defined and tasks assigned. Open this file (Simulate_Construction.nwf) in Navisworks:



Click on the TimeLiner command and the TimeLiner panel will appear:



For a quick preview of the construction simulation performed so far, click on the Simulate tab and then click play:

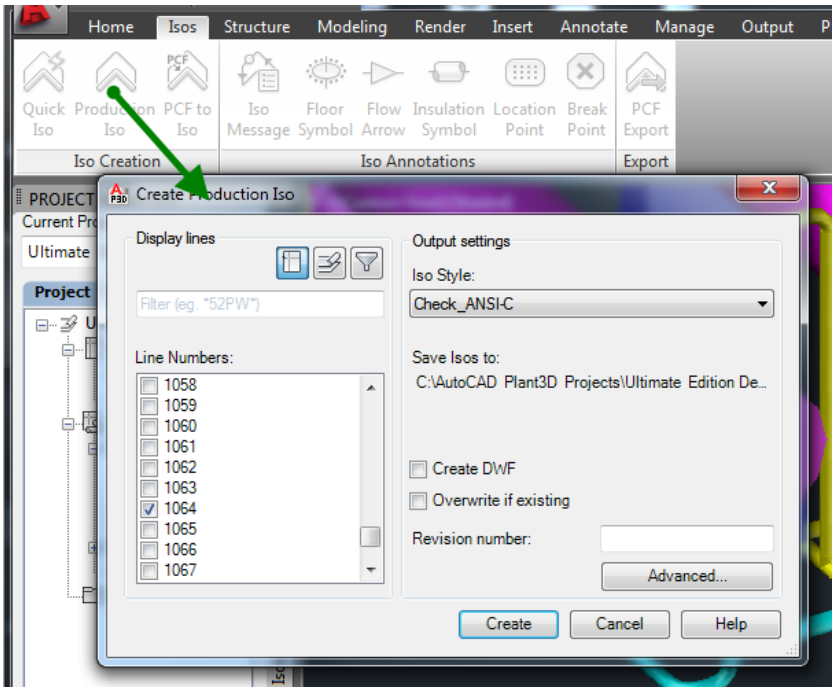


You can add new tasks, assign sets to then by dropping the set into the ‘Attached’ column for the new task, assigning a Planned Start and a Planned End and also a Task Type (Construct). You can also add cost data and watch the costs grow during the simulation.

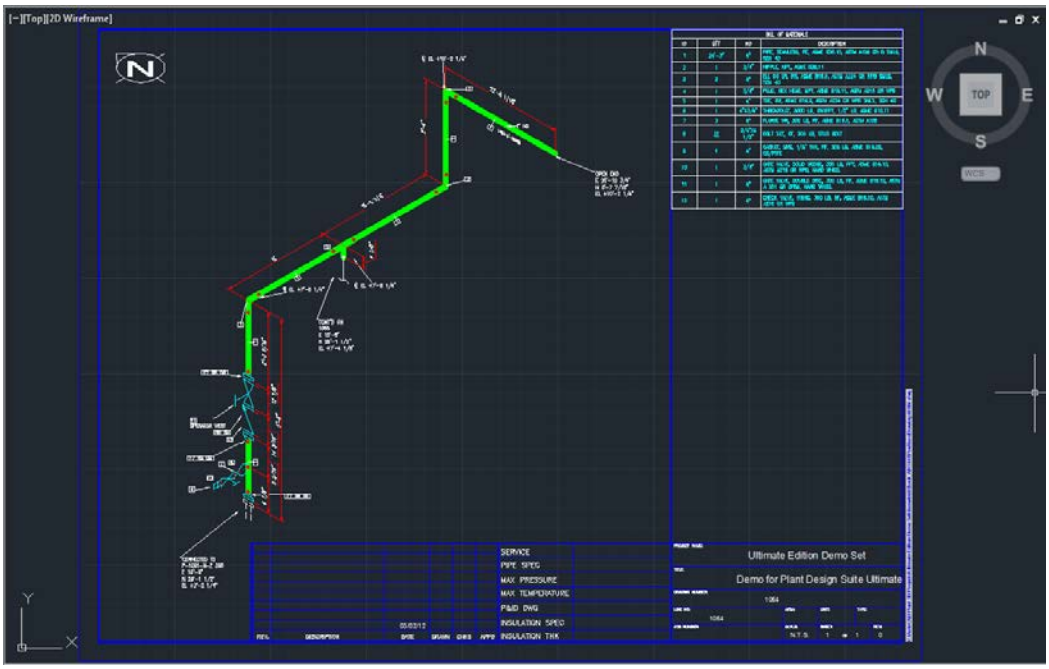
Deliverables

In this exercise we will create Piping Isometrics and an Orthographics drawing.

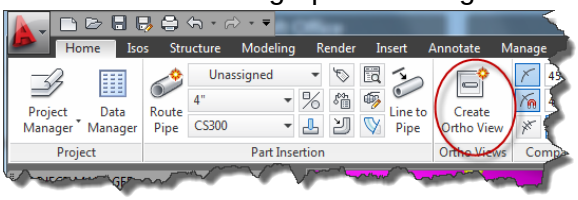
1. Create an isometric of the first line modeled:



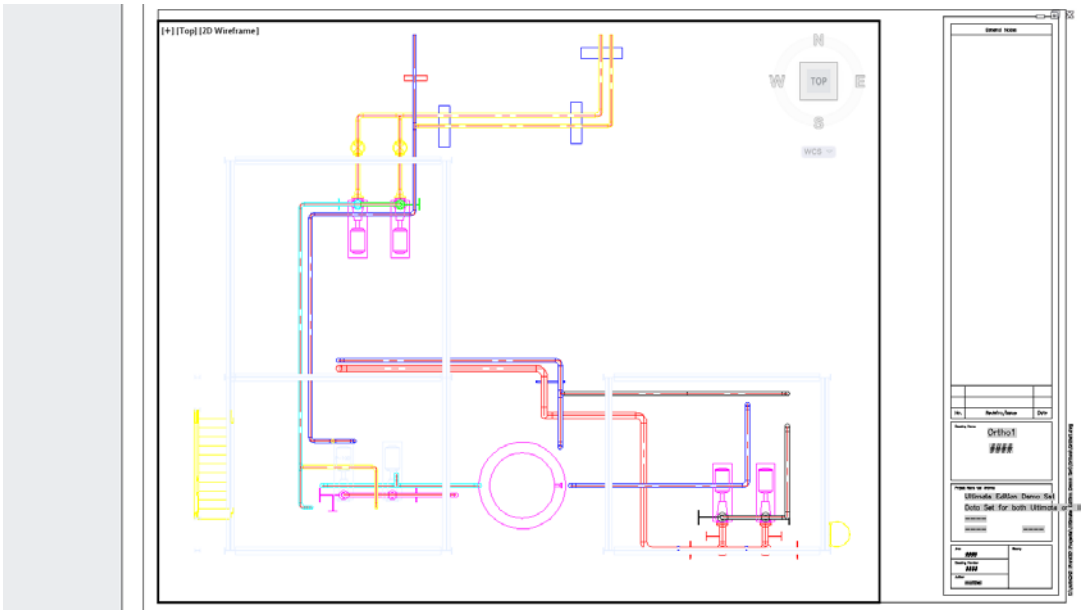
2. The Isometric should look like this:



3. Next create an orthographic drawing:



Follow the steps to end up with:



Conclusion

You have now used all the design tools within the Autodesk Plant Design Suite Ultimate 2013. And you should now have a good understanding of how to perform the following tasks:

- P&ID's
- Structural, Equipment and Piping Modeling
- Structural Workflows using Revit Structure and AutoCAD Structural Detailing
- Equipment Workflow using Inventor and Plant 3D
- Interference Detective
- Construction Planning using Navisworks TimeLiner

Feel free to use the data sets to perform other tasks.