Plant Design work flow Using Autodesk® Plant Design Suite Ultimate

Carlos Caminos

CAD Manager - Venture Engineering & Construction, Inc.

Class Summary

In this class, you will learn about a proven oil and gas industry workflow using Autodesk Plant Design Suite. We will start with P&IDs and go through creating plant design models using all of the components within the Autodesk Plant Design Suite Ultimate edition. We also will cover how to incorporate Autodesk® Inventor® software models into your design.

Key learning objectives

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

- Explain how Autocad P&ID and Autocad Plant 3D work together
- Incorporate Inventor models, such as equipment and structural, into Plant Design Suite.
- Show real world workflows used in the Oil/Gas industry using Autodesk Plant Design Suite Ultimate

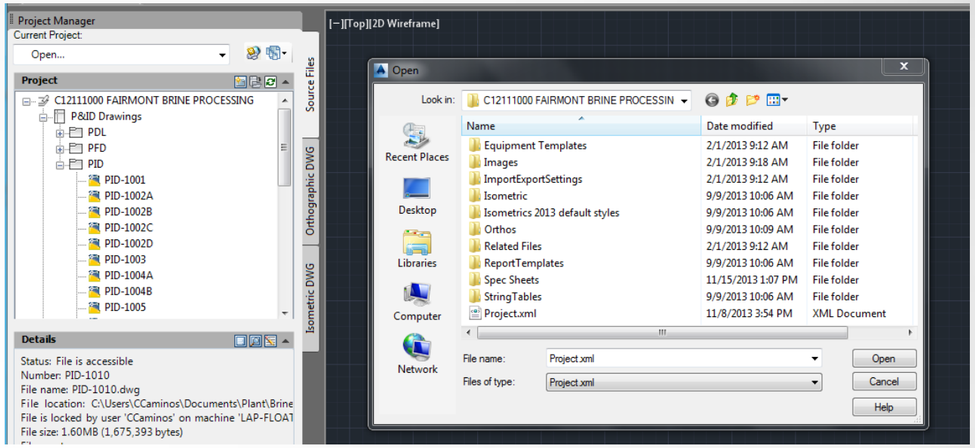
Autocad P&ID

Autocad P&ID

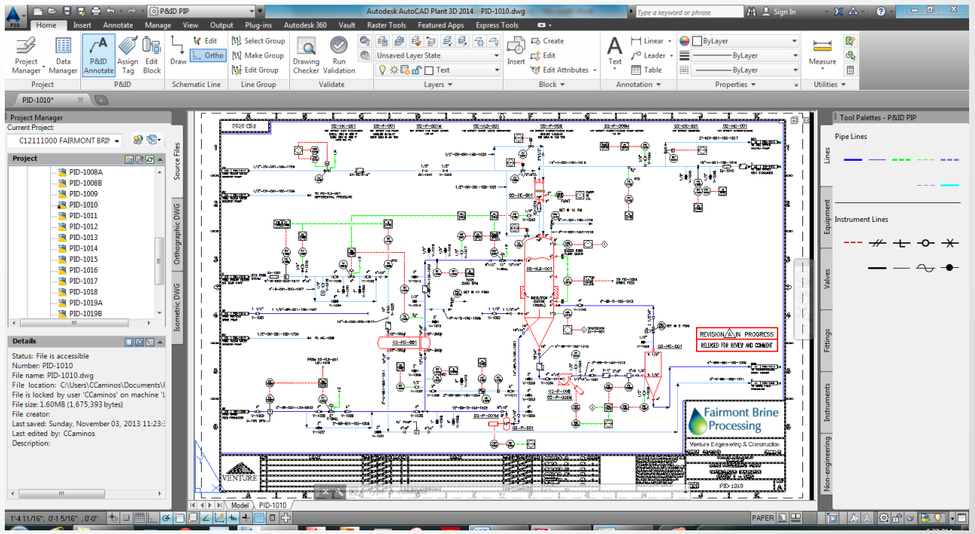
- Project Manager organizes all of your project P&IDs
- P&ID is a simple-to-use drafting tool with built-in intelligence designed to increase P&ID productivity
- P&ID data can be simply managed through Data Manager
- Reports can be created quickly and easily either from inside AutoCAD P&ID or outside the drawing using AutoCAD Plant Report Creator.

Autocad P&ID

- Open the project

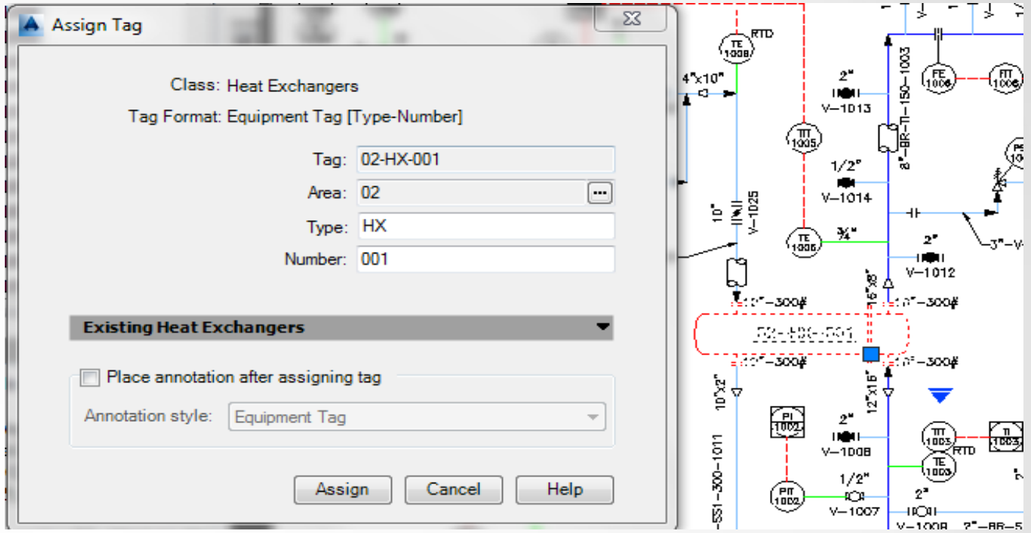


- Open and create P&ID ‘PID-1010’
- When the drawing opens, make sure you are in the P&ID Workspace. If not, click on the workspace symbol:

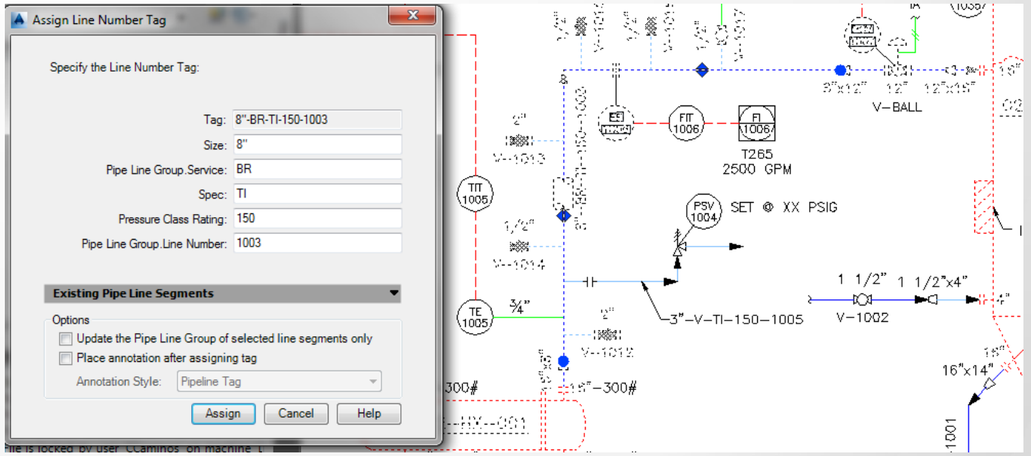


Autocad P&ID

- Drop in Equipment first (Compressors, Pumps, and Vessels) and assign tag information:

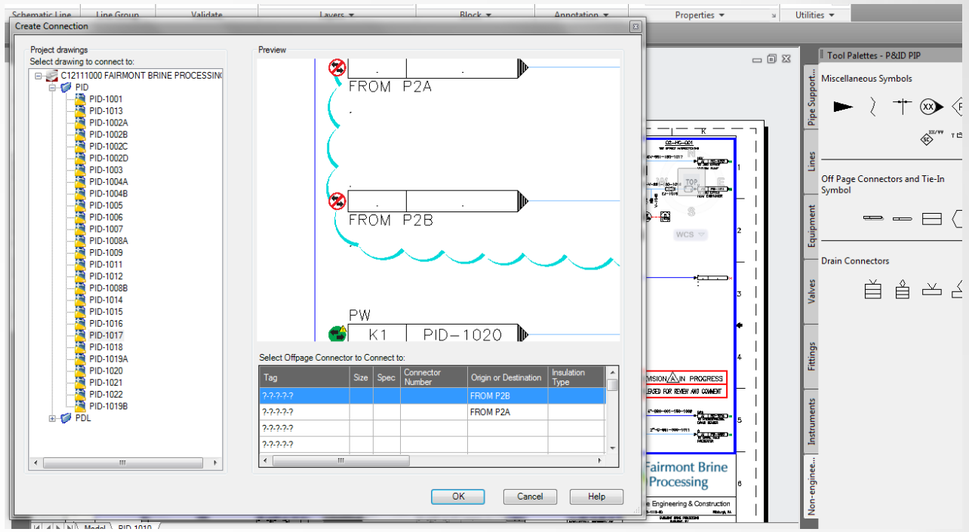


- Run process lines and assign information:

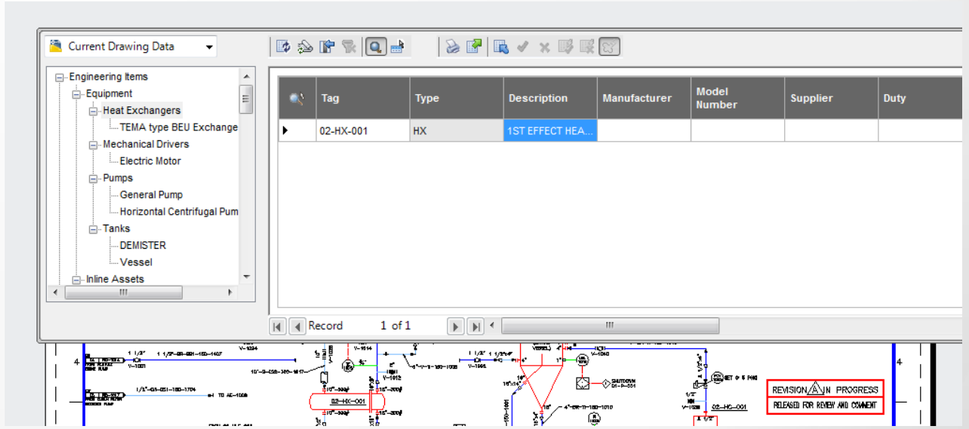


Autocad P&ID

- Insert page connectors, right click and connect to page connectors on other drawing:

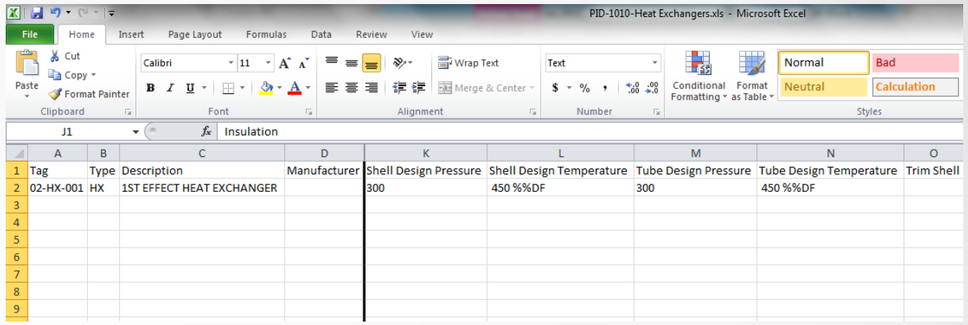


- Using Data Manager to update equipment:
  - Equipment name
  - Tag
  - Information

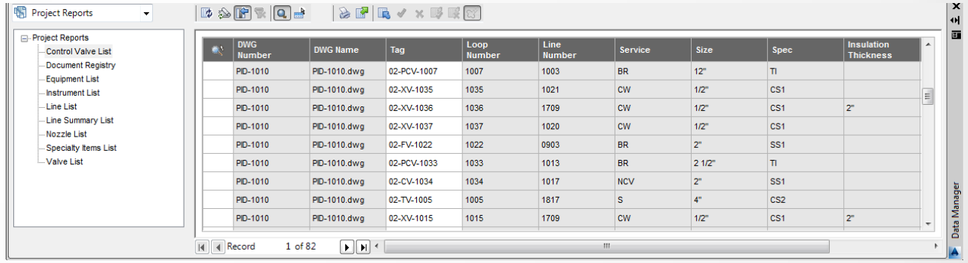


Autocad P&ID

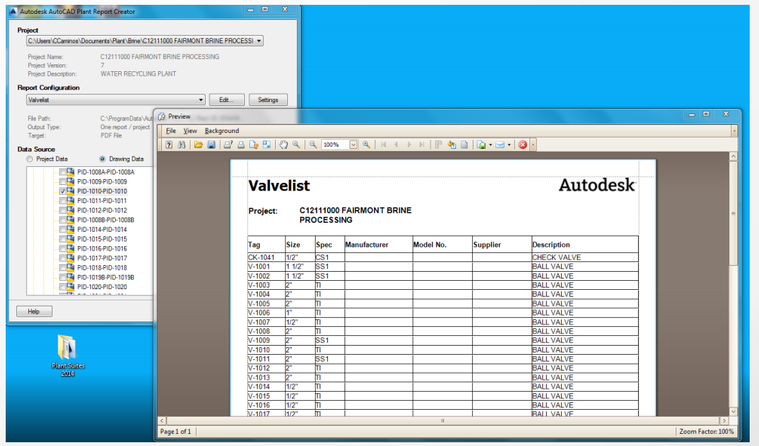
- Now use Export / Import to add model number and supplier by an external user through MS Excel. First export the data to Excel:
  - You can edit the information and import back into Data Manager



- Reporting:
  - Using the Data Manager, – select Project Reports in the pull-down:



  - Using the Report creator select the project and the type of report to generate:



Plant 3D

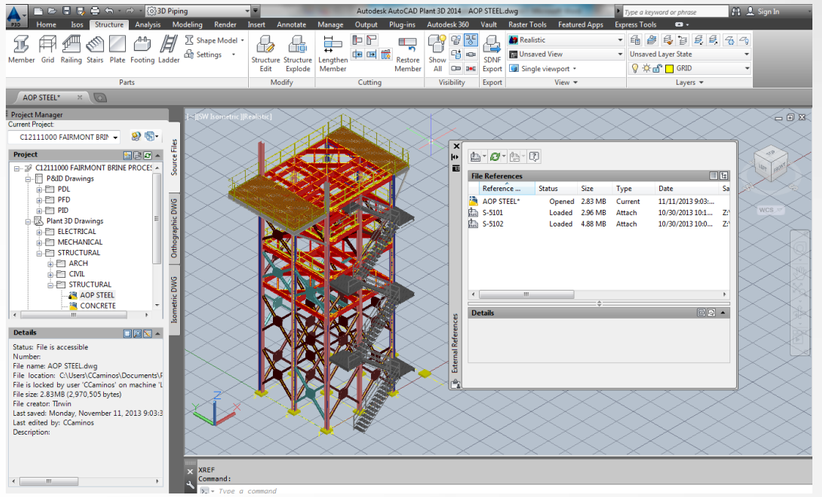
Autocad Plant 3D

- Autocad Plant 3D (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 function, which has a graphical user interface for easy customization.
- Inventor models can be imported into the P3D model as equipment and connected intelligently to P3D piping
- Structural models can be imported to P3D from Inventor or referenced from Autocad Structural Detailing.

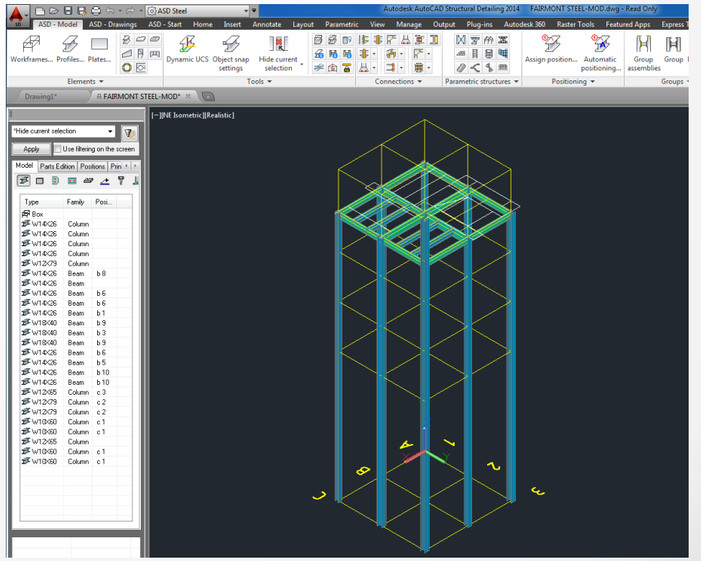
Autocad Plant 3D

Structural

- Structural model was created using Autocad 3D. Modifications were X-Referenced in a .dwg file from Inventor.

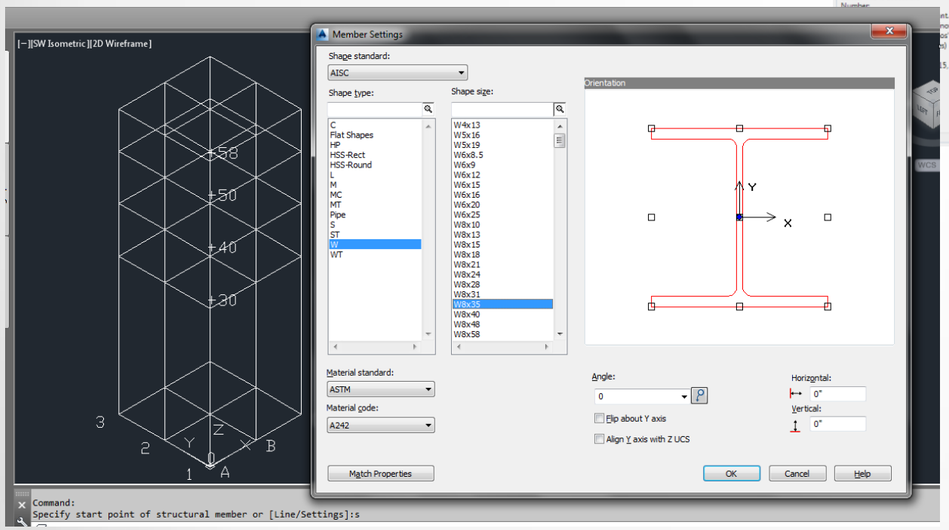


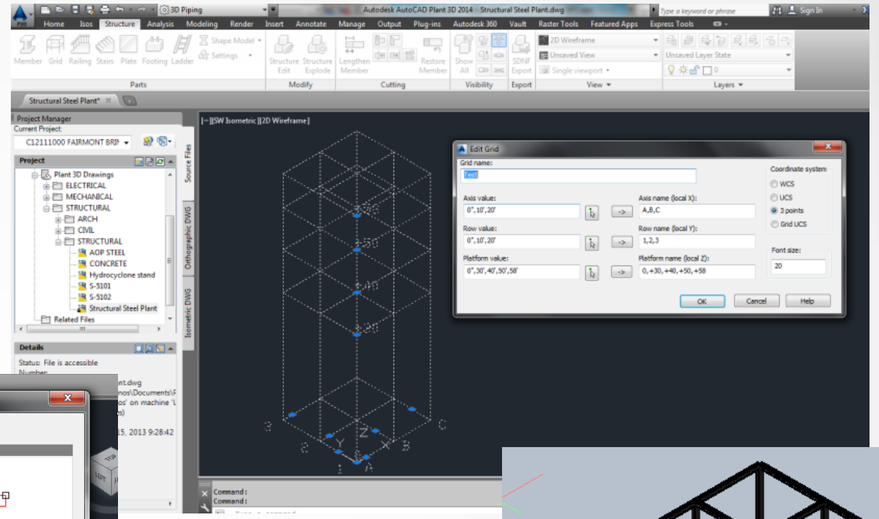
- Autocad Structural Detailing can be used to create the structural model. (Recommend)

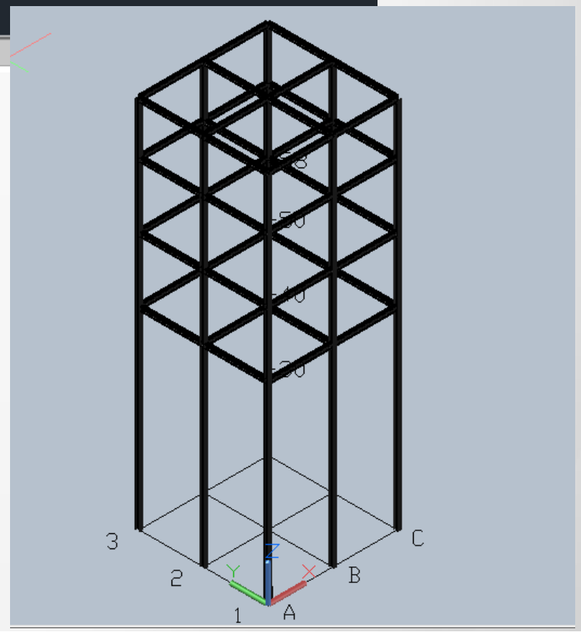


Autocad Plant 3D

- Using Plant 3D you also can create the structure shapes.



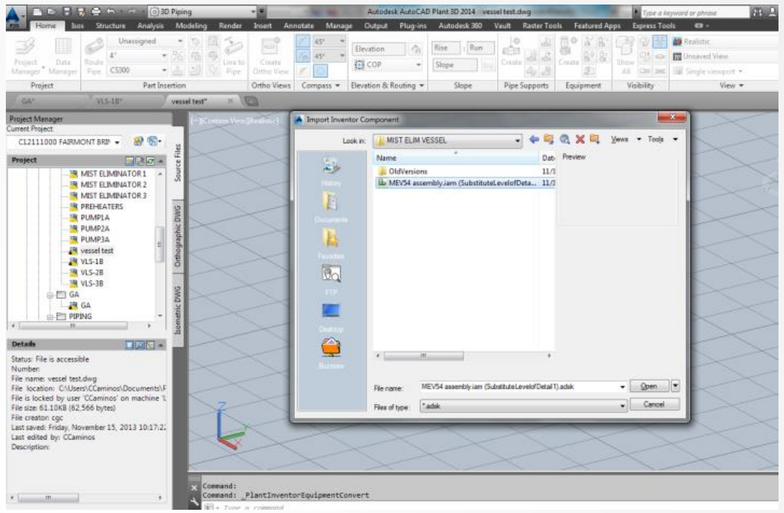


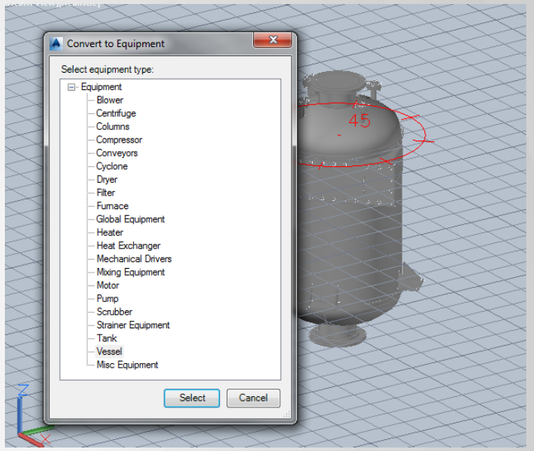


Autocad Plant 3D

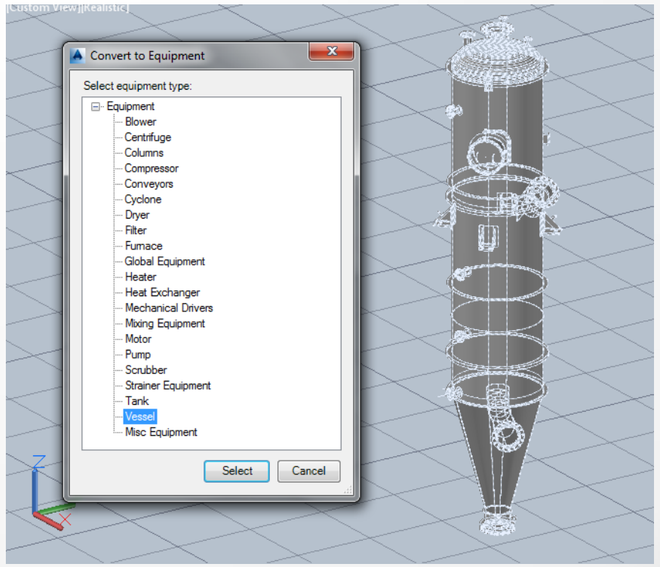
Equipment

- Equipment Models can be imported as ADSK file:
  - ADSK files are smaller and have less detail



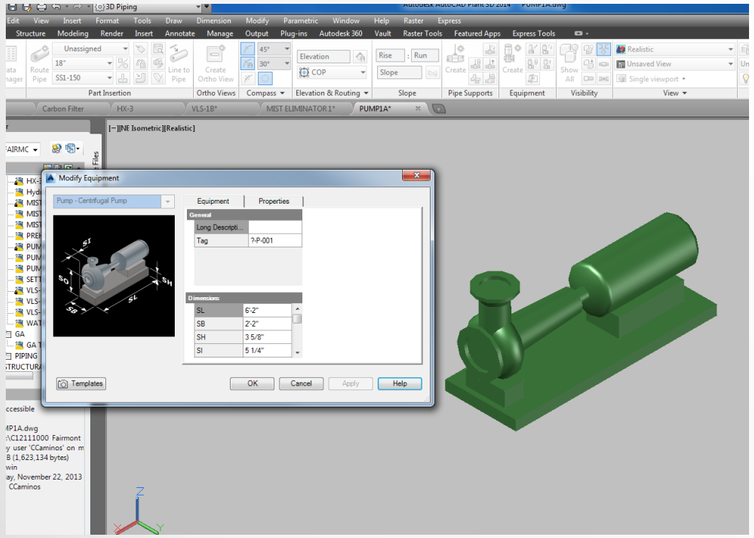


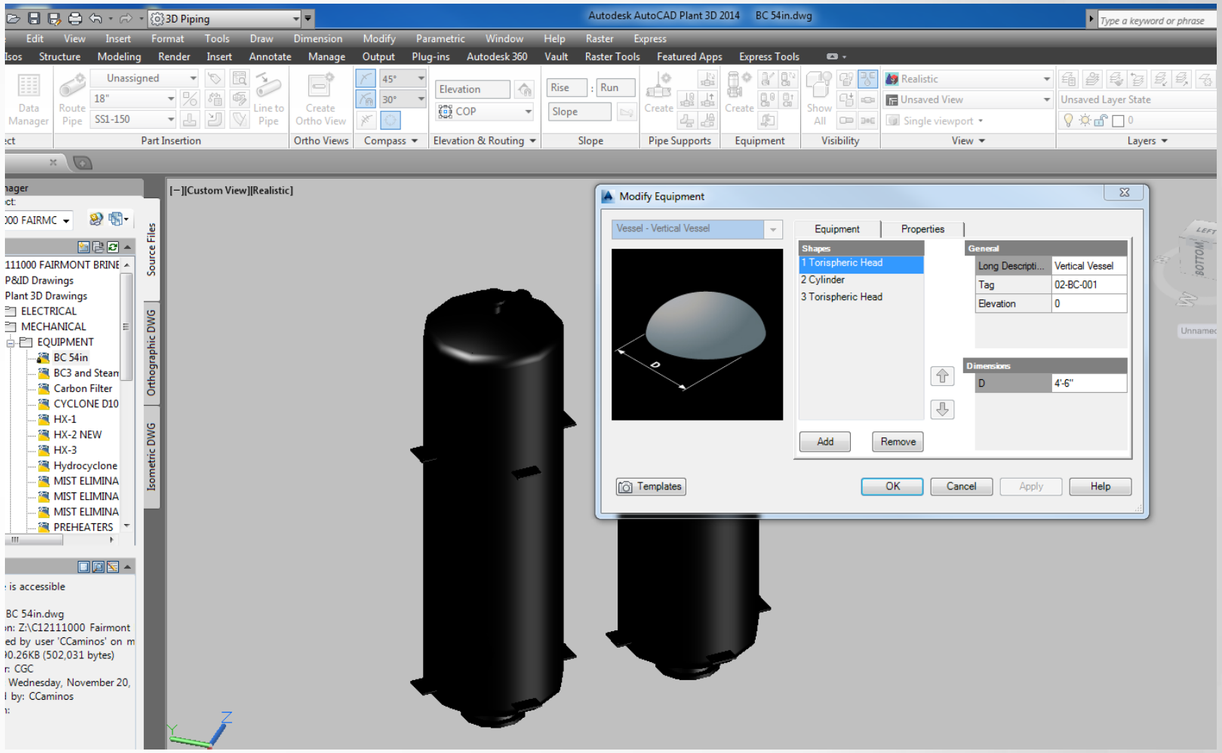
- Create equipment using Inventor models saved as a .dwg file format.
- Use the Plant Equipment Convert function to make this a Plant equipment.
- Assign equipment tag and nozzle locations



Autocad Plant 3D

- Models can also be created in Plant 3D
  - Click on the equipment create button from the ribbon
  - Add dimensions, equipment and tag information

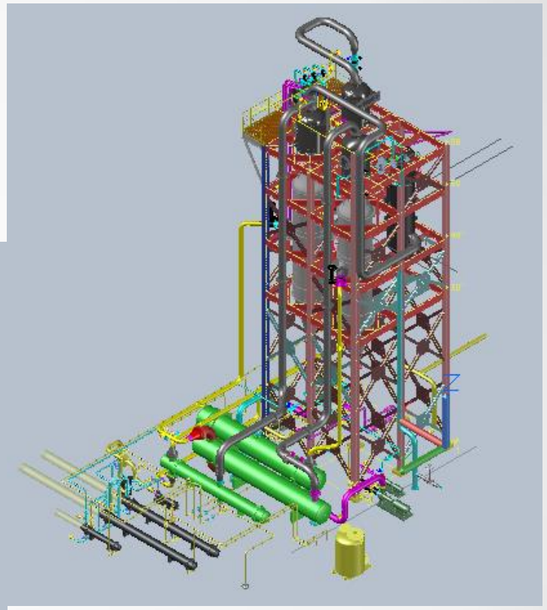


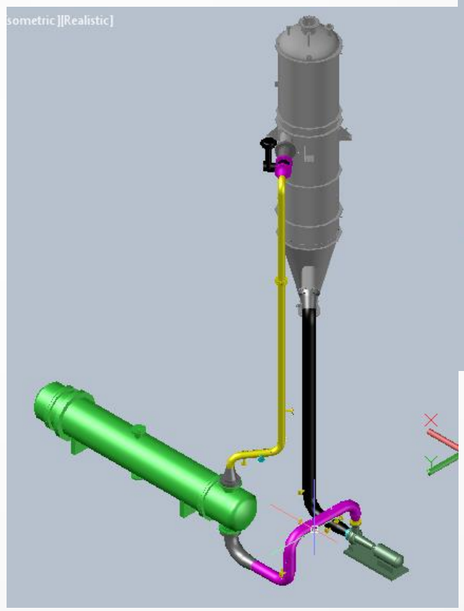


Autocad Plant 3D

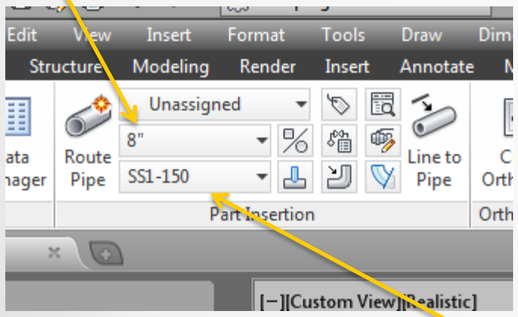
Piping

- Piping Layout
  - Unload Structural layout and leave the equipment you are piping “on” from the External References window .
  - Choose the pipe size and spec selector from the ribbon.
  - Route pipe from nozzle location of one equipment to the other.





Pipe size selector

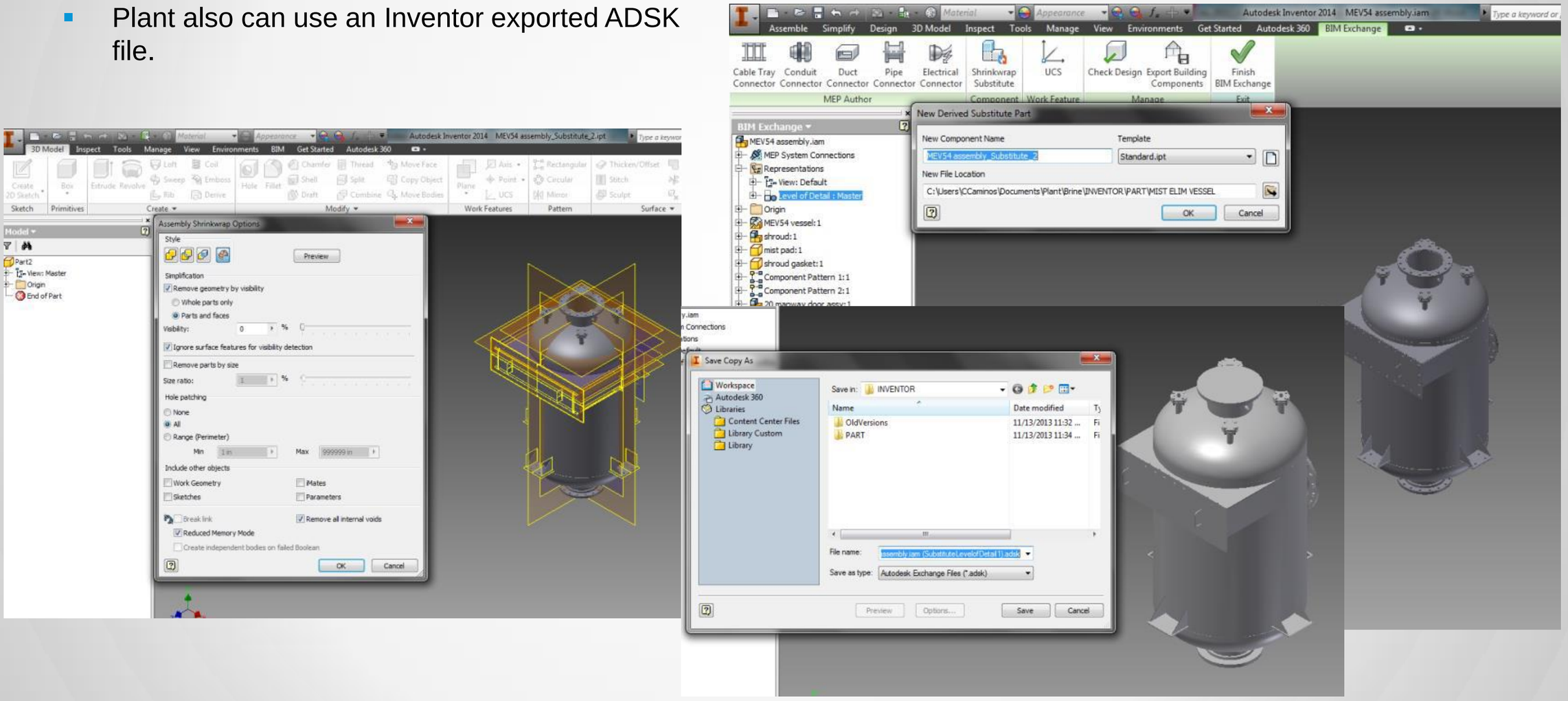


Spec selector

Incorporating Inventor, Equipment, Structural and Electrical (MEP)

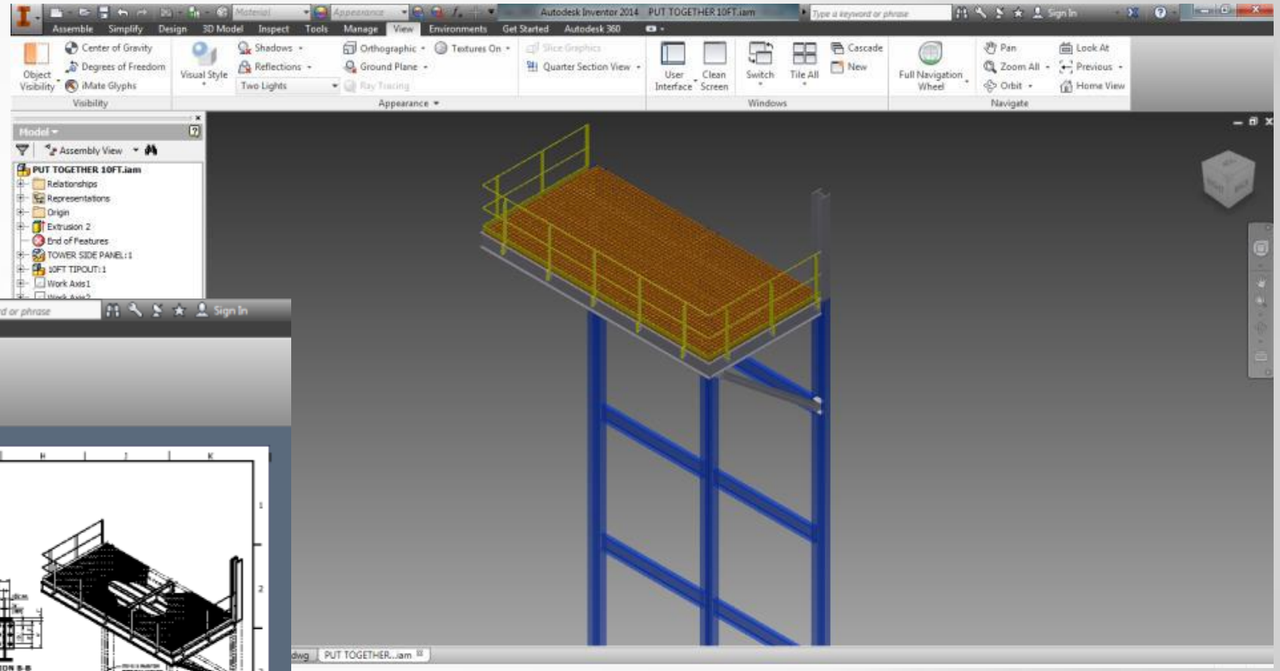
Autodesk Inventor

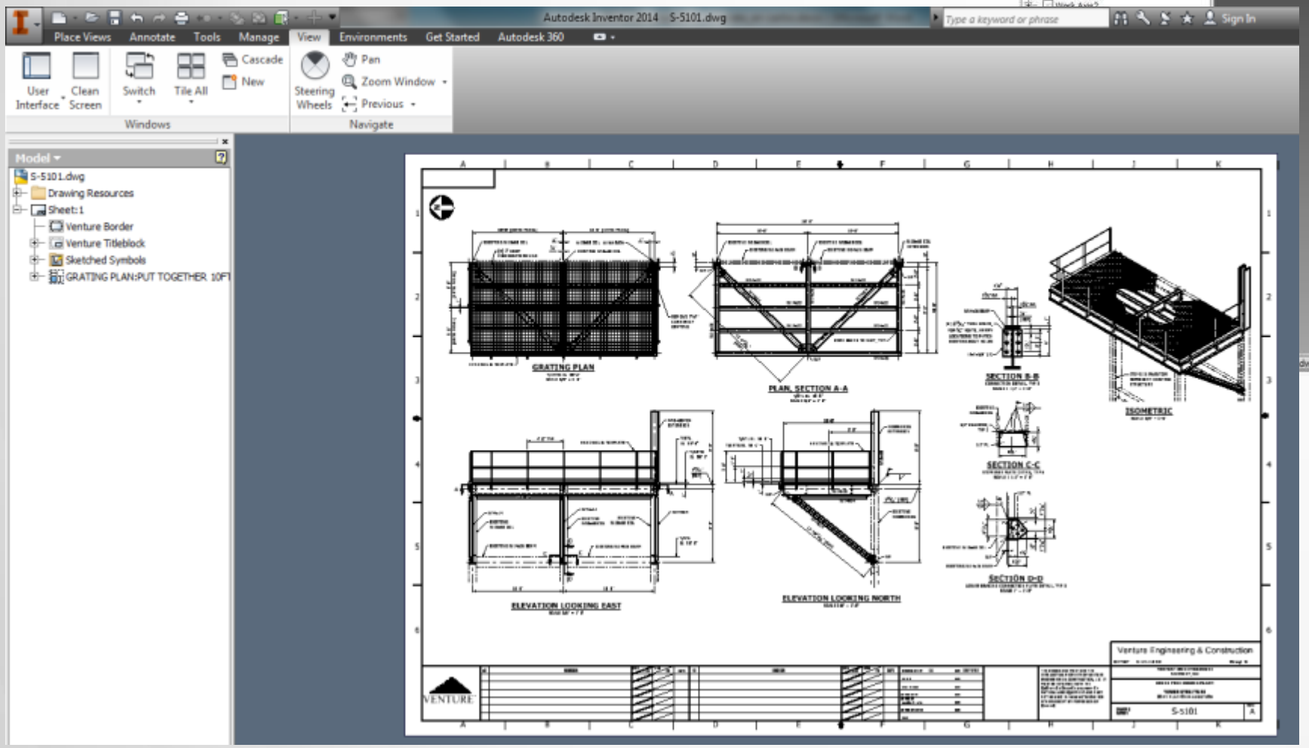
- Equipment creation:
  - Plant also can use an Inventor exported ADSK file.



Autodesk Inventor

- Structural model is created in Inventor and saved as a .dwg file format. Fabrication drawing also created in Inventor.

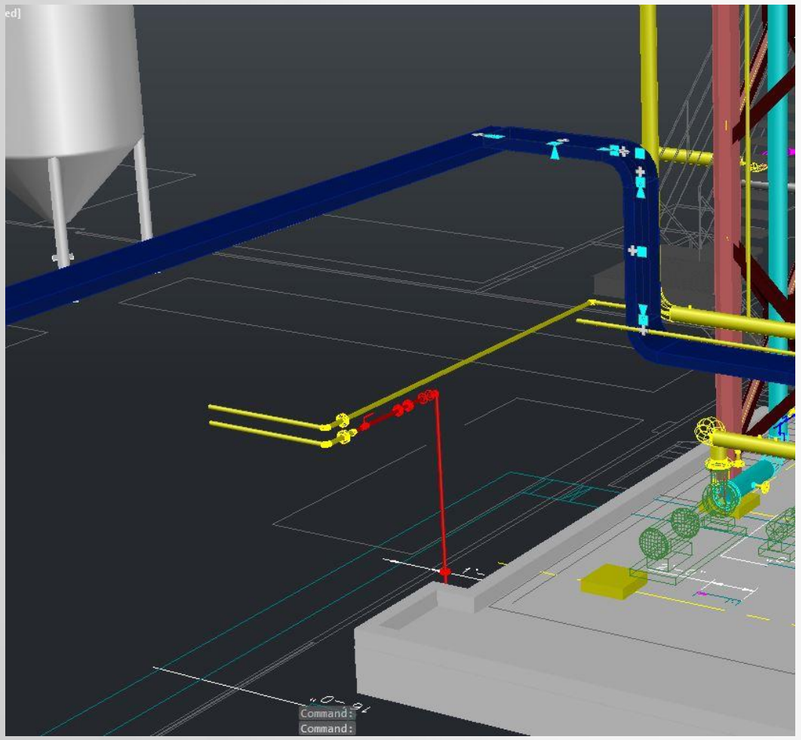


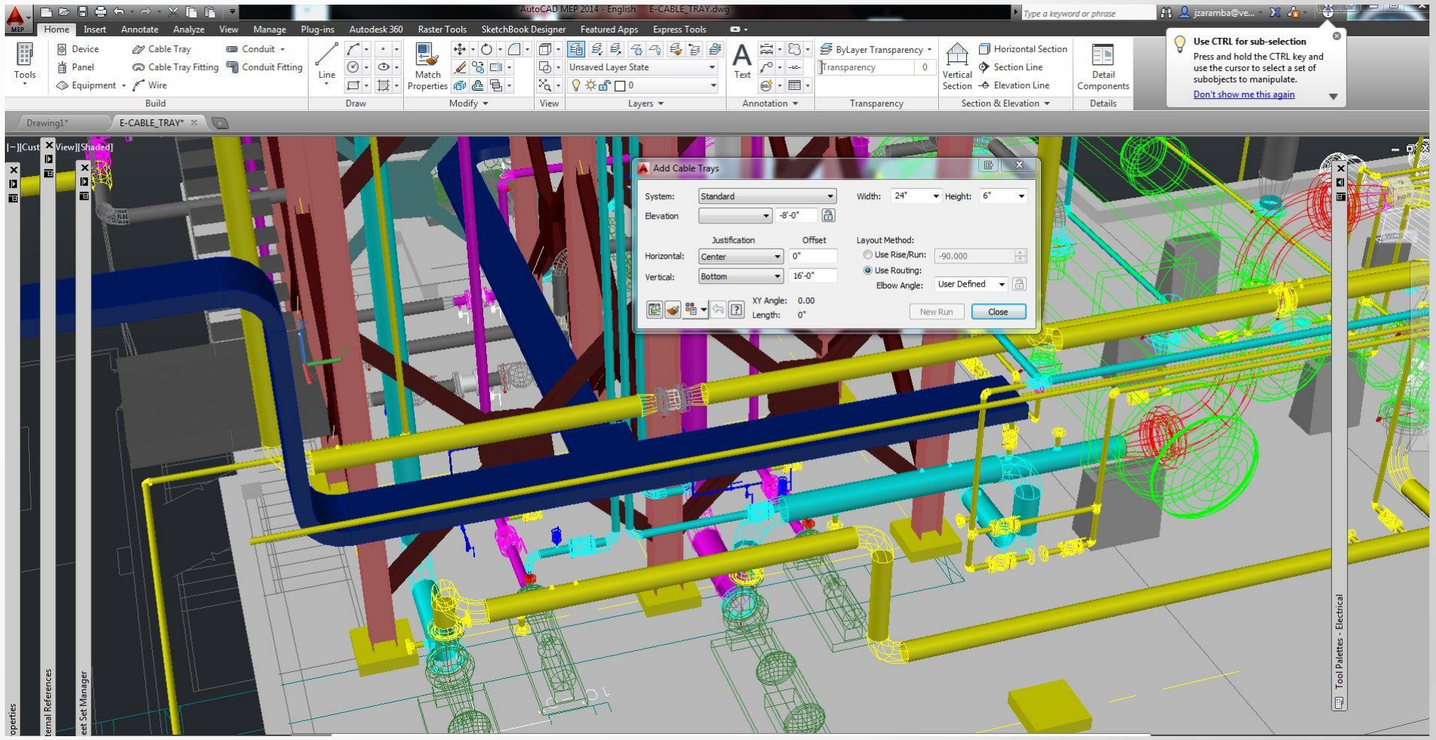


AUTOCAD MEP

Autodesk® AutoCAD® MEP (mechanical, electrical, and plumbing) software helps you draft, design, and document building systems.

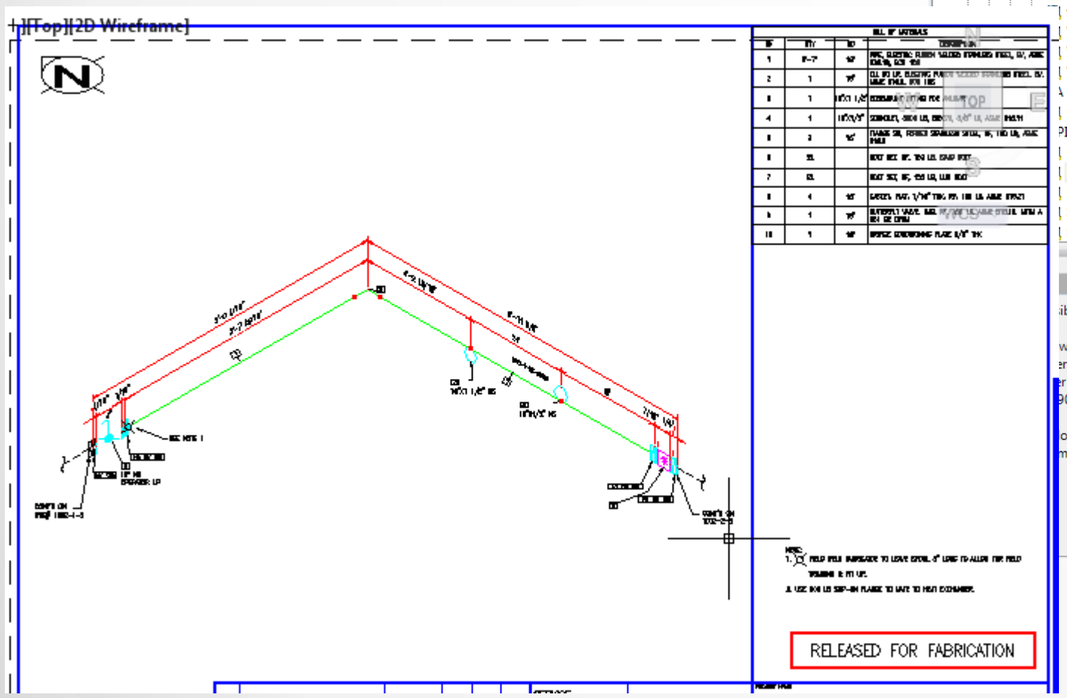
- In MEP we can reference in all plant models.
- By doing this we can layout cable trays and electrical equipment.

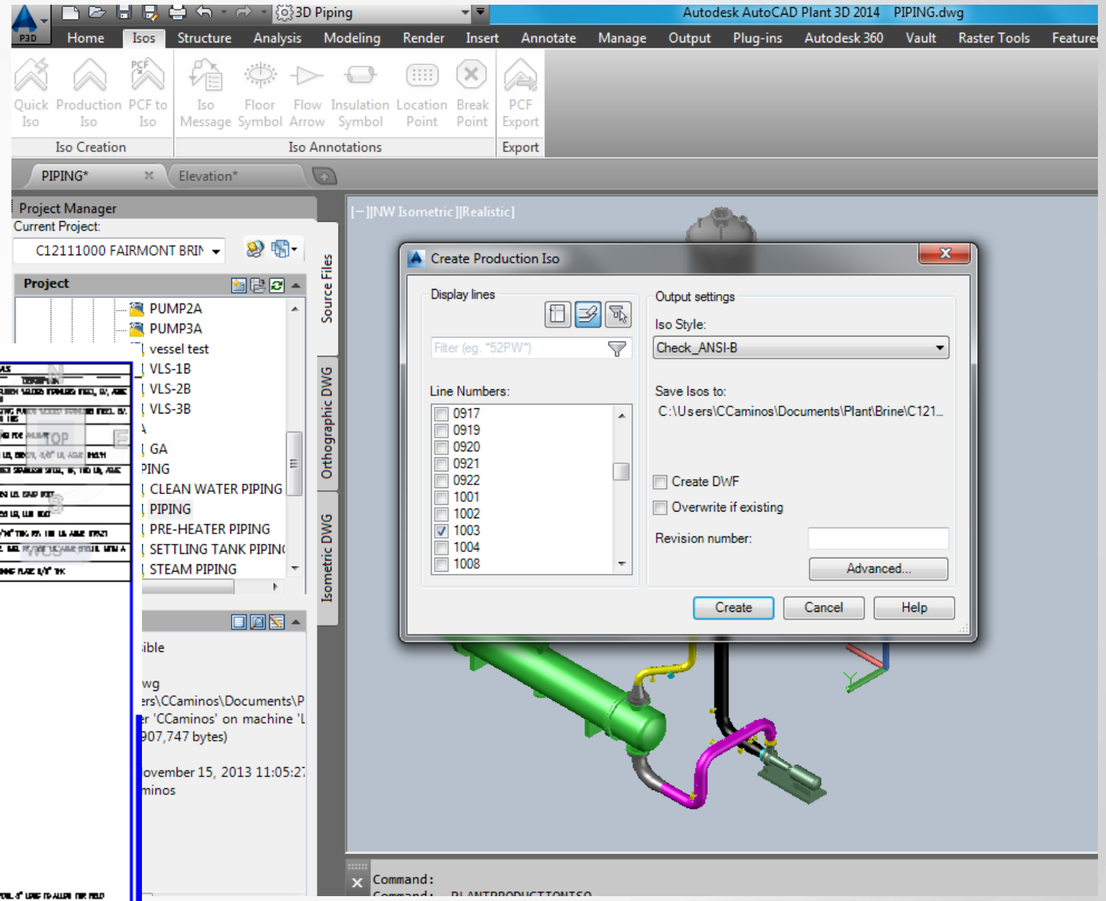




Deliverables

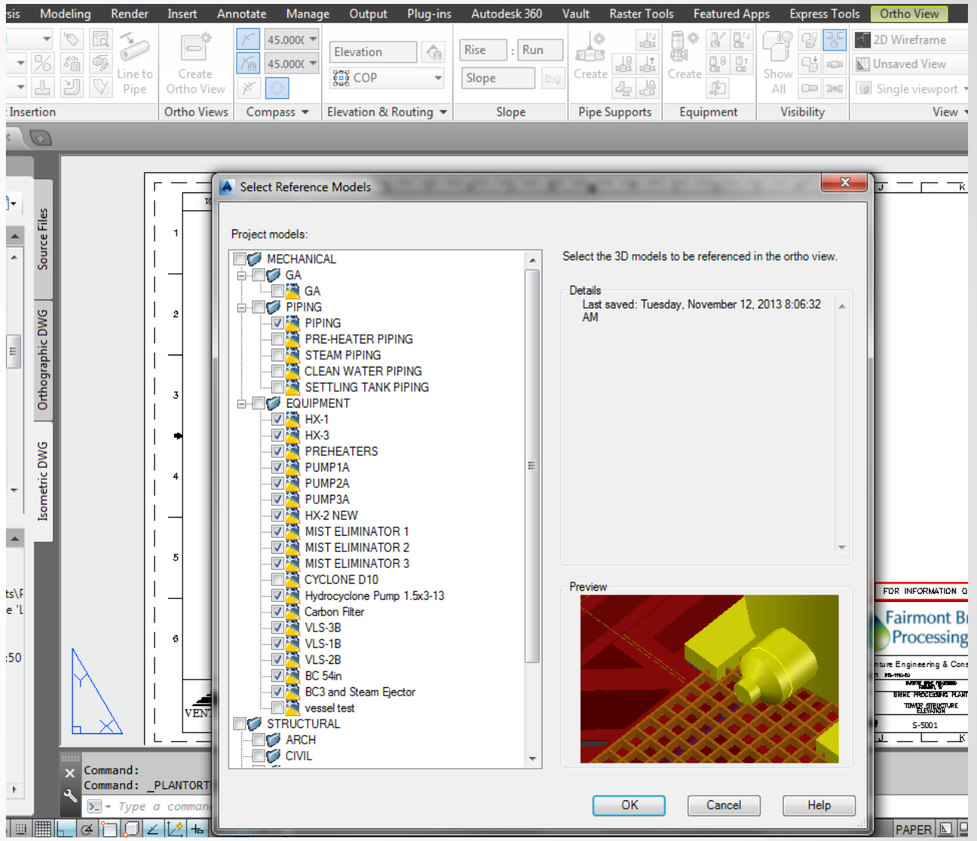
- Isometric Creation
  - Click on the ISO menu
  - Click the type of ISO you would like
  - When ISO window comes up choose line number and the ISO style.





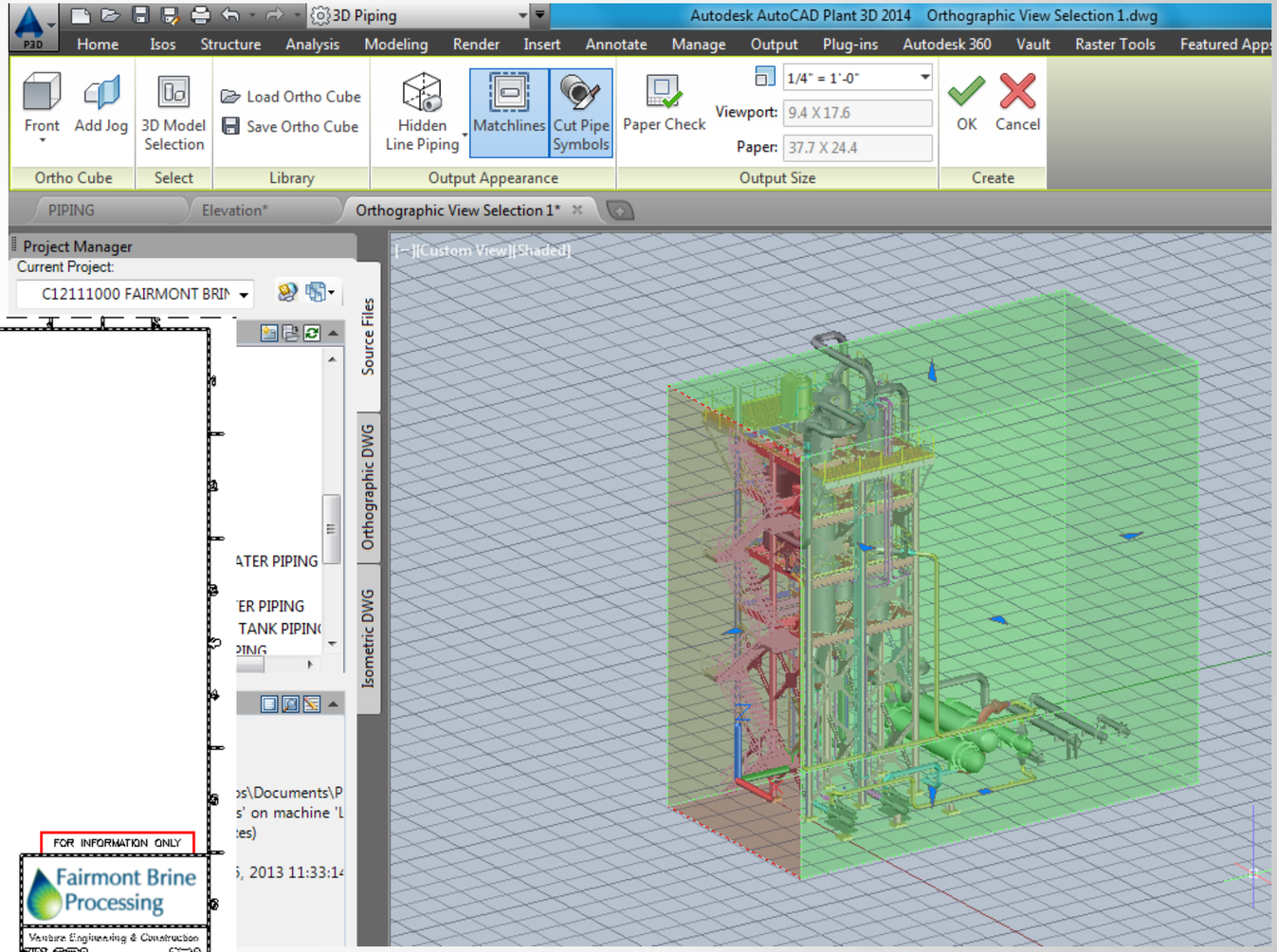
Deliverables

- Orthographic Creation
  - Using the ORTHO Create button on the ribbon, this window will appear.
  - Choose the equipment, structure and piping.



Deliverables

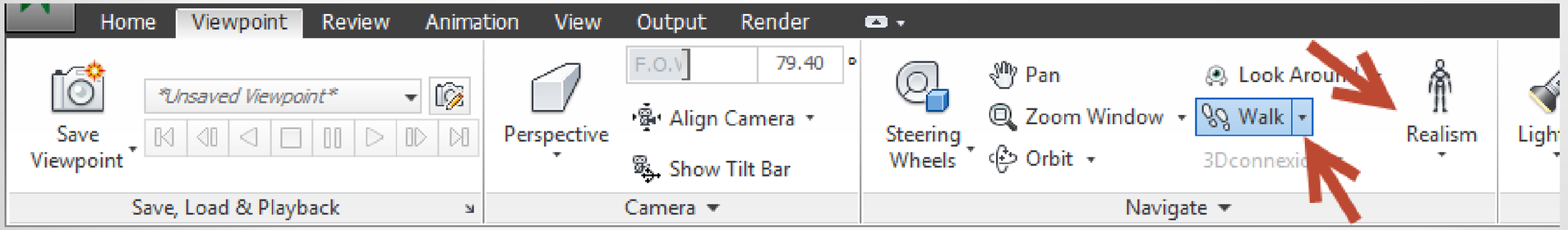
- Choose the area for the drawing using the model cube
- Choose the orientation using the ORTHO cube
- Ok to create ORTHO view



Project Collaboration and Clash Detection

Project Review

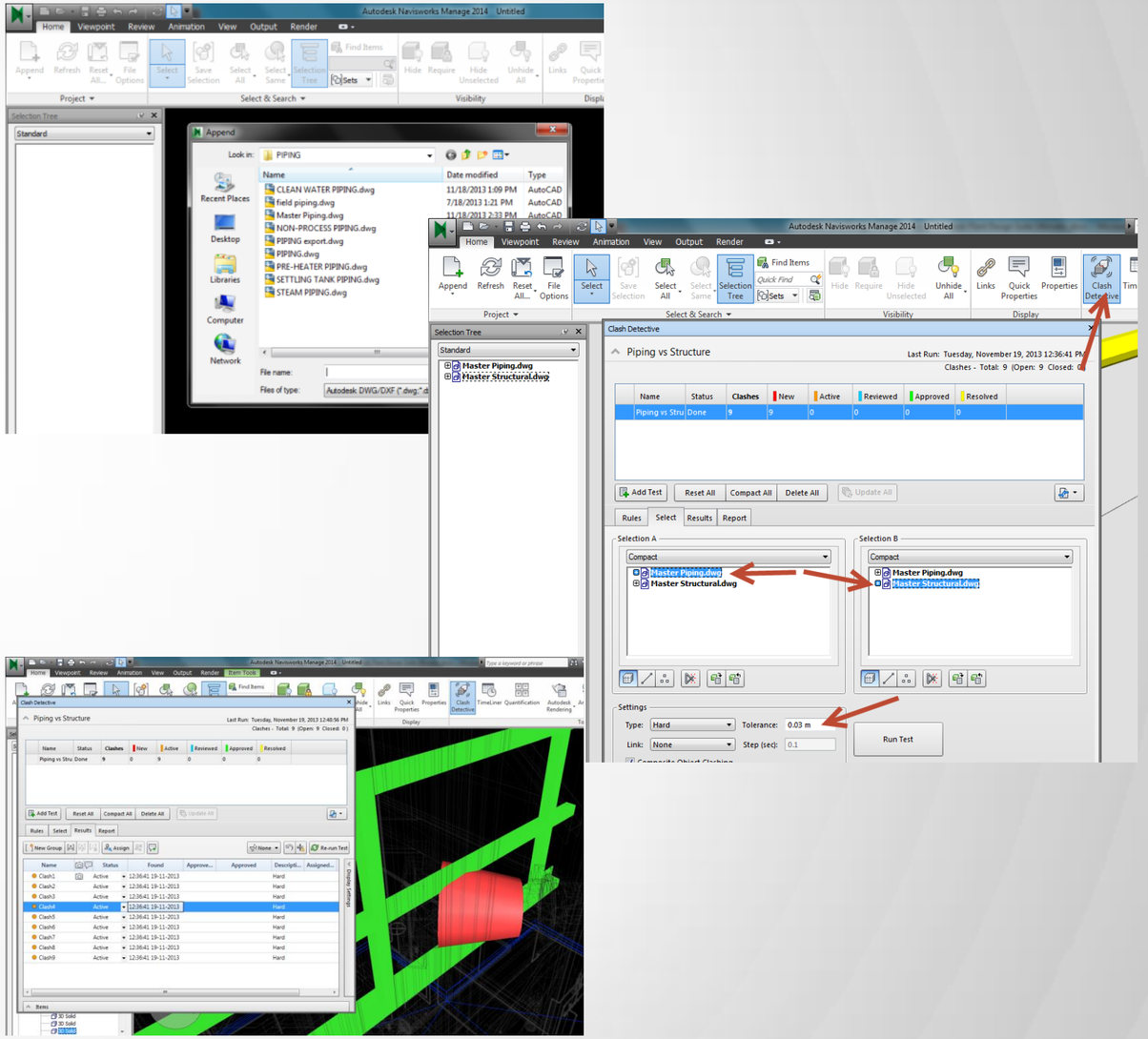
- You can use the ‘fly’ and ‘walk’ commands to review the project:
- In ‘walk’ mode you have various types of realism.
  - ‘Collision’ - you will not be able to walk through objects
  - ‘Gravity’ – you can walk through solid objects
  - ‘Crouch’ – you will attempt to crawl under or jump over objects in your path
  - ‘Third Person’ – you can look over the shoulder of an avatar



Project Collaboration and Clash Detection

Clash Detection

- You can check piping against structure.
- Use the Append button to open the piping and the structure file.
- Select Clash Detective from the ribbon
- Add a test to run and give it a name Piping vs. Structure
- In column selection A choose the Piping file and in column Selection B select the structure file.
- In the settings area choose what type and enter the tolerance.
- Click on the Run Test to perform the Clash Detection
- Once the Test has completed, the results will be displayed in the ‘Results’ tab.
- 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:



WorkFlows

WorkFlows

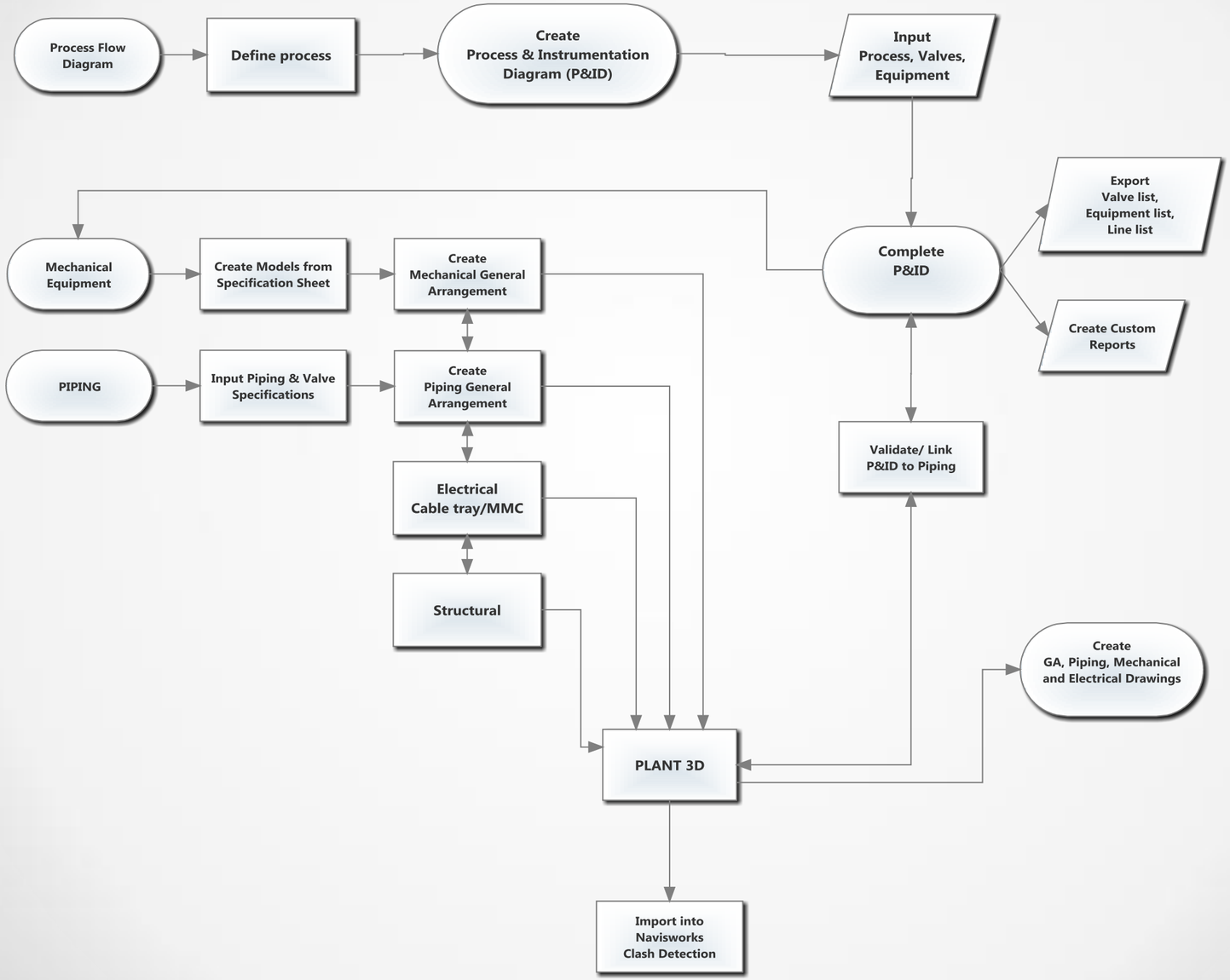
Plant Design Suite Workflow

- Autocad Process & Instrumentation Diagram (P&ID)
- Autocad Plant 3D
  - Structural
  - Equipment Modeling
  - Electrical
  - Piping
- Autocad Structural Detailing (ASD)
  - Structural
- Autodesk Inventor
  - Equipment Modeling
  - Structural

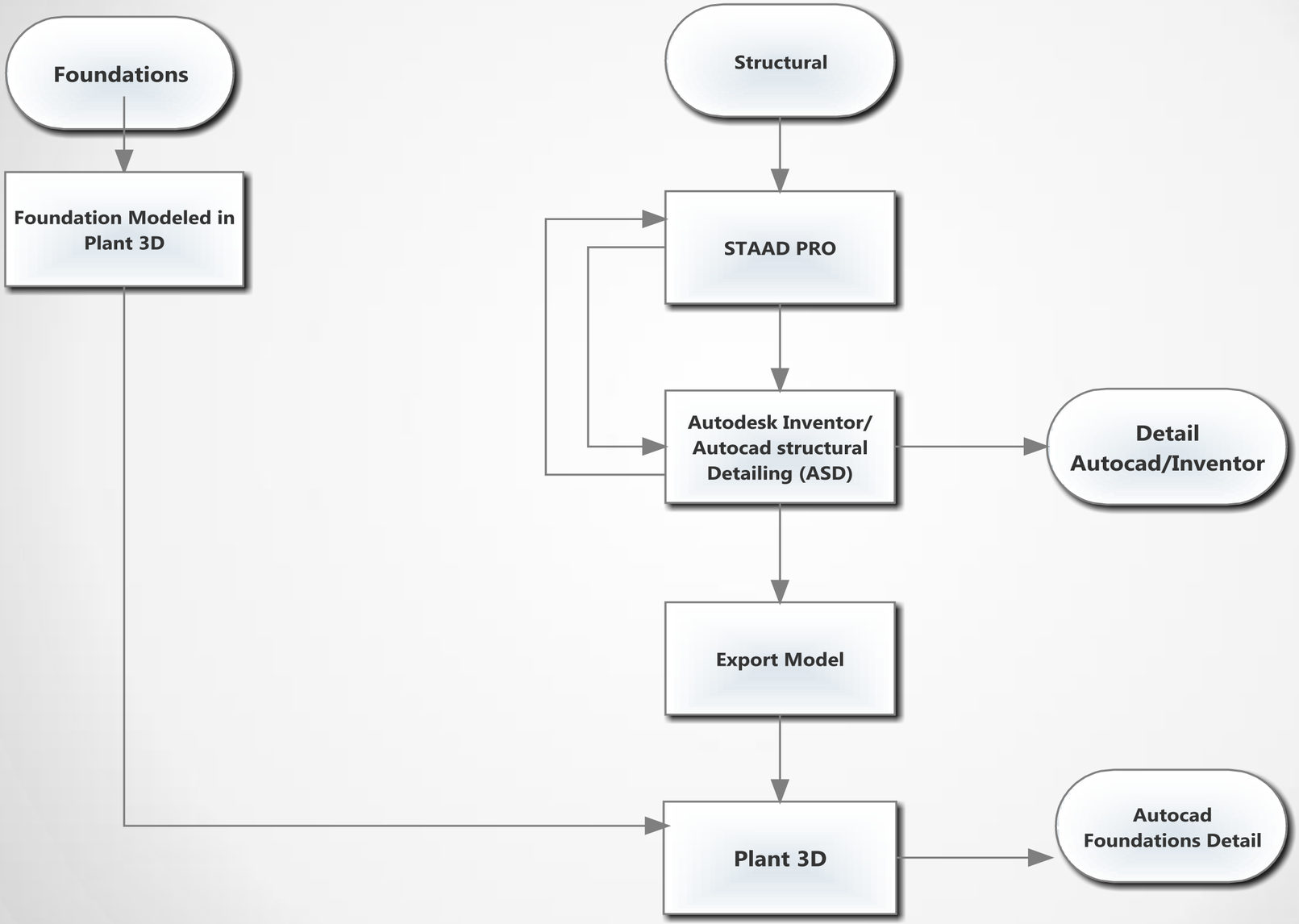
Oil & Gas Workflow

- Process/Mechanical/Piping Workflow
  - Autocad Plant 3D / PID
  - Autodesk Inventor
- Civil/Structural Workflow
  - Autocad Plant 3d
  - Autocad Structural Detailing
  - Autodesk Inventor
- Project Collaboration
  - Navisworks Interference Detection
- Deliverables
  - Piping Isometrics drawings
  - Orthographic drawings

WorkFlow – Process / Mechanical / Piping



WorkFlow – Civil / Structural

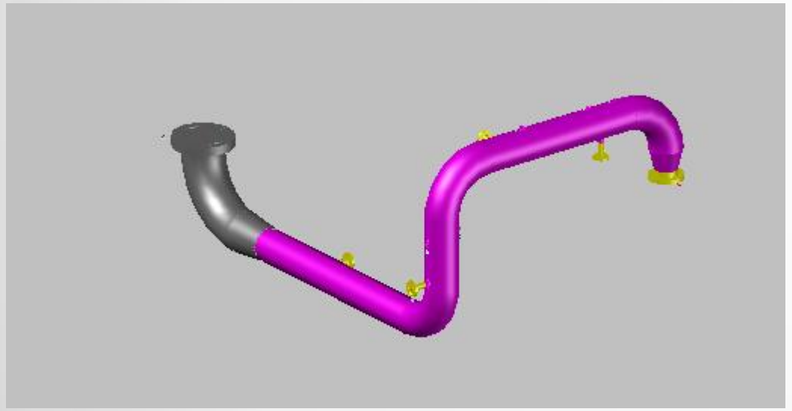


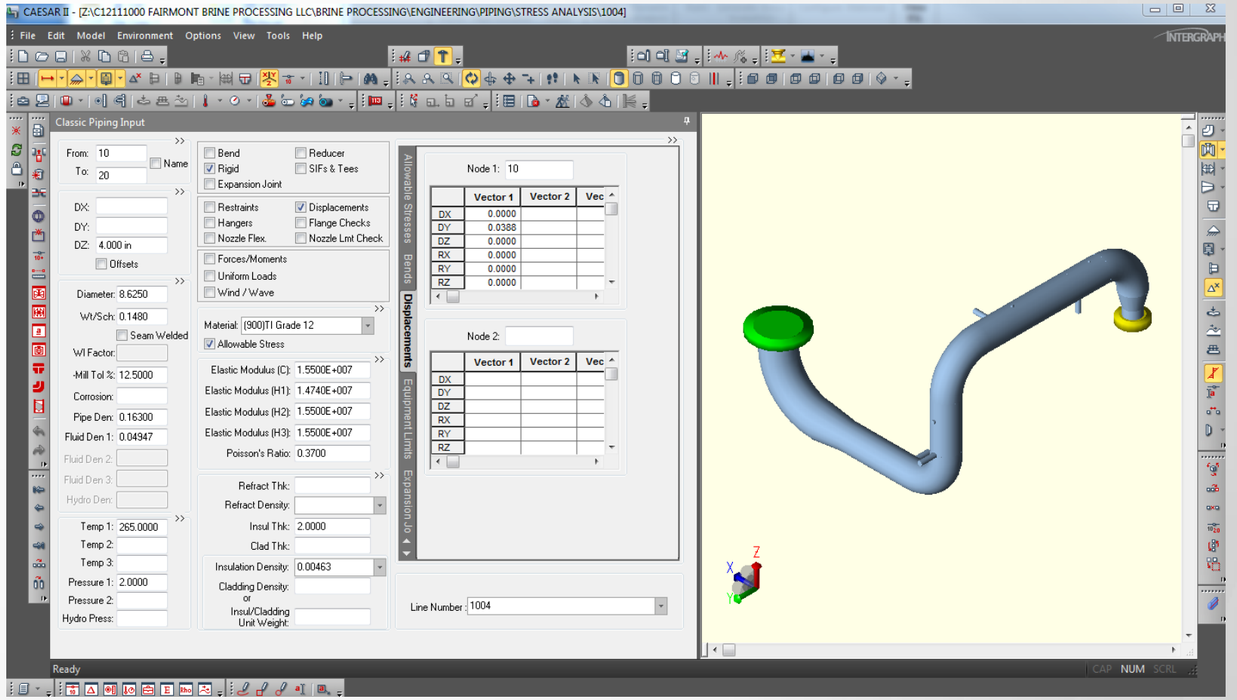
WorkFlow


PROCESS
Process Flow Diagram
Define process
Create Process & Instrumentation Diagram (P&ID)
Input Process, Valves, Equipment
Export Valve list, Equipment list, Line list, Tie Point list
Complete P&ID
Create Custom Reports
Create Inventor Models
Export Model
Mechanical Equipment
Create Models from Specification Sheet
Create Mechanical General Arrangement (GA)
Validate/ Link P&ID to Piping
Preliminary 2D General Arrangement Drawing
PIPING
Input Piping & Valve Specifications
Create Piping General Arrangement
ELECTRICAL
Create Model from Specification Sheets
Electrical Cable tray/MMC GA
Create GA, Piping, Mechanical, Electrical, Foundation and Structural Drawings
FOUNDATIONS
Foundation Modeled into Plant 3D
Structural Modeled into Plant 3D
PLANT 3D
Import into Navisworks Clash Detection
Export Model
Export Piping into Caesar II for Stress Analysis
CIVIL/STRUCTURAL
STAAD Pro
Autodesk Inventor/ Autocad Structural Detailing (ASD)
Create GAs, Details AutoCAD/Inventor
Create Foundations Detail AutoCad

Engineering software

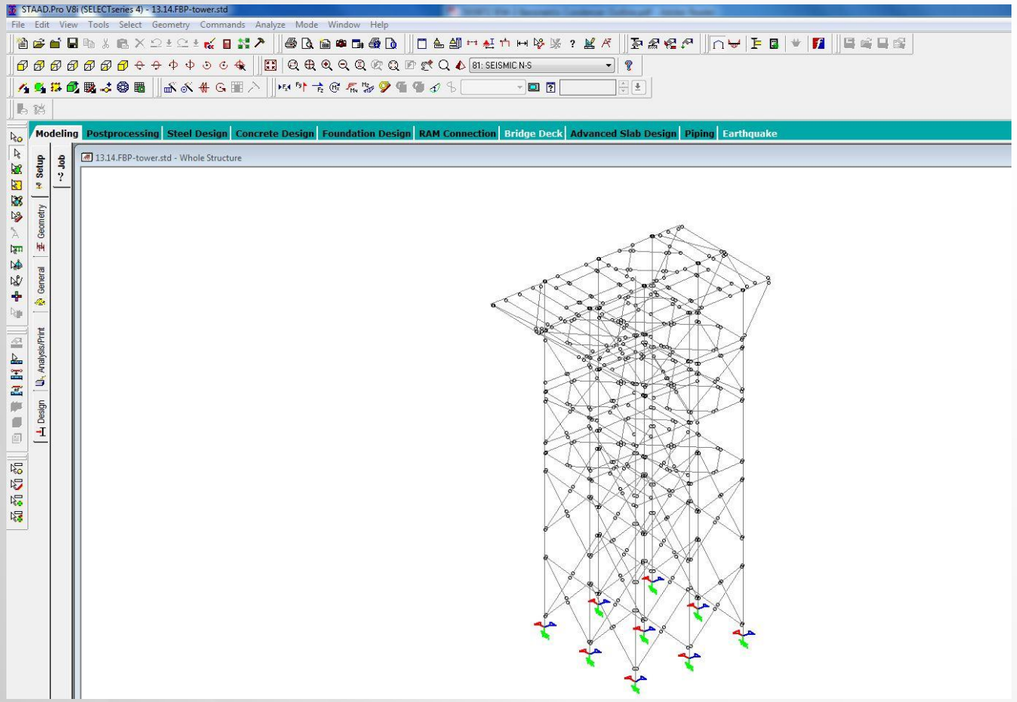
- Plant 3D allows us to import the piping layout into Intergraph Caesar II for thermal and seismic analysis.
- Intergraph CEASAR II evaluates the structural responses and stresses of piping systems to international codes and standards.

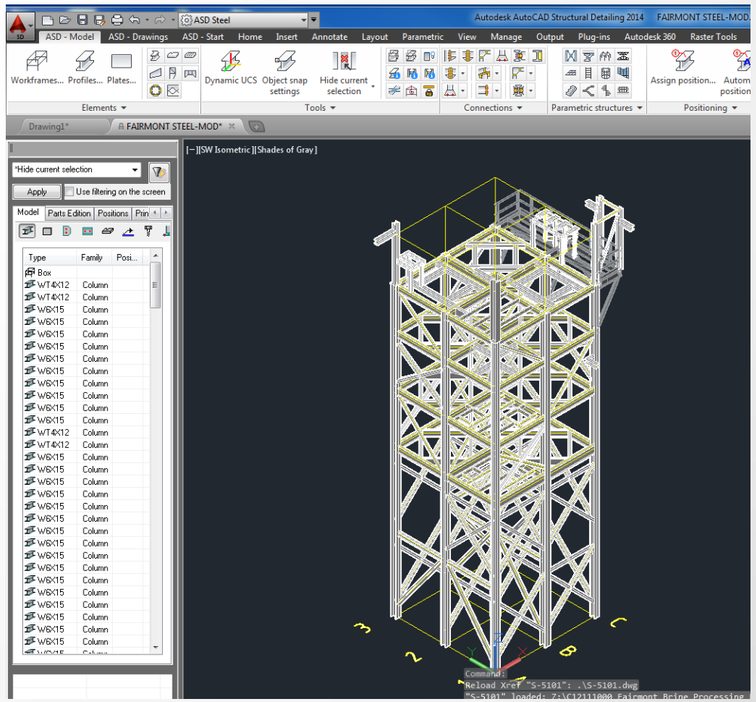




Engineering software

- Autocad Structural Detailing (ASD) and Inventor allows us to import STAAD Pro models after load calculations are completed.
- STAAD PRO is the structural engineering software to perform 3D structural analysis and design for steel, concrete, aluminum and cold formed steel of virtually any structure.





Conclusion

You have been just been introduced to a viable industry workflow using the design tools within the Autodesk Plant Design Suite Ultimate 2014. Now, you have a good understanding of how the following tools interact with each other to be interoperable:

- P&ID's
- Structural, Equipment and Piping Modeling
- Structural Workflows using Autodesk Inventor and AutoCAD Structural Detailing
- Equipment Workflow using Inventor and Plant 3D
- Collaboration with Navisworks
  - Interference Detection
- Deliverables
  - Isometrics
  - Orthographic