IM322819-L

Factory Design Utilities Workflow-from Zero to Hero

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Co-presenters:

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Autodesk

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Autodesk

Learning Objectives

- Get familiar with Factory Design Utilities as part of the Production Design & Manufacturing Collection
- Experience the smooth data transition between AutoCAD, Inventor, and Navisworks using Factory Design Utilities
- Learn how to overcome broken workflows using Factory Design Utilities
- Learn the fastest way to set up your digital mockup

Description

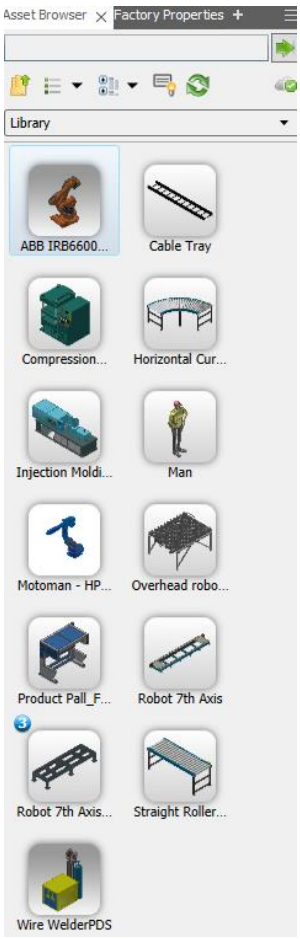
This introductory hands-on lab will guide you through all the steps of setting up a production facility with Factory Design Utilities, from ideation to imagery, based on a step-by-step guided data set.

Speaker(s)

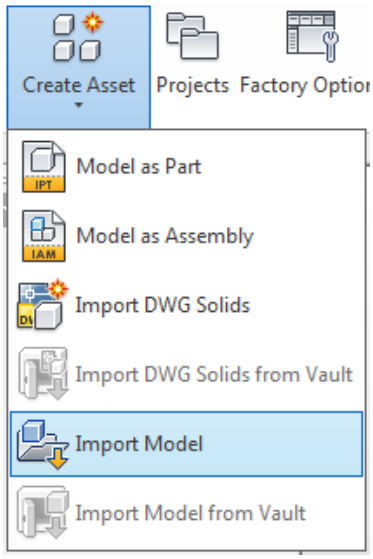
Peter De Strijker is an application engineer / industrial manufacturing for Autodesk, Inc. He is responsible for driving the Autodesk manufacturing sales channel in the Benelux region in Europe. Before joining Autodesk, Peter worked as mechanical design engineer at a Belgian marine engine and gearbox manufacturer. He is a graduated engineer with a degree in electro mechanics.

User Assets Library

It's important to be able to populate the library with user specific assets. Let's create one!



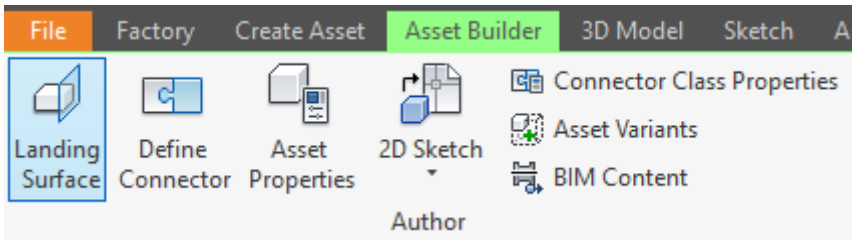
1. Open the ***Import Asset*** function in Inventor Factory Ribbon.
   Ribbon: Get Started >Factory Launch > Create Asset > Import Asset



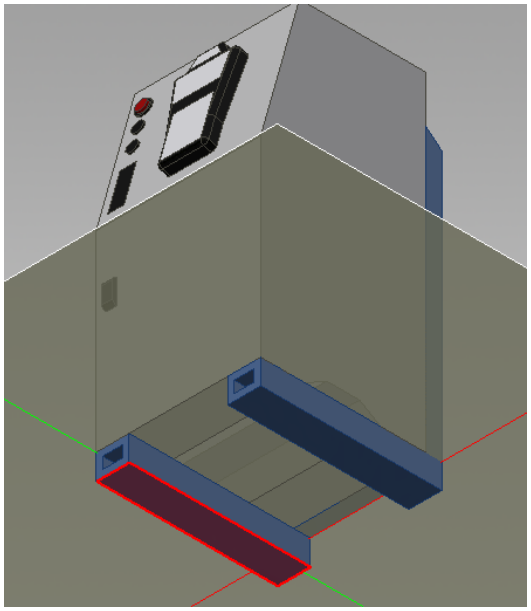
   Select ***…\AU2019FDUDataset\Design\05-Asset Creation\Robot Controller.ipt*** and click ***Open***.

   The model is now loading into the ***Asset Builder*** environnement.

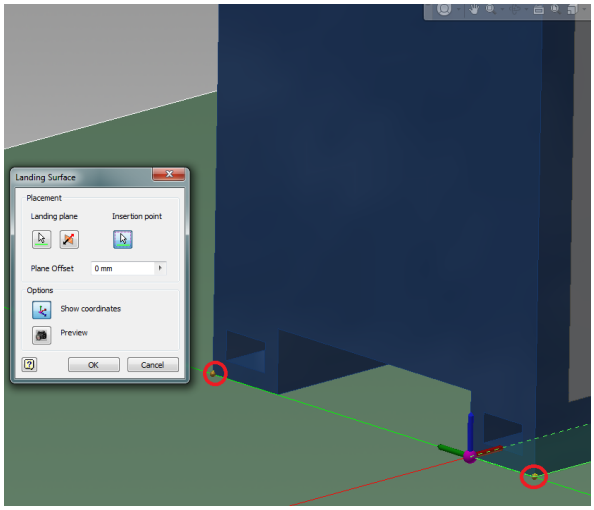
2. Open the ***Landing Surface*** function.
   Ribbon: Asset Builder > Author > Landing Surface



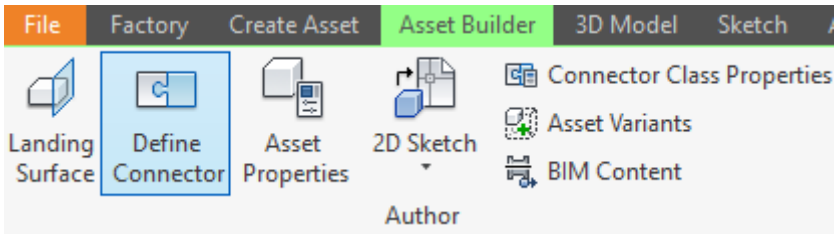
   Select the bottom surface of the machine enclosure to define it as the landing surface.



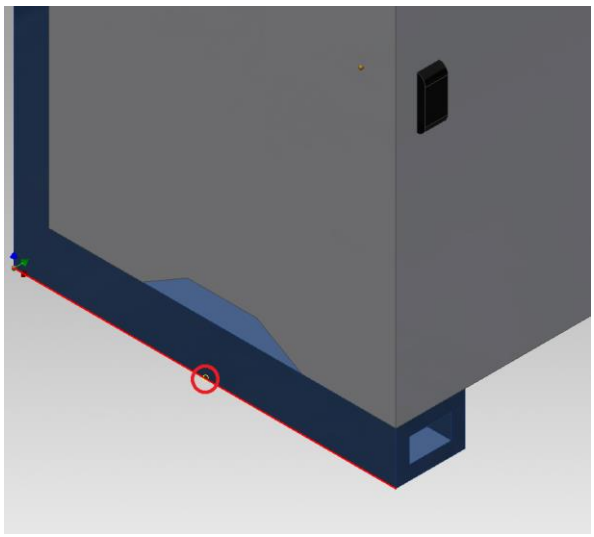
   In the ***Landing Surface*** dialog, click ***Select Insertion Point*** and select the two points marked. Click ***OK*** to confirm the changes.



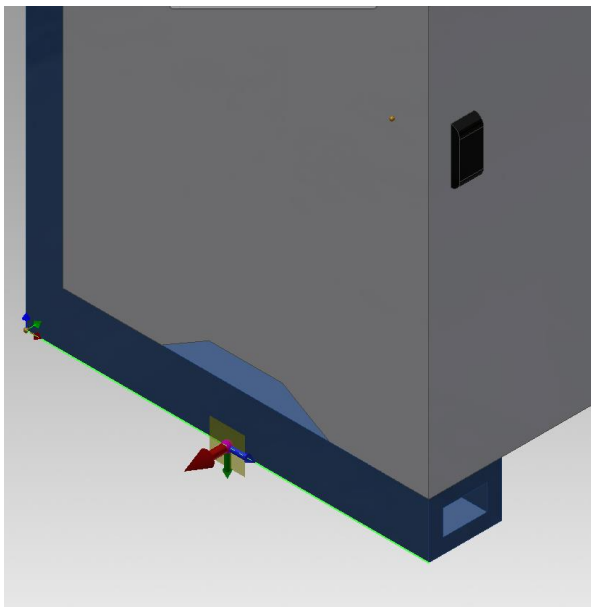
3. Open the ***Define Connector*** function.
   Ribbon: Asset Builder > Author > Define Connector



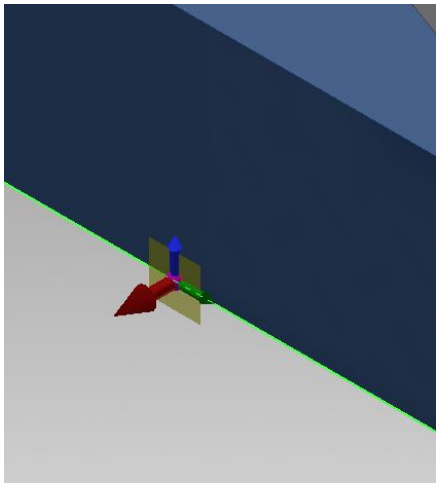
Select the center of the left-hand edge as the insertion point.



Select the red direction arrow and click the left-hand vertical edge of the box to define alignment.

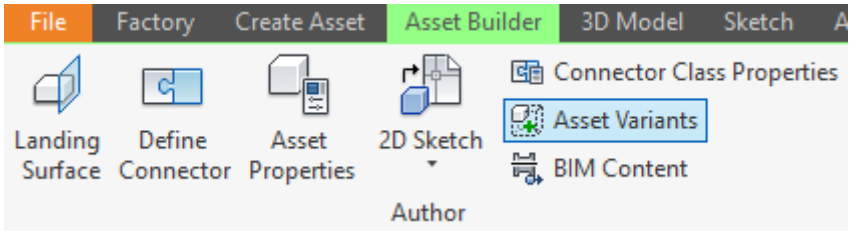


Select the blue arrow and select a vertical edge on the model. The blue arrow now points upwards.

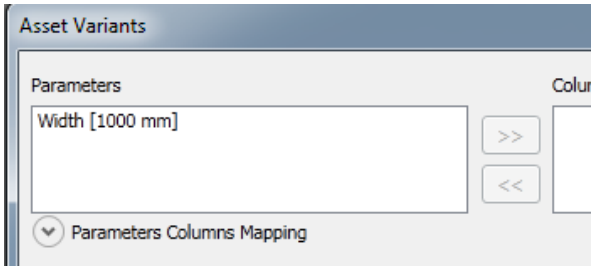


Press [ENTER] to close the command.

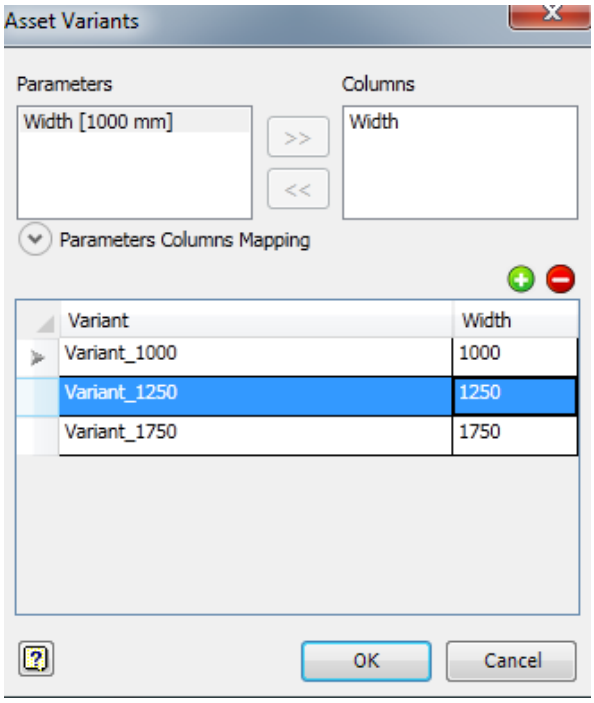
4. Create a second connector in the same way.
5. Open the ***Asset Variants*** function.
   Ribbon: Asset Builder > Author > Asset Variants



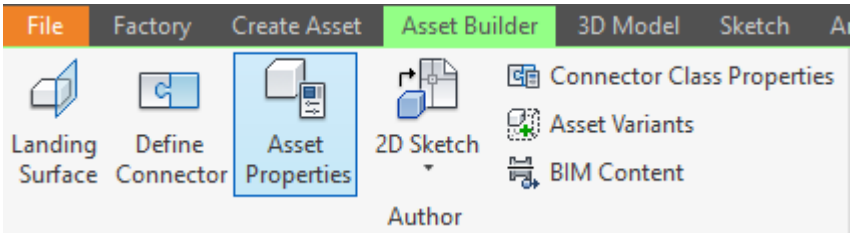
Select the ***Width*** parameters and click the **>>** button.



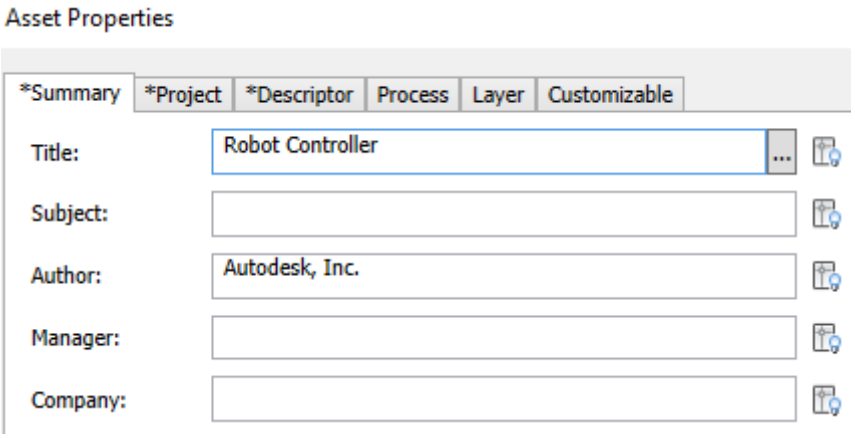
Using the ***+*** button, create three variants with the following values and click ***OK*** to close the dialog.



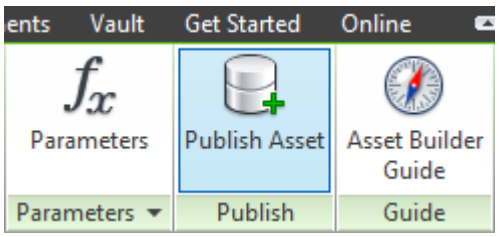
6. Open the ***Asset Properties*** function.
   Ribbon: Asset Builder > Author > Asset Properties



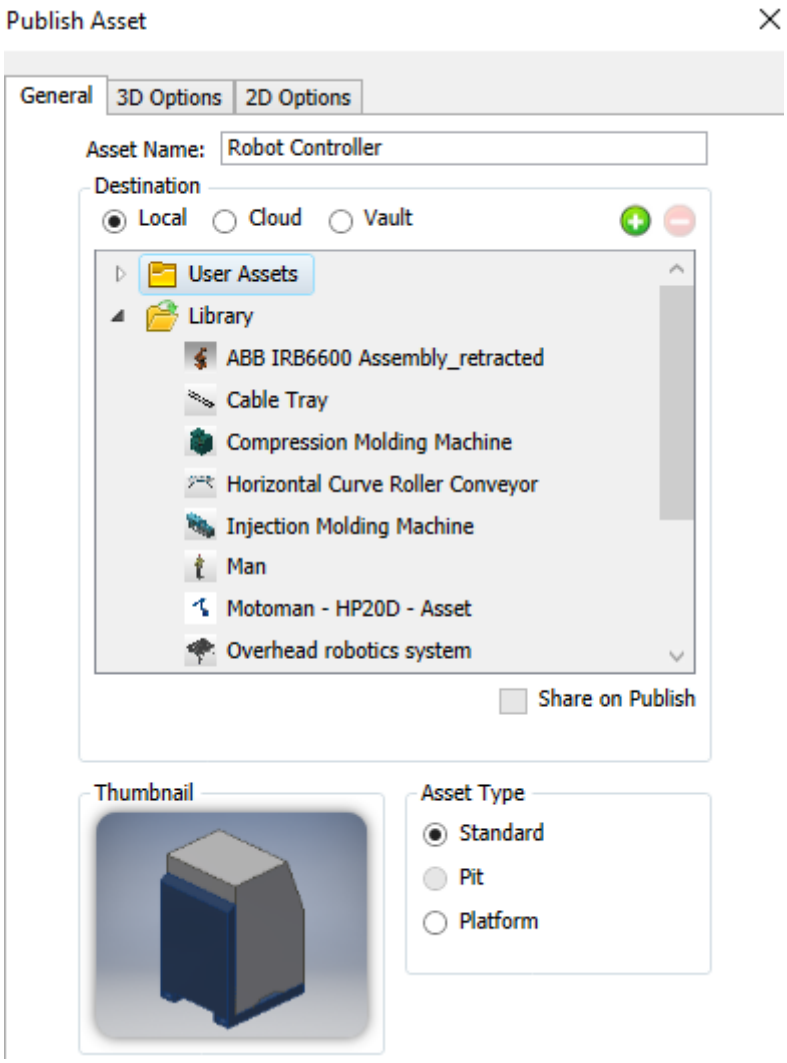
On the ***Summary*** tab, enter Title ***Robot Controller*** and Company ***Autodesk*** and click ***OK*** to confirm your entry.



7. Save the design.
8. Open the ***Publish Asset*** function.
   Ribbon: Asset Builder > Publish > Publish Asset

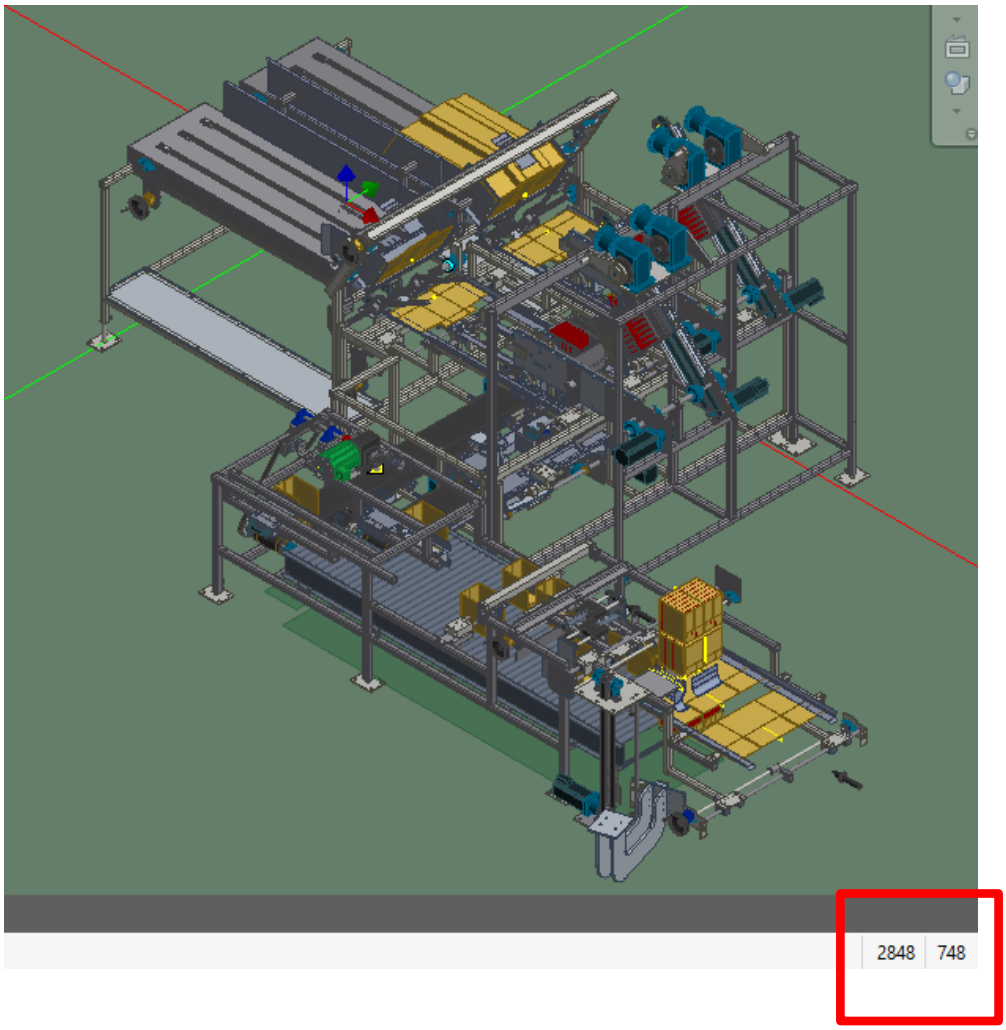


   Enter asset name ***Robot Controller*** and select a destination directory. Click ***OK*** to confirm your entry.



9. Close the part.

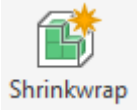
10. Open file ***…\ AU2019FDUDataset\Design\04-Packaging machine\ _0012009310.iam***



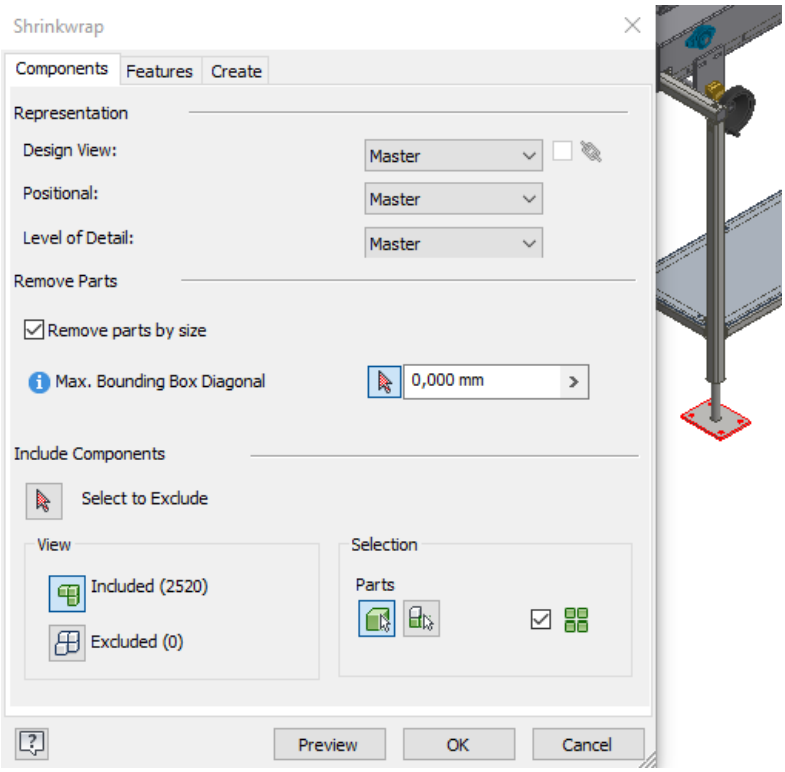
As you can see, there are over 2.800 parts, too much for an asset so let's simplify this

11. First make sure to fully load the file.

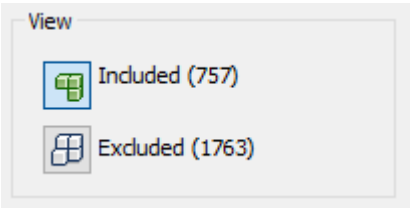
12. Open ***Shrinkwrap*** function
    Ribbon: Assemble > Simplification



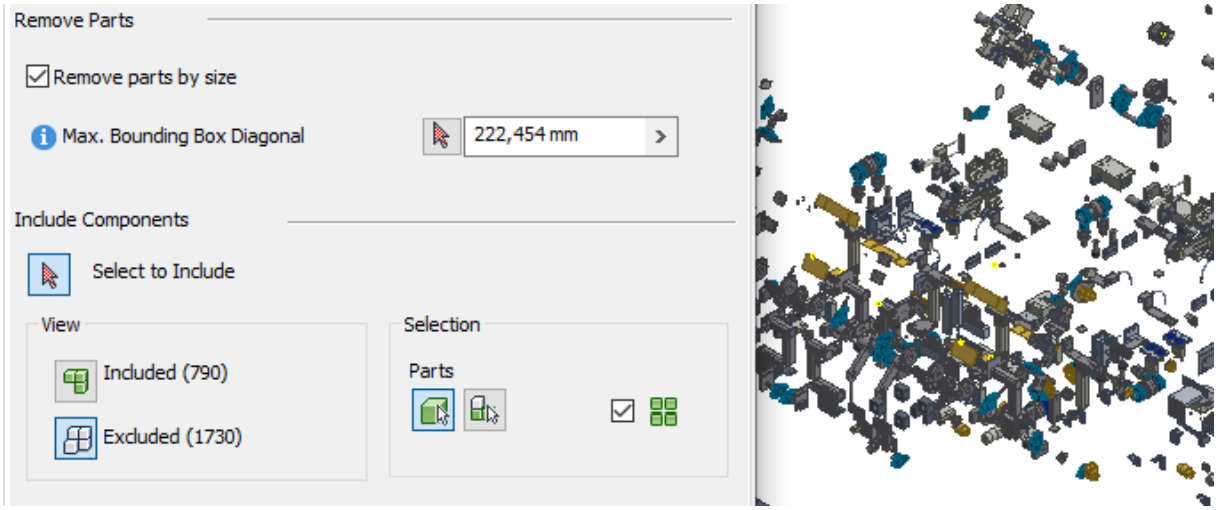
13. Enable “Remove parts by size” and select footplate as reference.



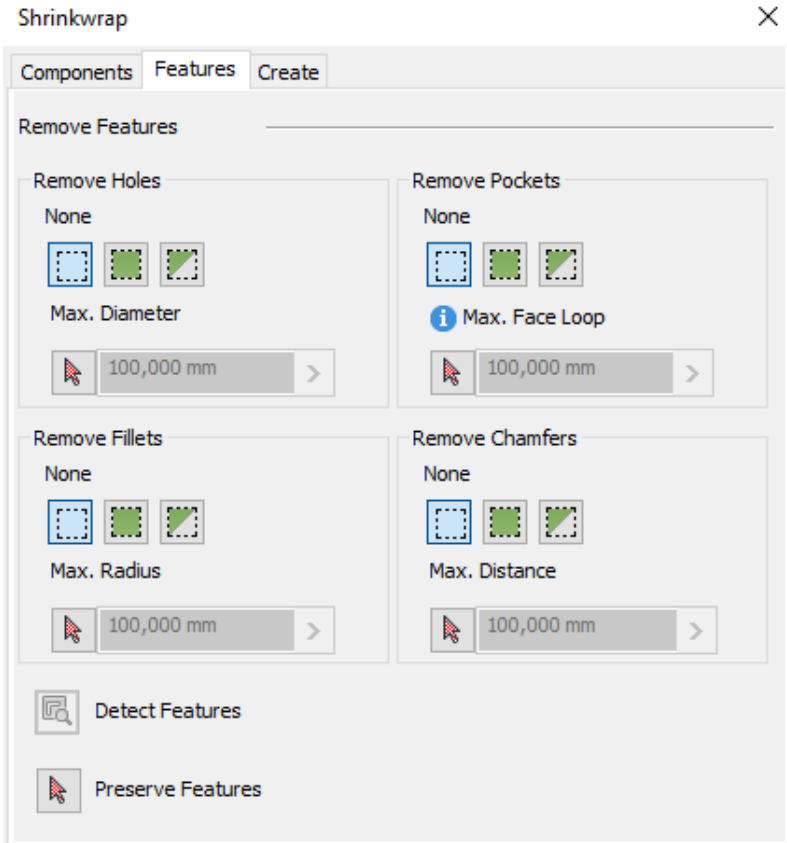
14. With this operation, almost 2/3 of the parts are already excluded from simplification



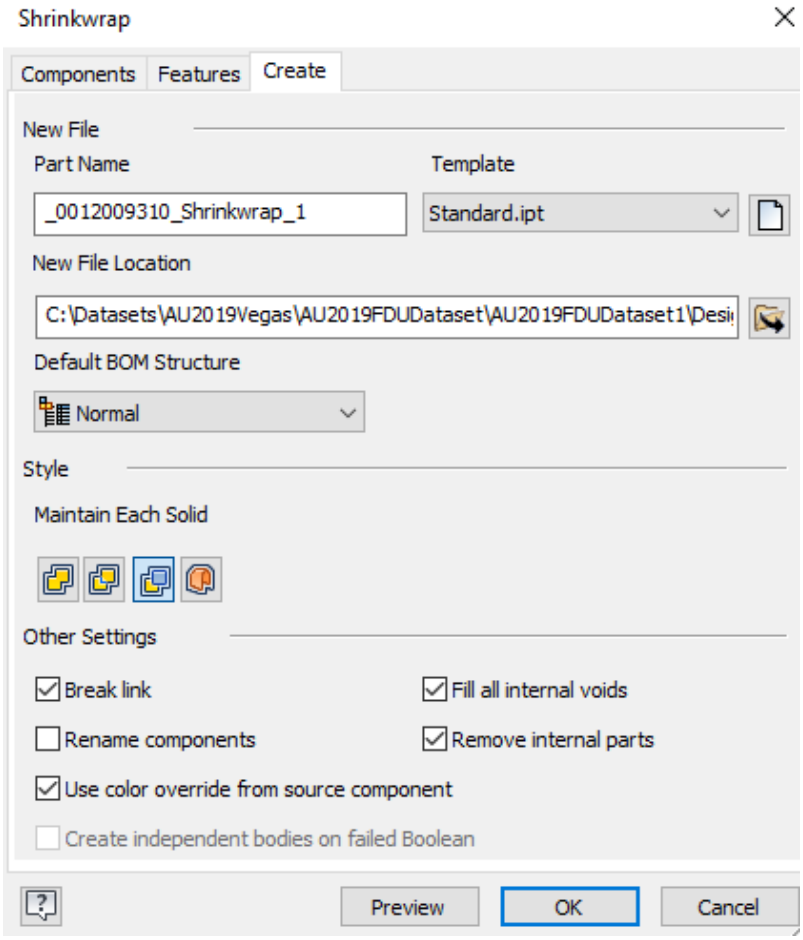
15. If you want to include hidden parts again, click Excluded option and select e.g. footplates again in graphical interface.



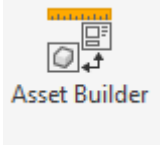
16. Go to the ***Features*** tab to remove unnecessary features like holes, filets and chamfers items the same style.



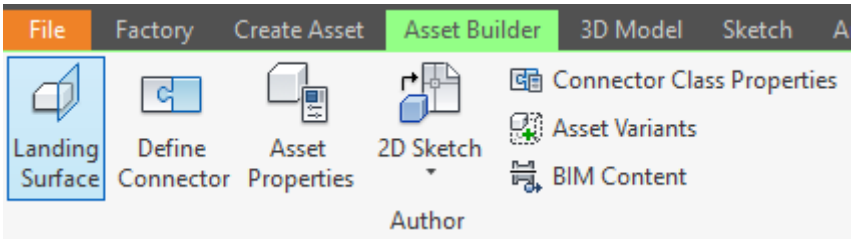
17. Go to the **Create** tab to convert the simplified model into one single object
18. Enable ***Break link*** to improve performance



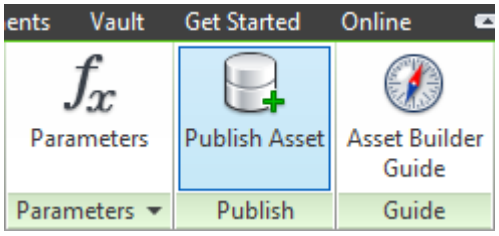
19. Open ***Asset Builder*** function
    Ribbon: Factory > Factory Launch



20. Define the landings Surface



21. Open the Publish asset function



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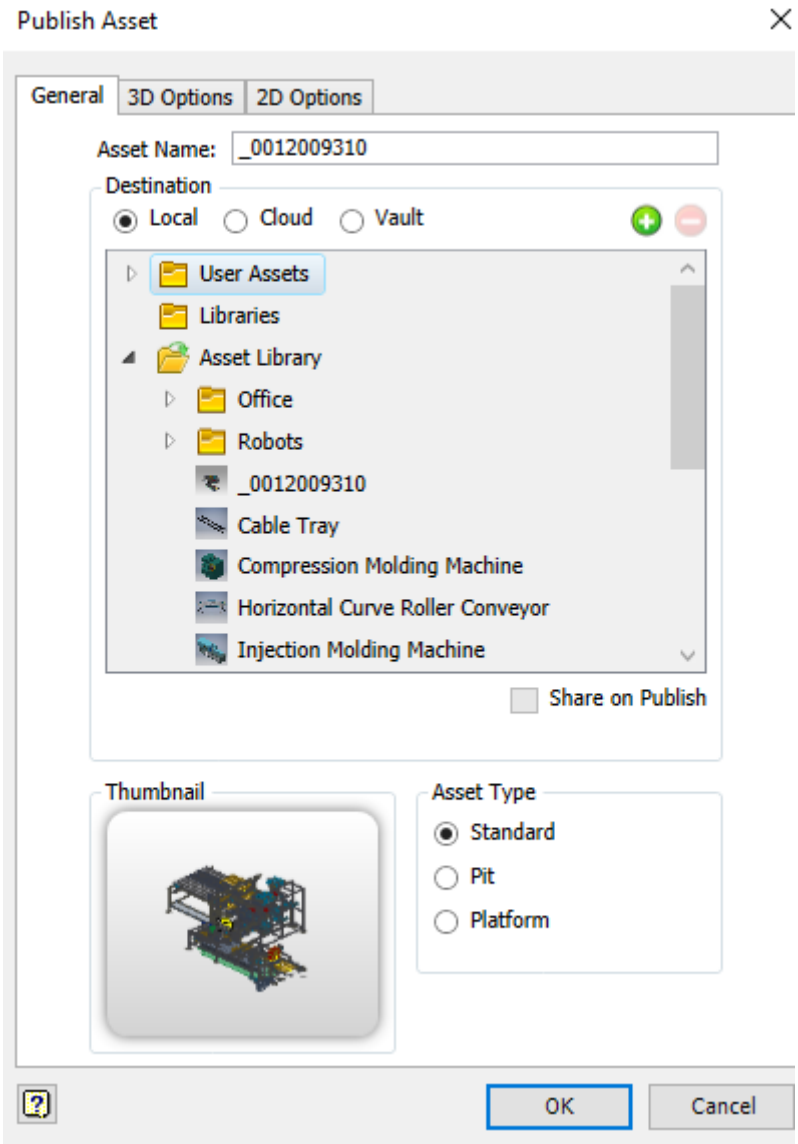
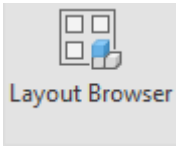


22. Close the assembly.

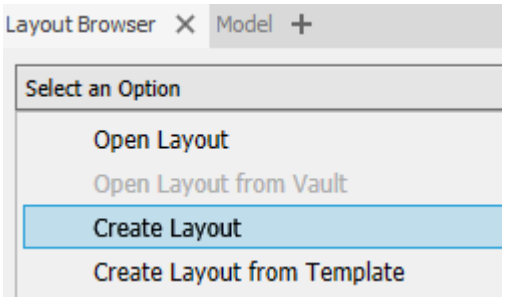
Production Process Analysis – Process Flowchart

OPTIONAL

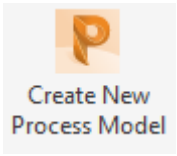


23. Make sure the Layout Browser is loaded

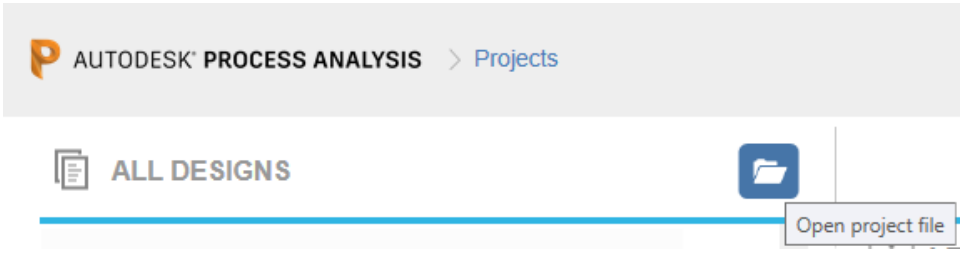
24. Create a New Layout



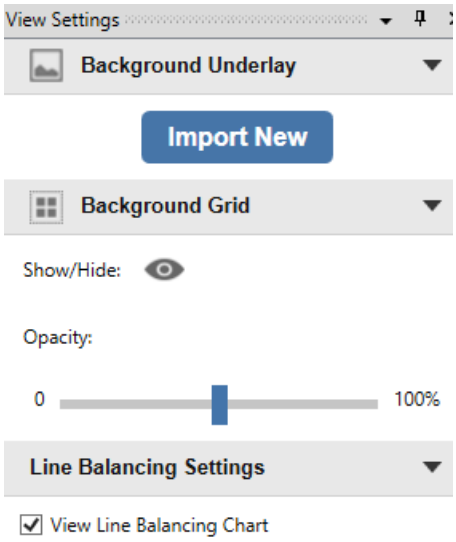
25. Start ***Process Analysis*** in the factory ribbon
Ribbon: Factory > Tools



Open …\ AU2019FDUDataset\Design \06-Process Analysis \ Mannheim_Process - Start.adskfpa

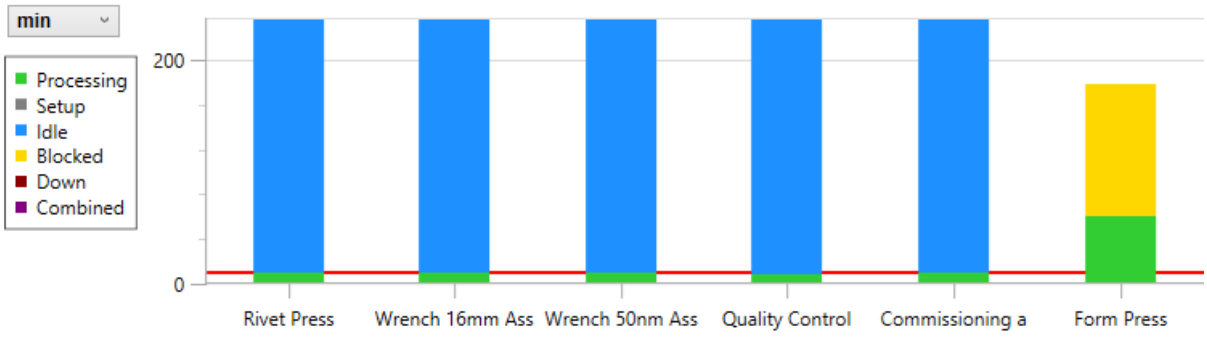


26. ***Activate "View Line Balancing Chart" in View Settings***



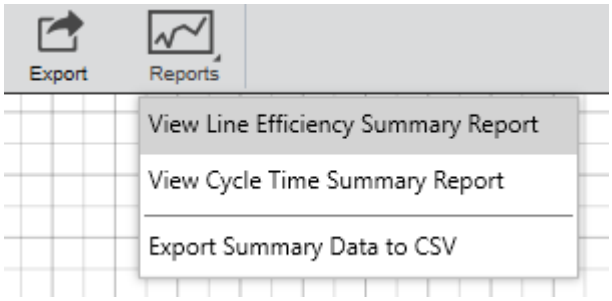
27. *Run Simulation*

28. Note that for example the Rivet Press is most of the time in “Idle” state because it’s waiting for materials and the Form Press is blocked because the next machine is still processing.

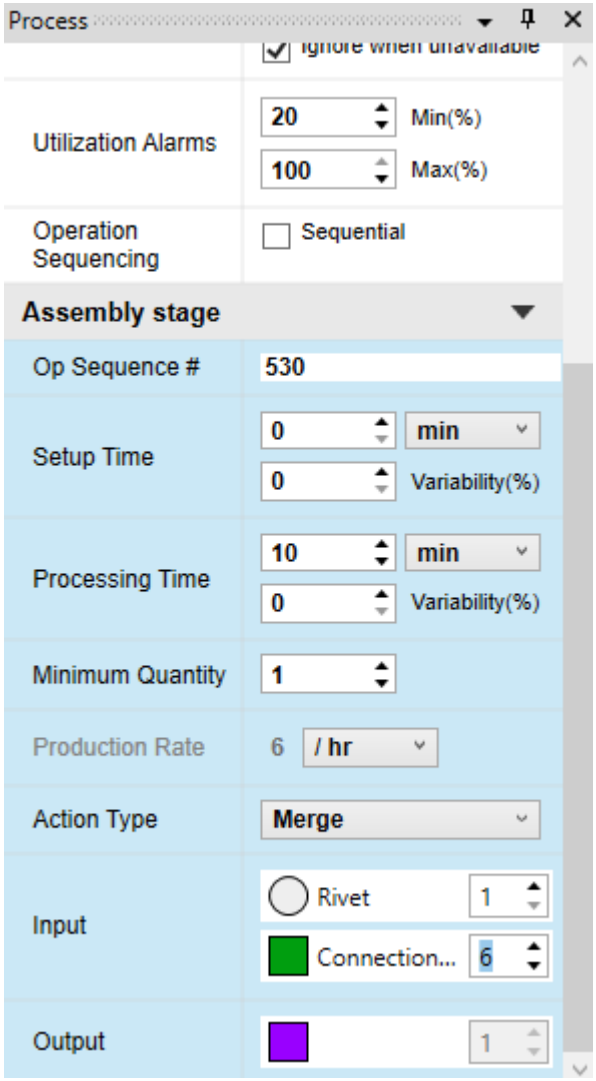


29. Note that the total process time to produce 20 shovels is 78 h

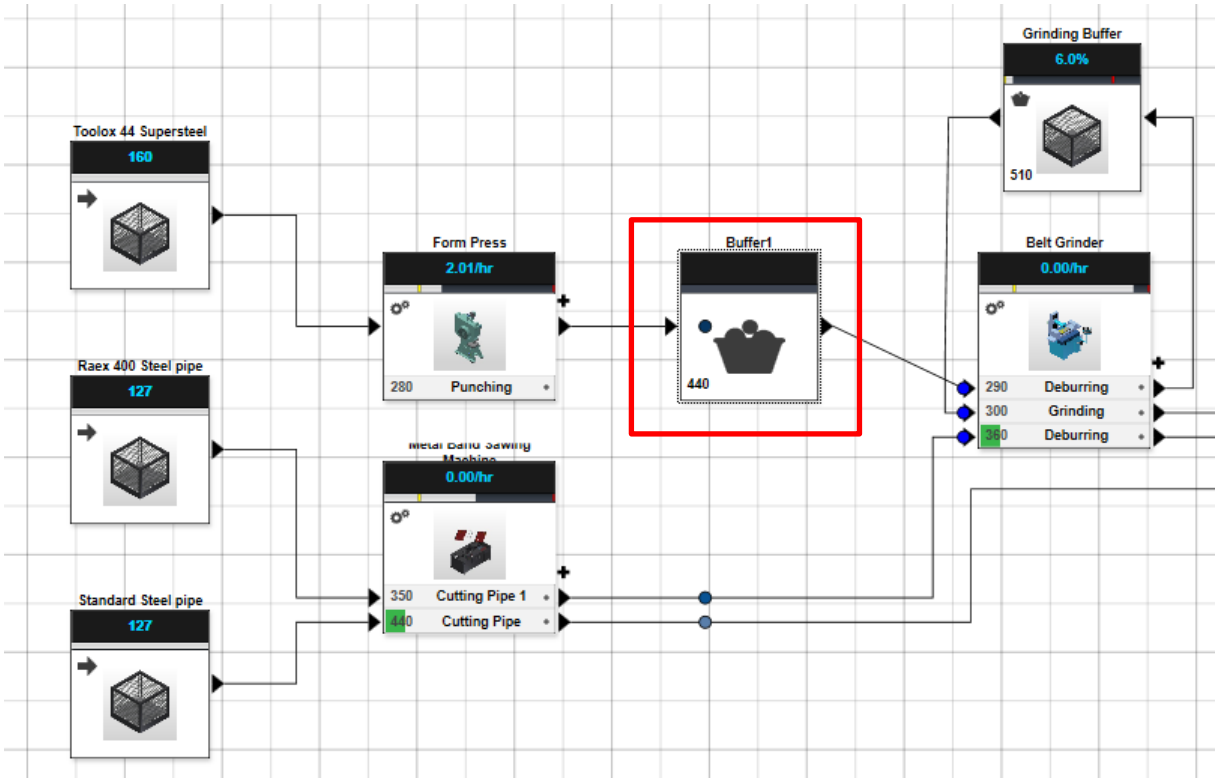
30. Run a html report to document the current state.



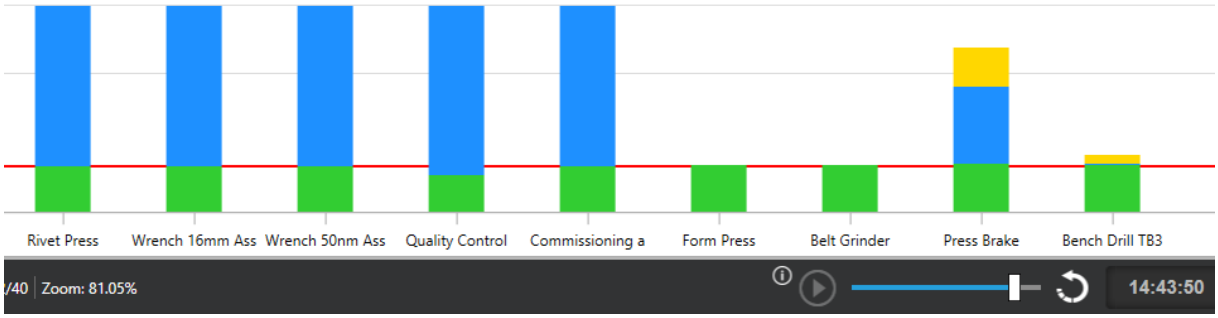
31. Select „Rivet Press“ and modify the production parameters from 6 connection elements to 1



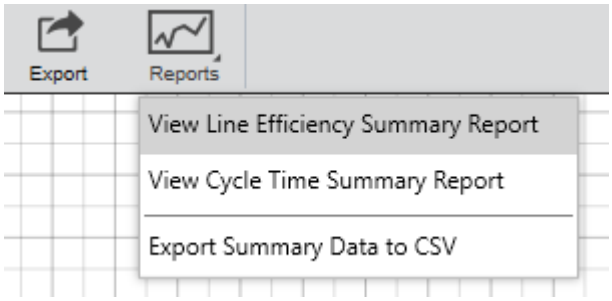
32. In the Process layout, add a buffer with 500 pieces capacity between „Form Press“ and „Belt Grinder“ and reconnect the process



33. Run the simulation again and analyse the process impact of the modified machines



34. Run a html report to document this process state.



35. Open both html reports and compare the results

Line Efficiency Summary Report - Mannheim_Process_Finish

Folding Spade (18:41)

Simulation Summary

Run Date/Time:	3/8/2018 3:21:22 PM
Elapsed Time:	14:21:30 (h:m:s)

Production Summary - Folding Spade (18:41)

Units Produced:	20
Total Production Run Time:	14:21:30 (h:m:s)
Average Production Time:	00:43:04:500 (h:m:s:ms)
Average Production Rate:	1.39 / Hour

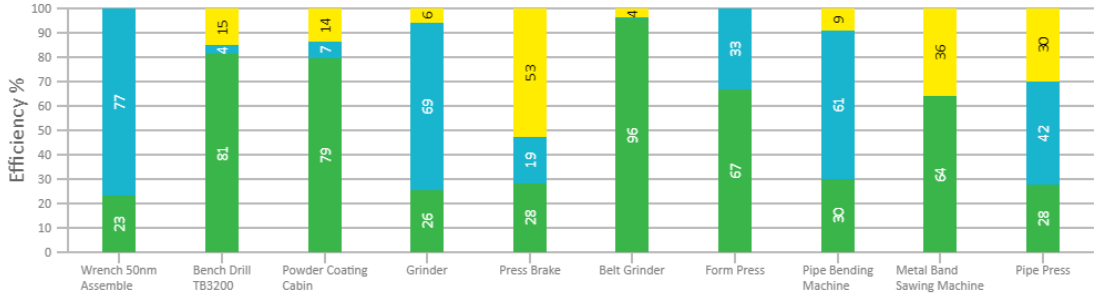
Processor Efficiency Summary

# of Processors:	16
Most Efficient Processor:	95.84% - Belt Grinder
Least Efficient Processor:	18.57% - Quality Control

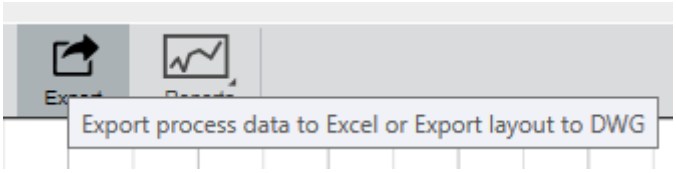
Operator Utilization Summary

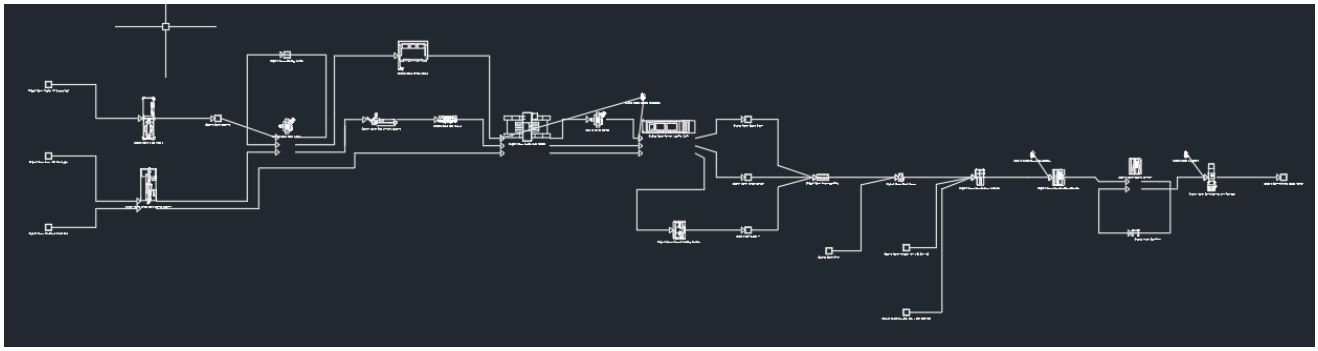
# of Operators:	3
Highest Utilized Operator:	62.99% - Drilling Specialist
Lowest Utilized Operator:	23.22% - Logistics

Processor Efficiency Charts



36. Export the Process layout to a DWG file

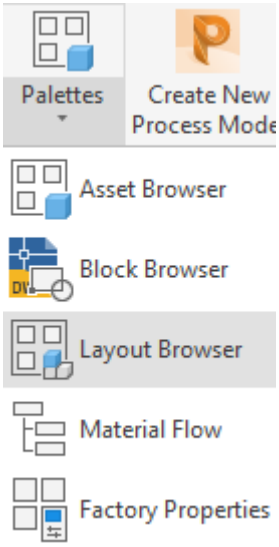




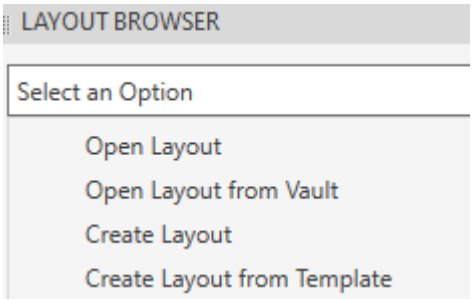
Create a New Sub Layout Area

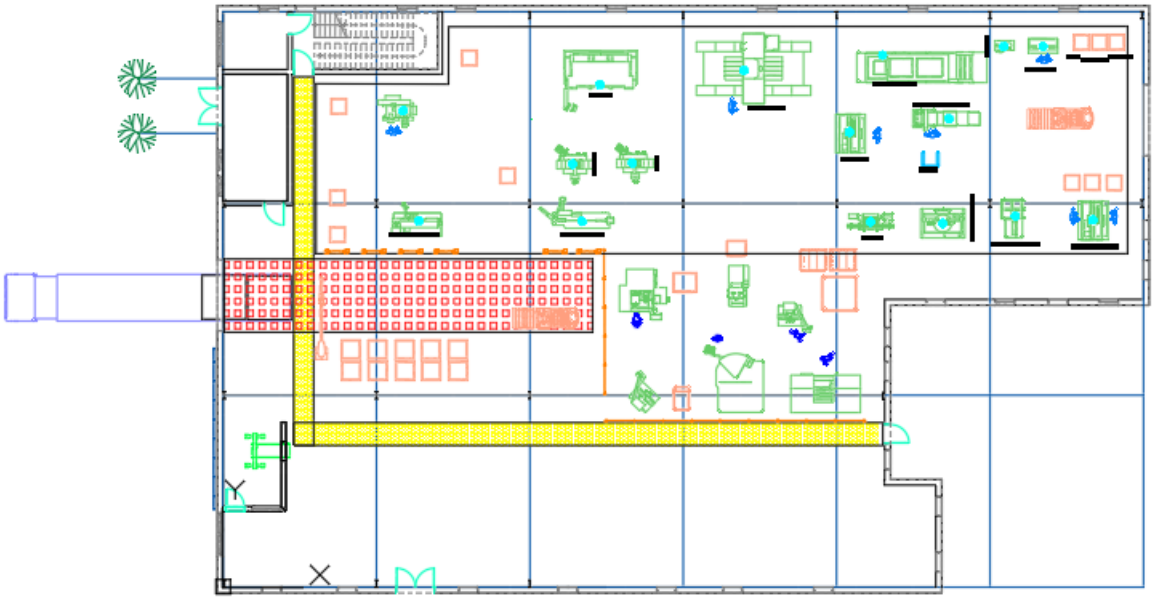
37. In Autocad Arch, create a new drawing**.**

38. Make sure the Layout Browser is loaded

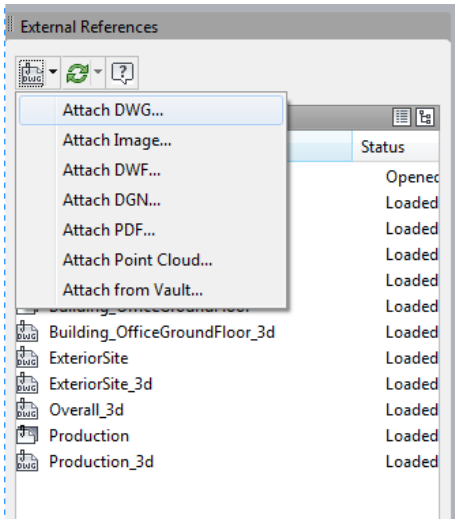


39. Open in Layout Browser this file ***…\ AU2019FDUDataset\Design\01-Data\Mannheim_F.LayoutData***

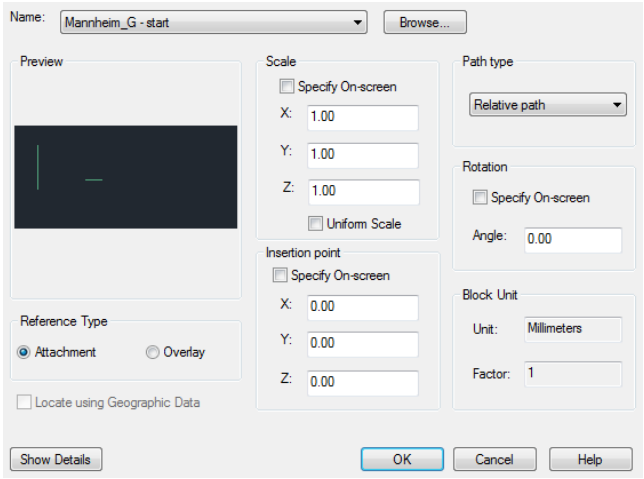




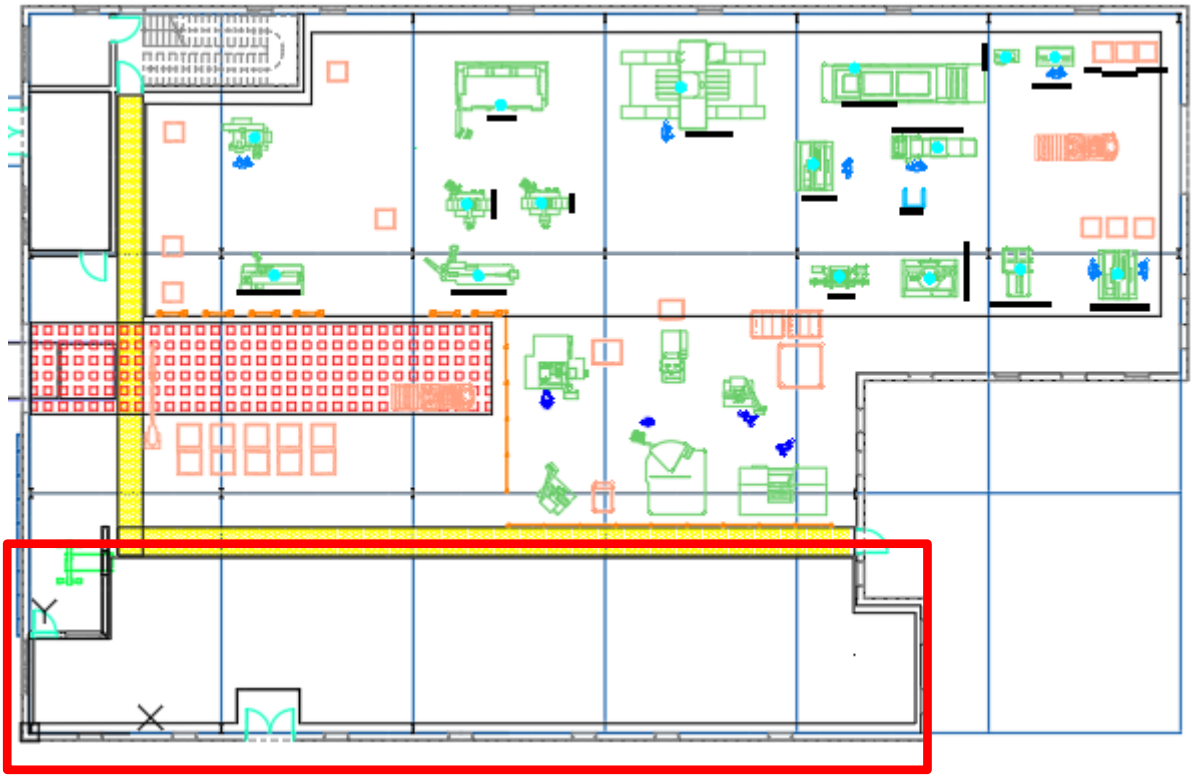
40. Type ***XREF*** in the command line to launch External References Manager
41. Attach new XREF “Mannheim_G .dwg” to the drawing



42. Use Xref import settings as shown

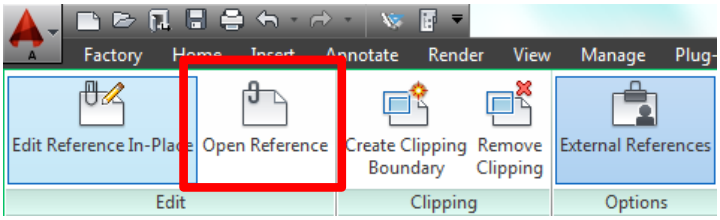


43. The xref will be automatically positioned as shown below

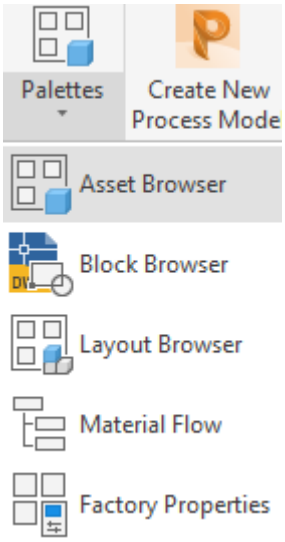


44. Select the outline of the xref(1).

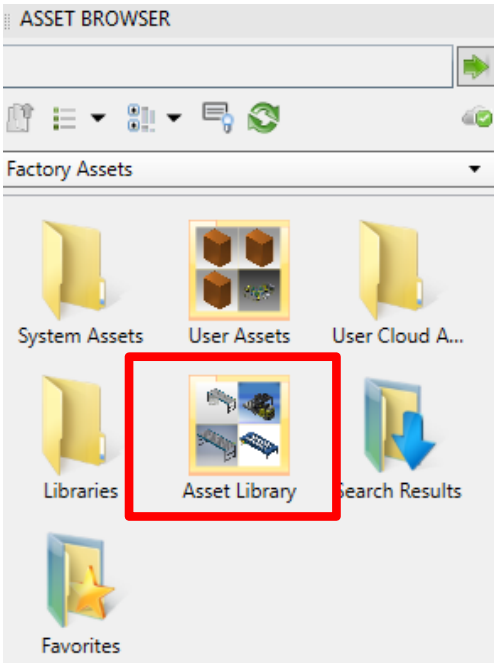
45. Click the Open Reference command on the Context Ribbon (2).



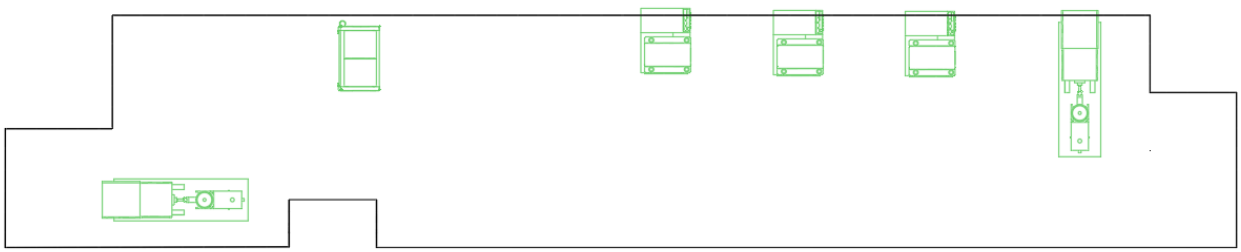
46. Activate the Factory Asset Browser by selecting the **Palettes** flyout on the Factory Ribbon and Click **Asset Browser**.



47. Open this library folder in the Asset Browser

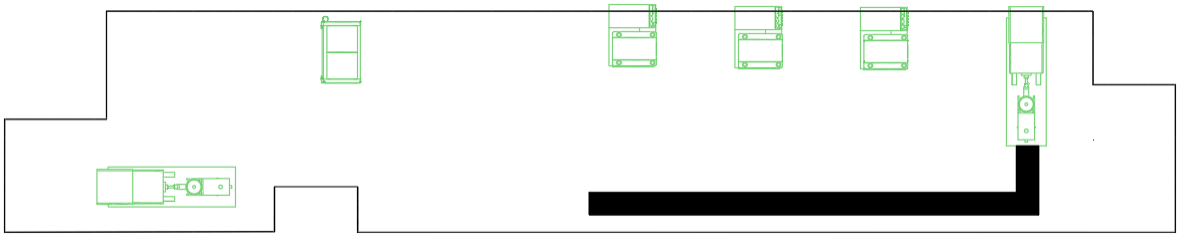


48. Drag and drop Assets from the Asset Library into the layout as shown below

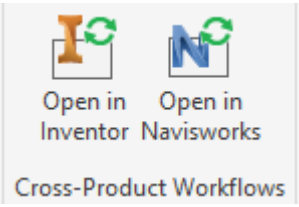


49. Click on icon 

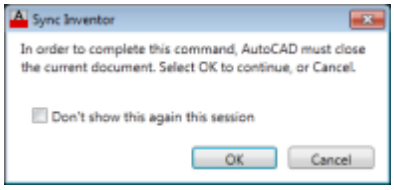
and draw a line as shown below



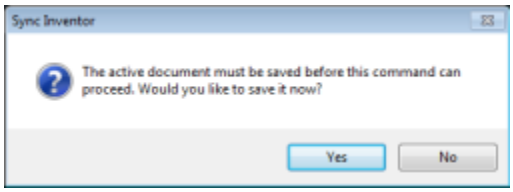
50. Click ***Open in Inventor*** Command.



51. Click OK on the dialog that displays.

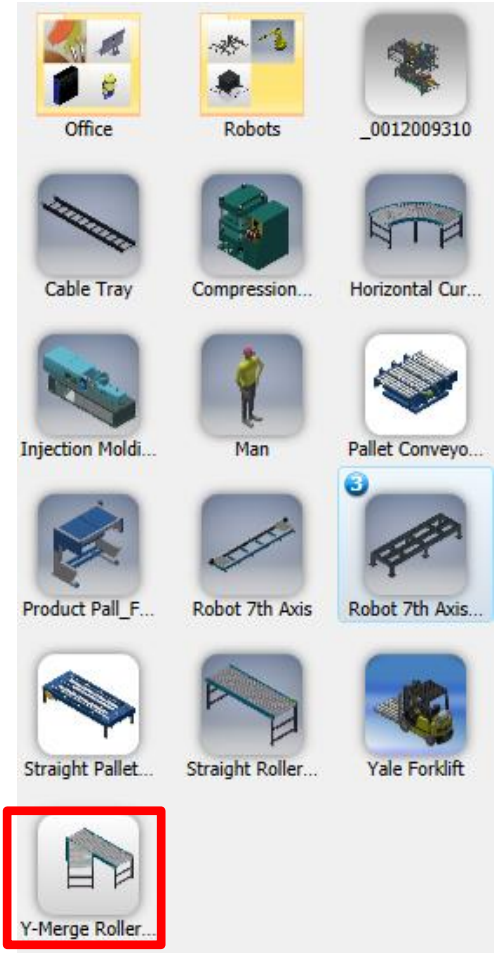


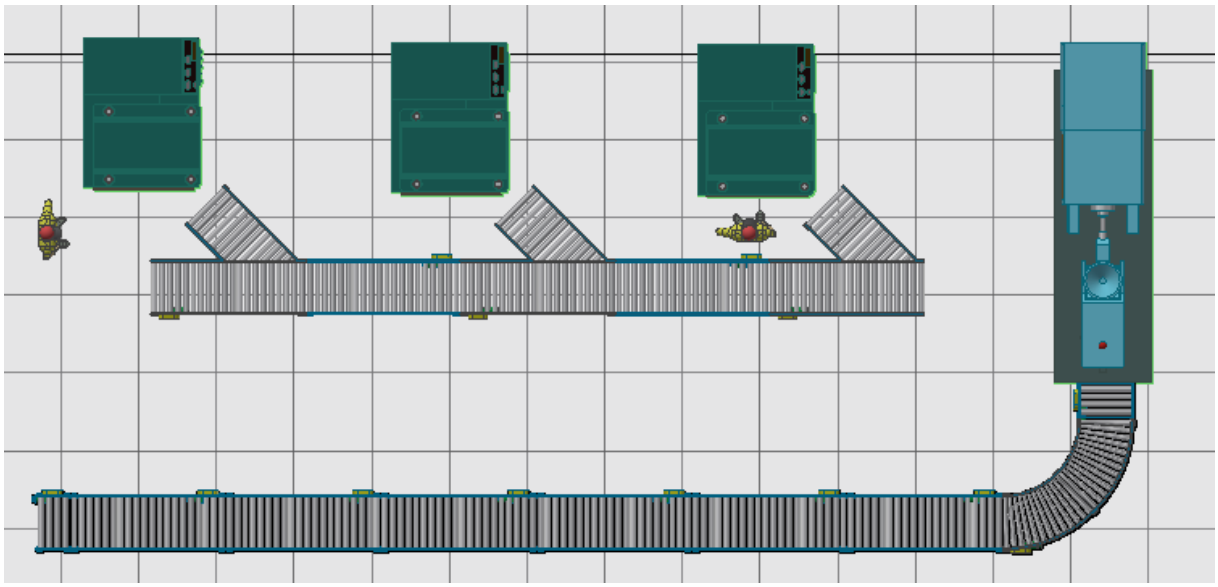
52. Click Yes on the Save Notification is necessary.



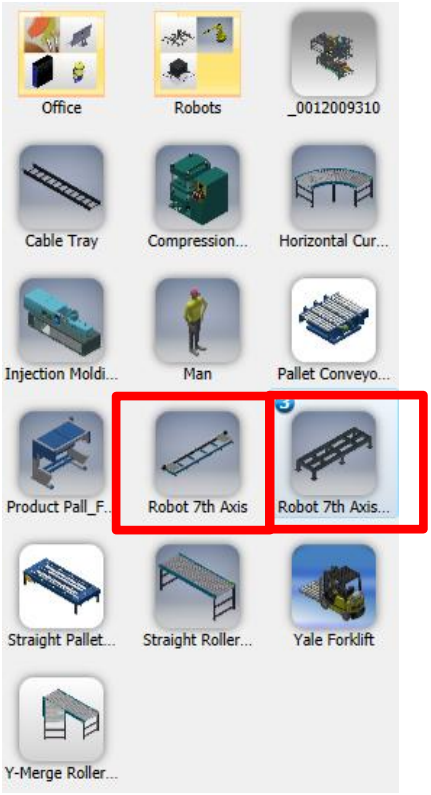
53. The Inventor application will launch and create a 3D version of your 2D layout.
54. Let's wait a few seconds ….this is what you'll get

55. Select Y-merge roller conveyor and place them as shown below, connect with strait conveyors



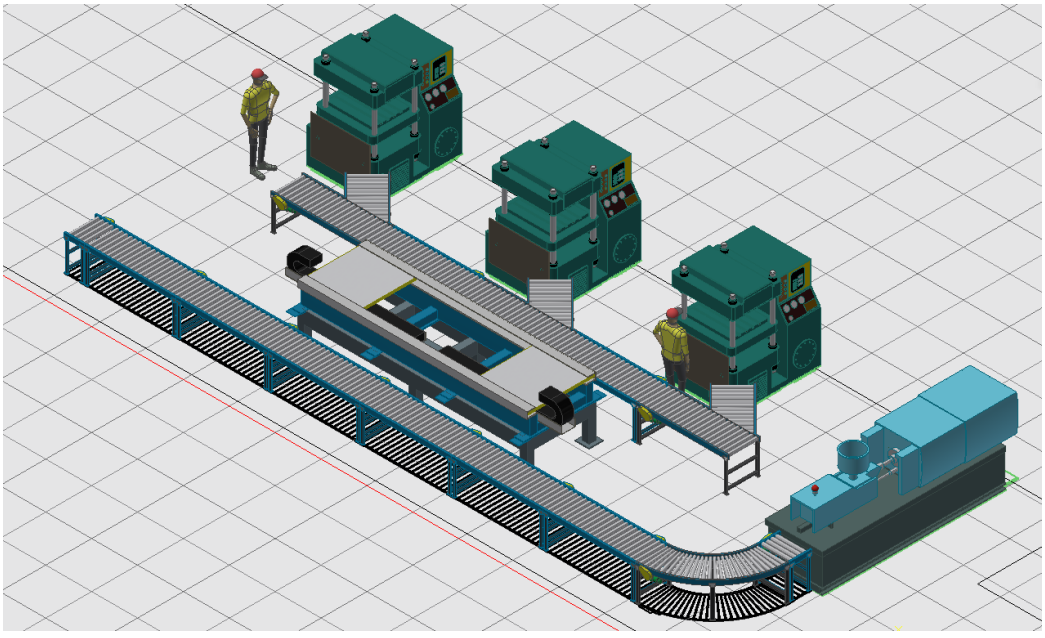


56. Select Robot 7th Axis asset in library

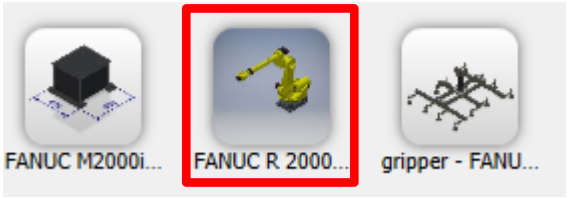


57. Connect the Robot positioning table to the frame connector as shown below

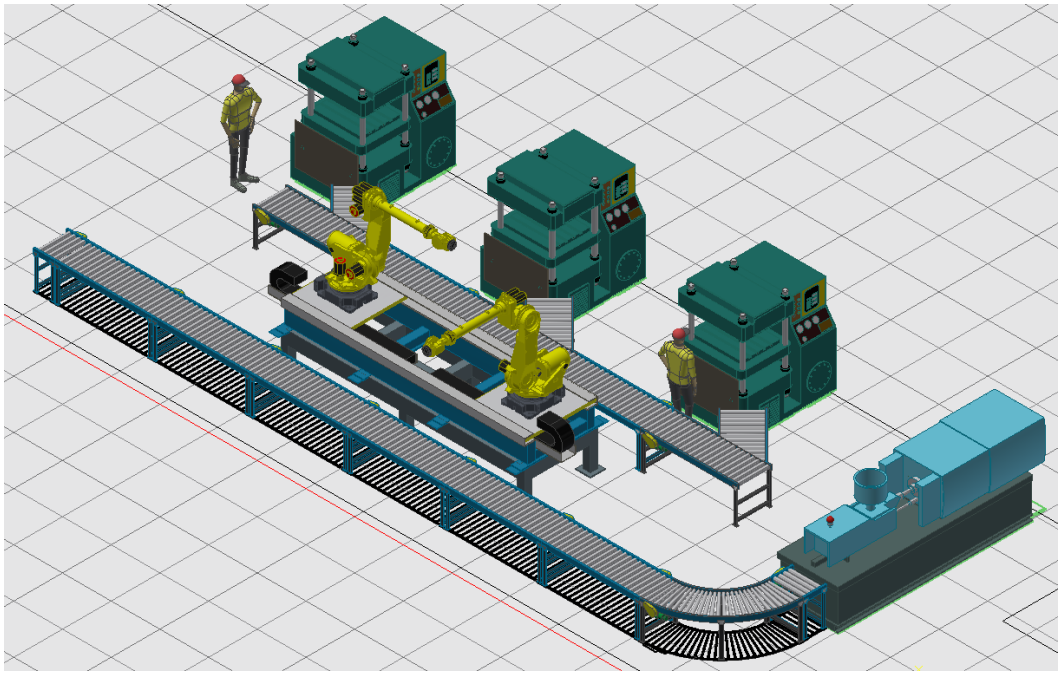
58. …and let it snap like this…..



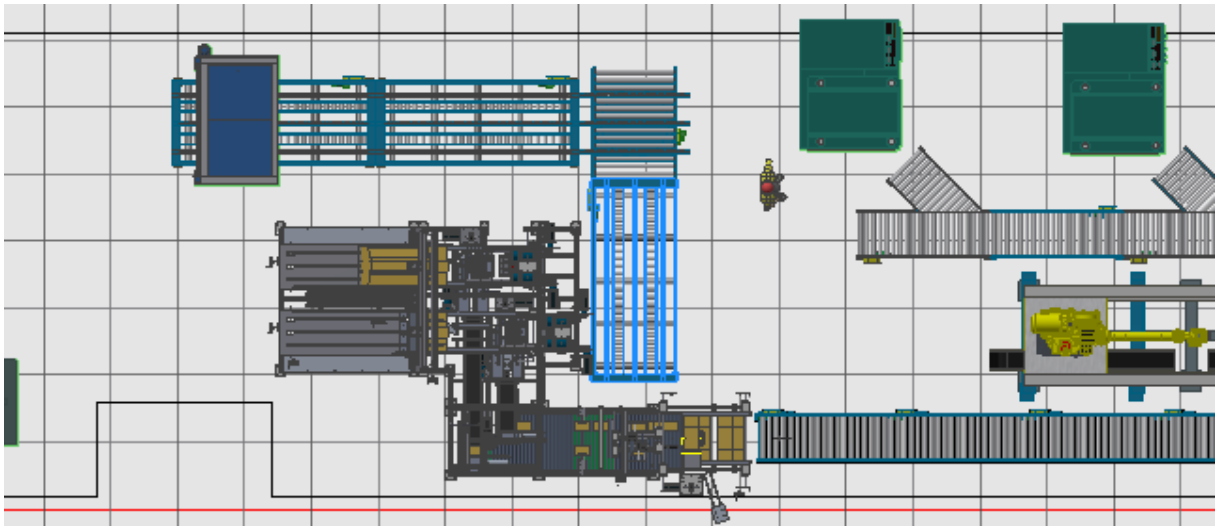
59. Select Fanuc robot asset in library

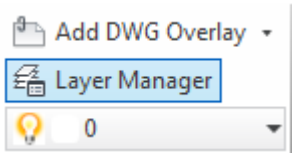


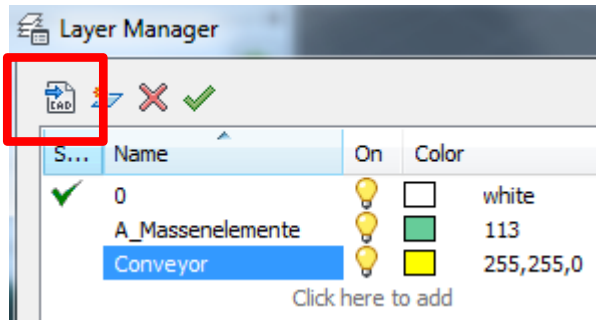
60. Complete the layout as shown below



61. Finish the sub-layout by adding the below packaging machine and pallet conveyor assets as shown below.

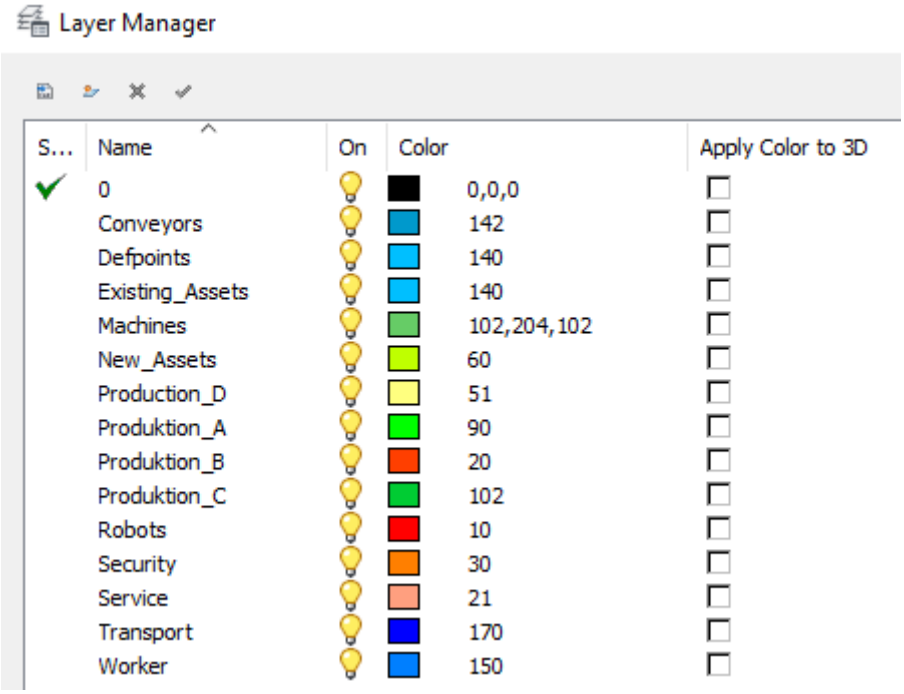


62. Open Layer Manager 

63. Open Import Layers 

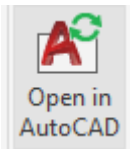
64. ….. and load “Layer_Template_FDU.dwg” from the Documentation folder

65. Import should look like this

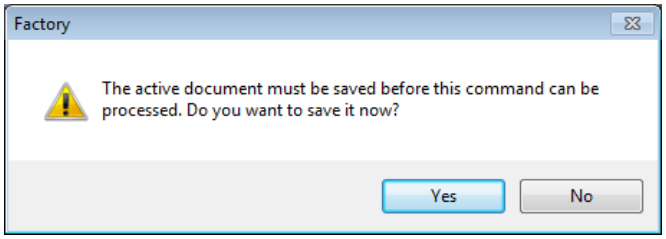


66. Select all conveyors in the layout and assign them to the “Conveyors” layer and continue with other assets Don’t forget to ENTER after each layer assignment

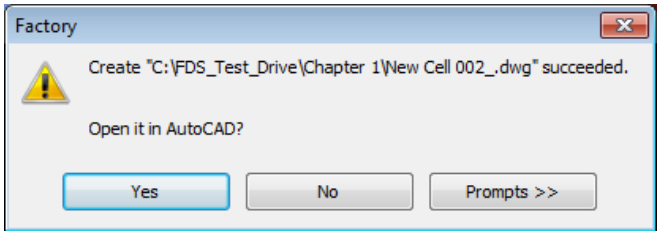
67. On the Factory Ribbon, Click the **Open in AutoCAD** command.



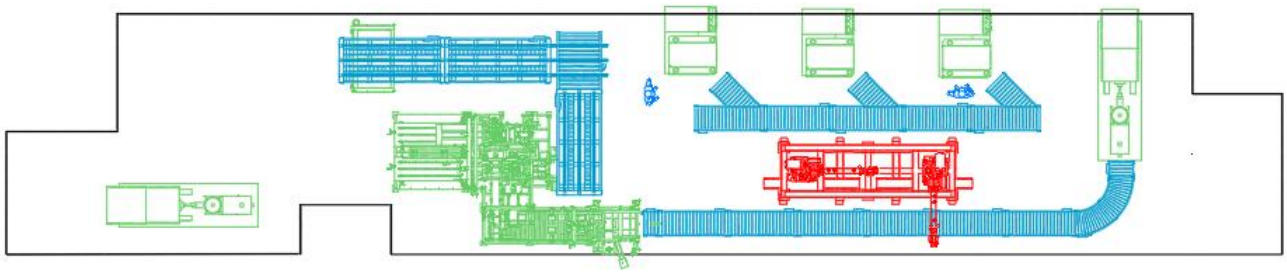
68. If prompted to Save the file, Select **Yes** and **Ok** to any dialog prompts.



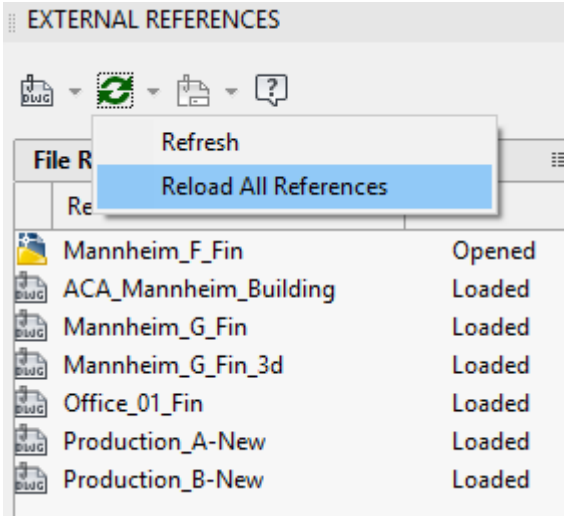
69. Click **Yes** when prompted to open the File in AutoCAD.



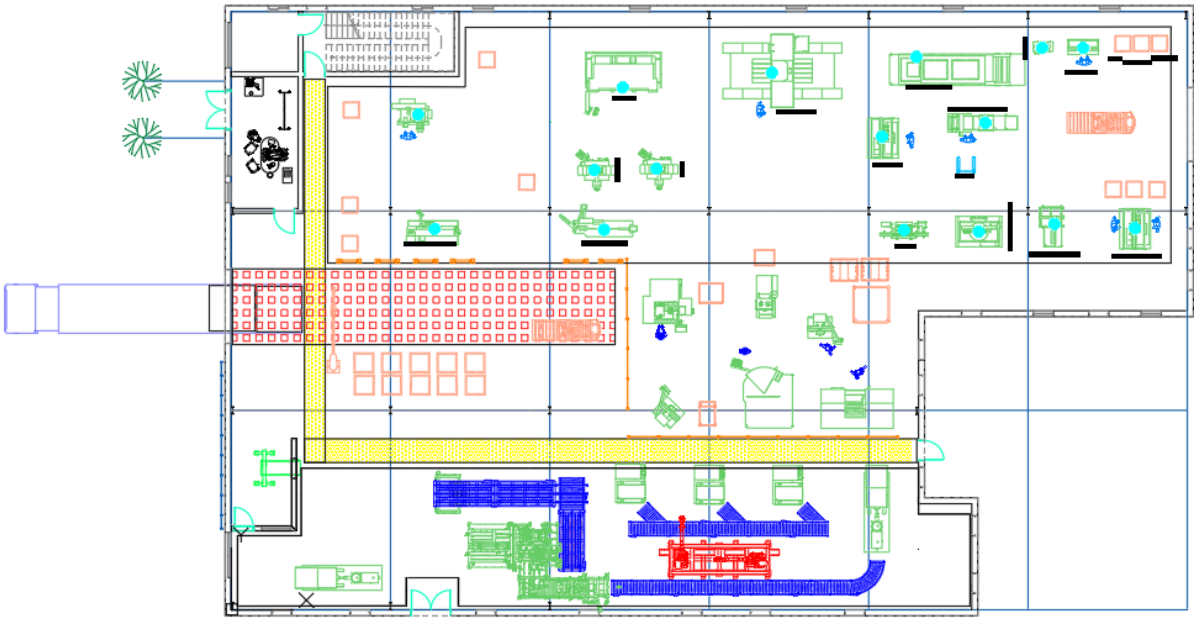
70. Autocad Xref will be updated with all 3D changed made



71. Save this file
72. Switch to the overall.dwg file and update all Xref's

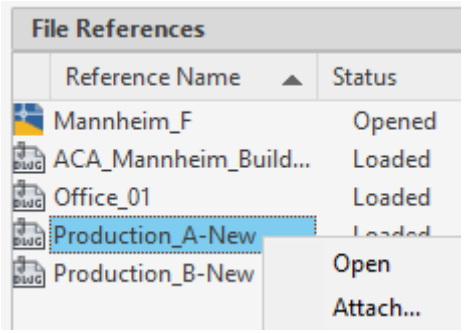


73. Overall Layout is updated with new Xref content.

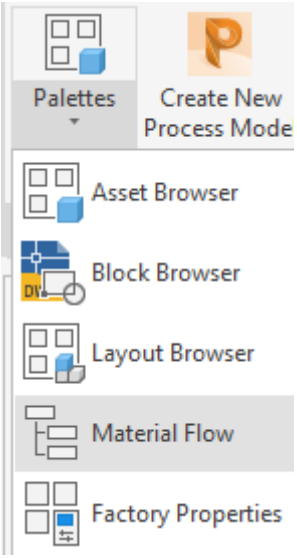


Material Flow

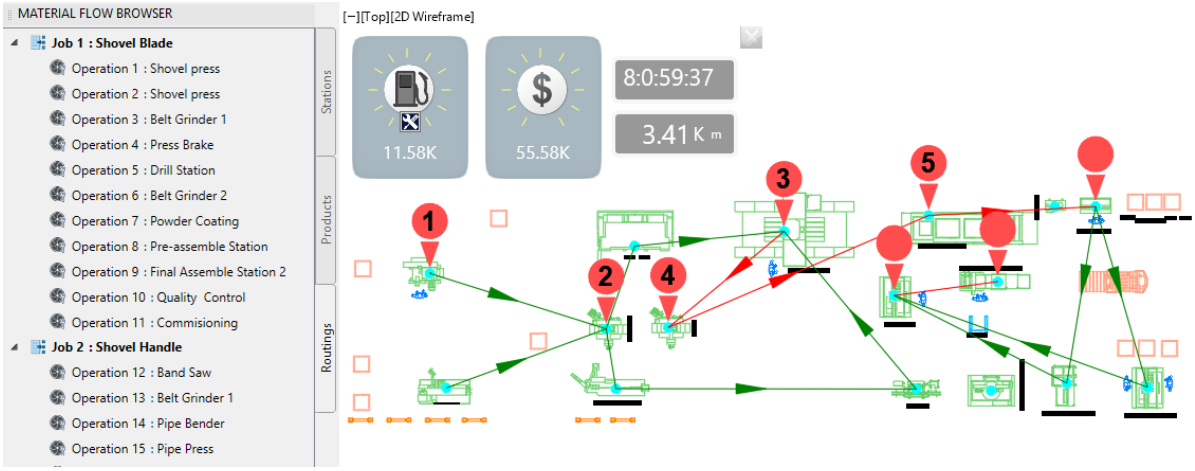
74. Open Production A-New xRef



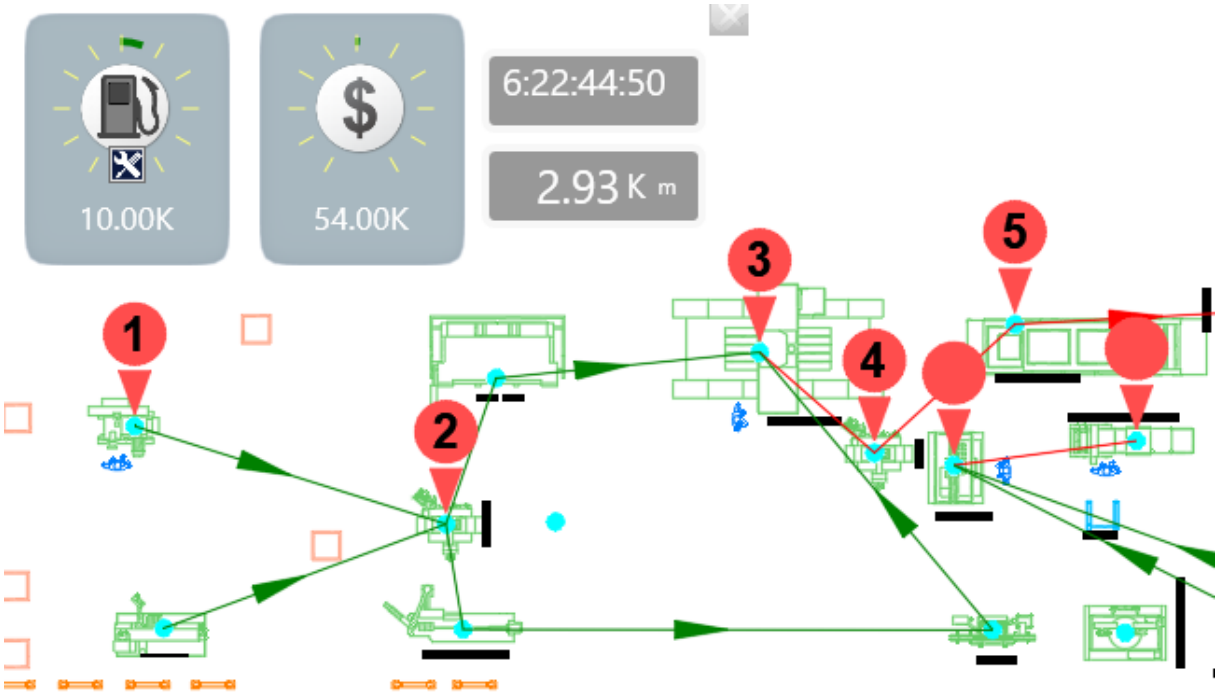
75. Open the ***Material Flow Browser***.
Ribbon: Factory > Tools > Palettes Flyout > Material Flow



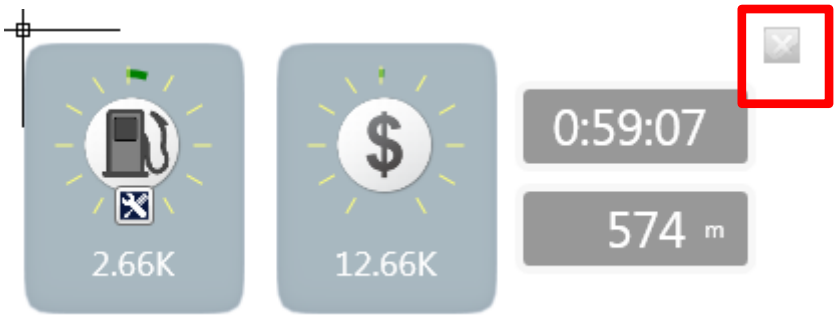
76. Click on the ***Routings*** ribbon tab.



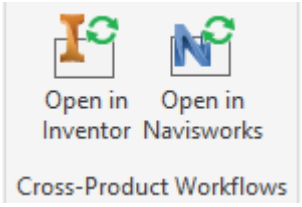
77. Move “Grinder 2” to location closer to powder coating machine and see the impact on time and distance of the process.



78. Close Optimization environment by selecting button below

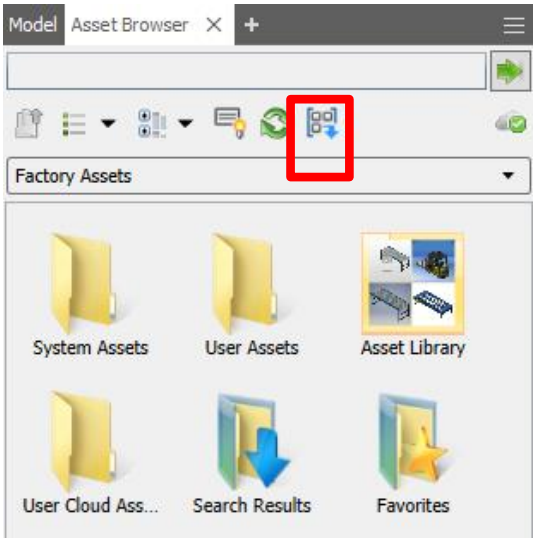


79. Click ***Open in Inventor*** Command.

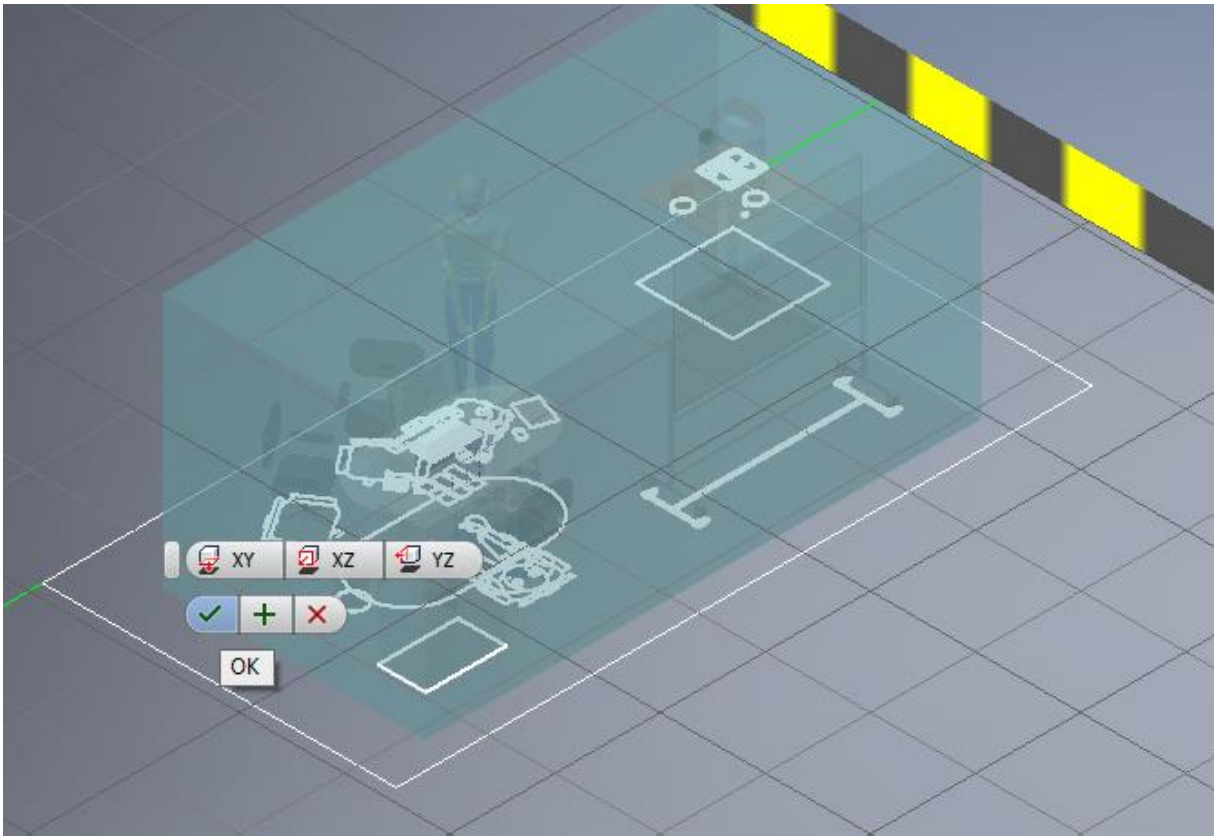


80. ***Open …\ AU2019FDUDataset\Design\01-Data\Office_01.iam***

81. In the asset browser, select "Insert Asset Group" and select ***…\ AU2019FDUDataset\Design\01-Data\Finished_Layout\ Office_01_Fin.iam***

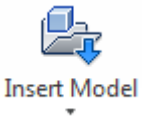


82. Position the asset group inside the empty rectangle and confirm

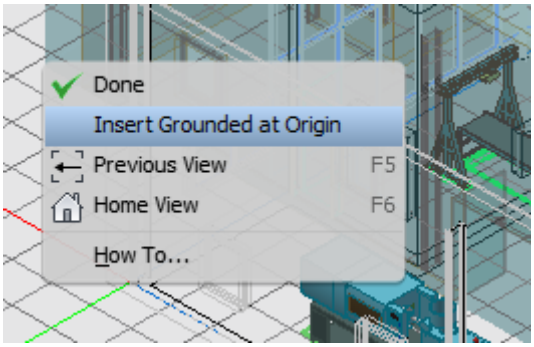


83. The main Layout will now contain an office space equipped with a standard set of furniture.

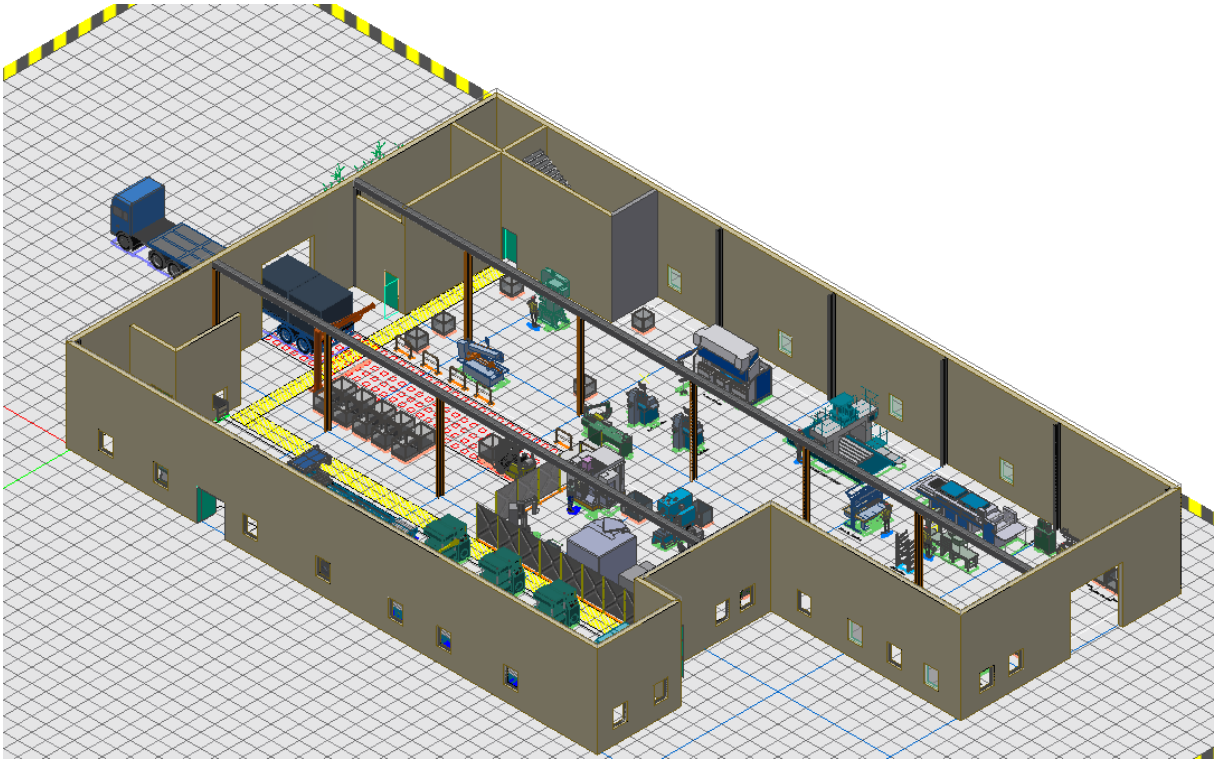
84. **OPTIONAL**



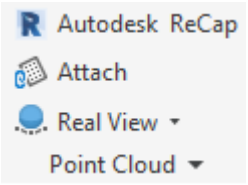
85. Insert solid building
86. Select file ACAD_A_BUILDING_1.ipt in the 02-Buildings folder
87. RMB and select “Insert Grounded at Origin



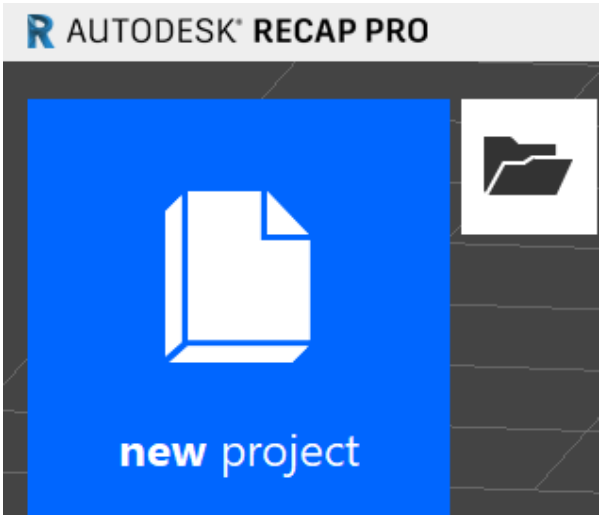
88. Layout should look like this



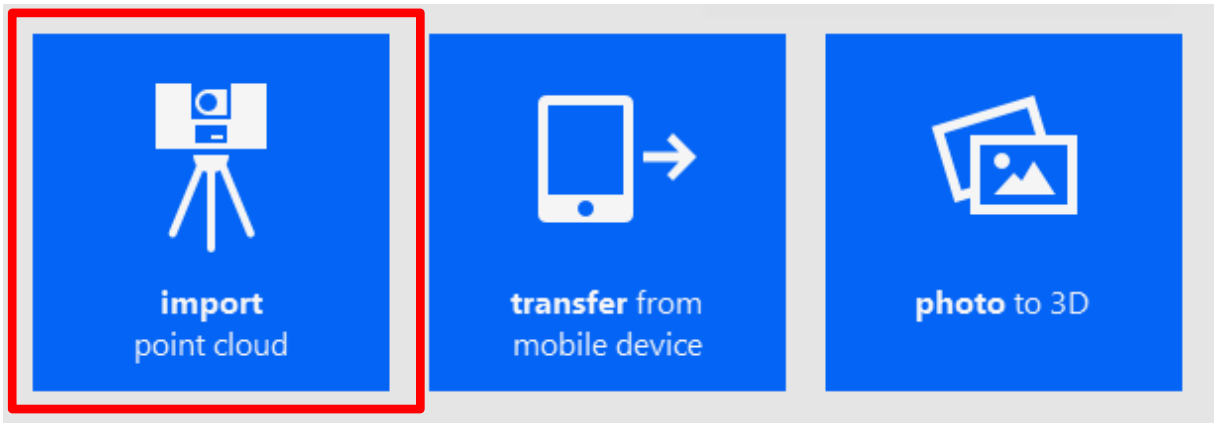
Point cloud project integration with Recap



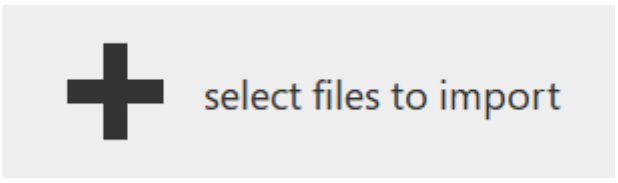
89. In Factory>Point Cloud tab, select Autodesk Recap
90. Create a new project and give it a name and destination



91. Import point cloud

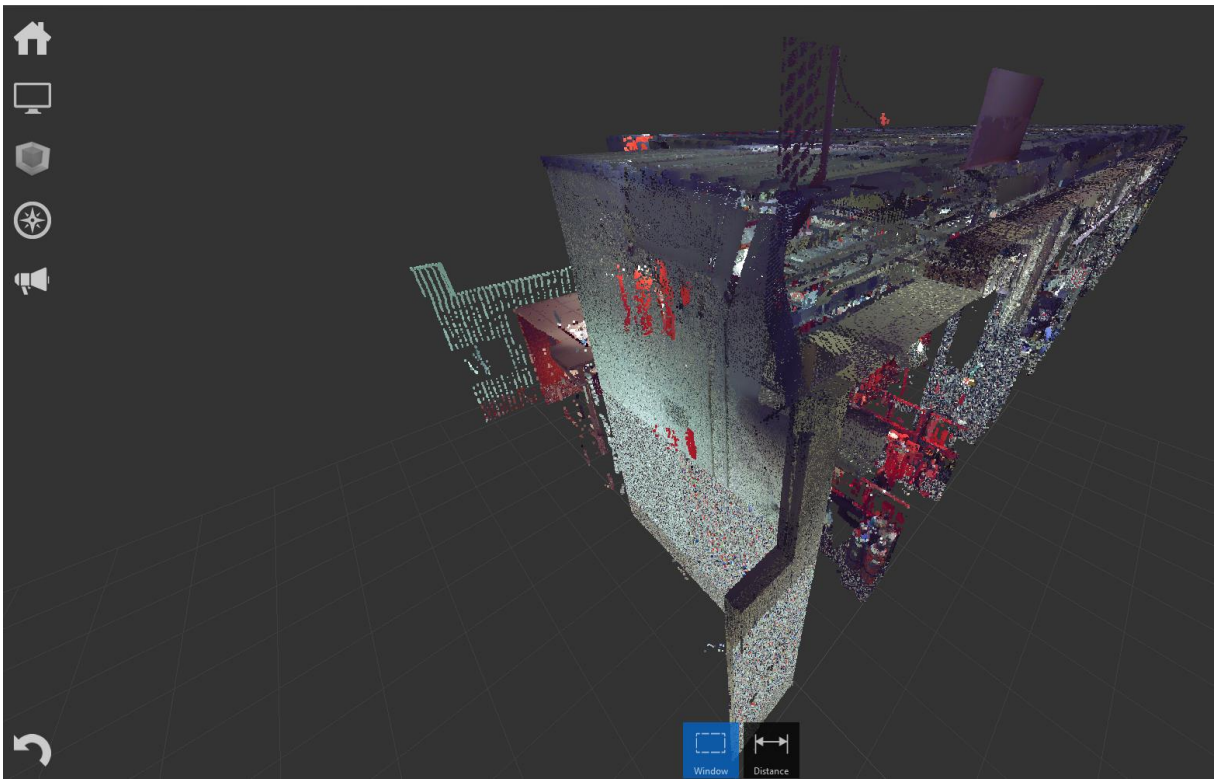


92. Select Files to Import button

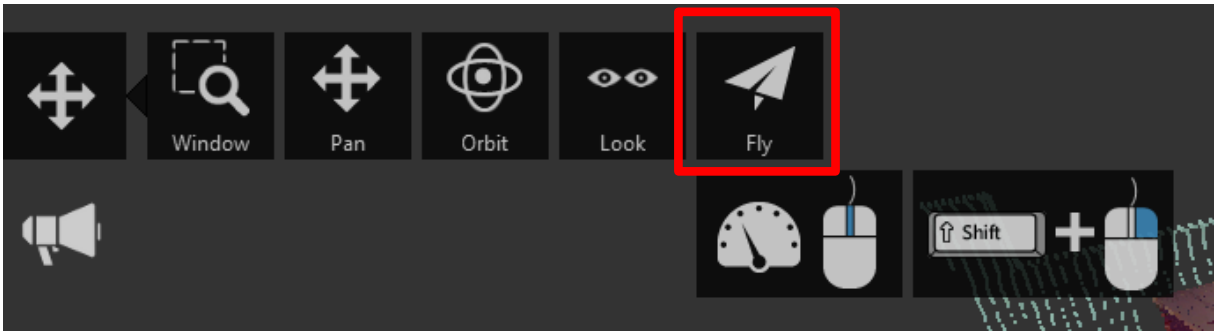


93. Browse for file Bestand_3.rcs and open
94. Launch project

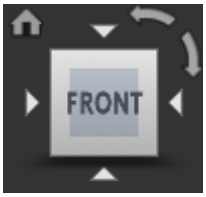
95. Screen should look like this



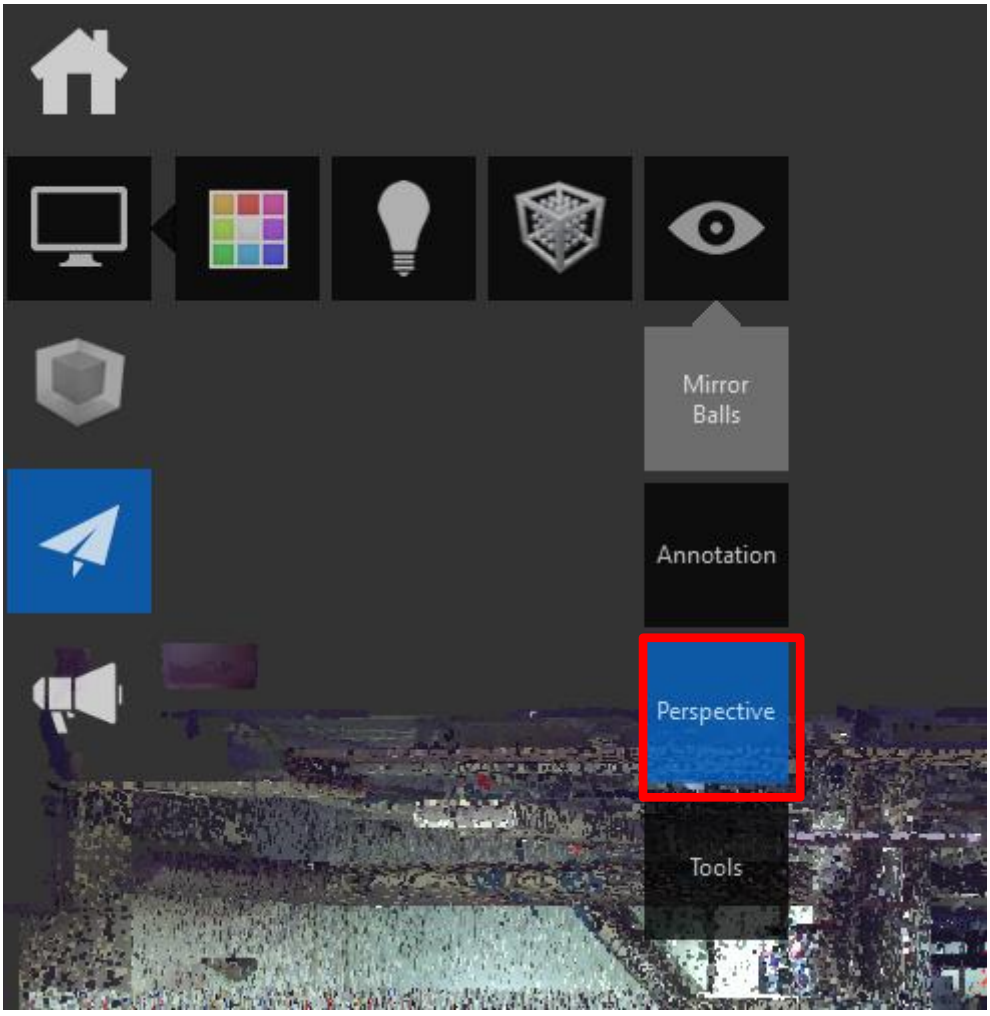
96. Let's make a discovery flight through the point cloud data



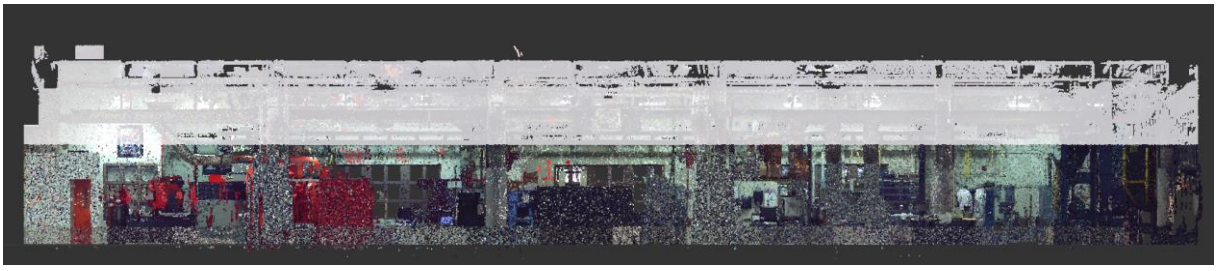
97. After the fly through, select Front in the View Cube.



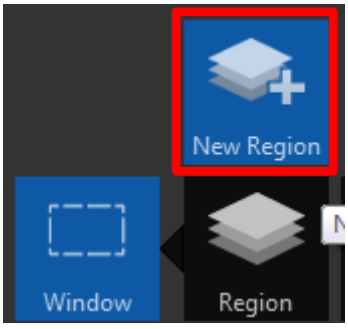
98. Change to Orthographic view by selecting



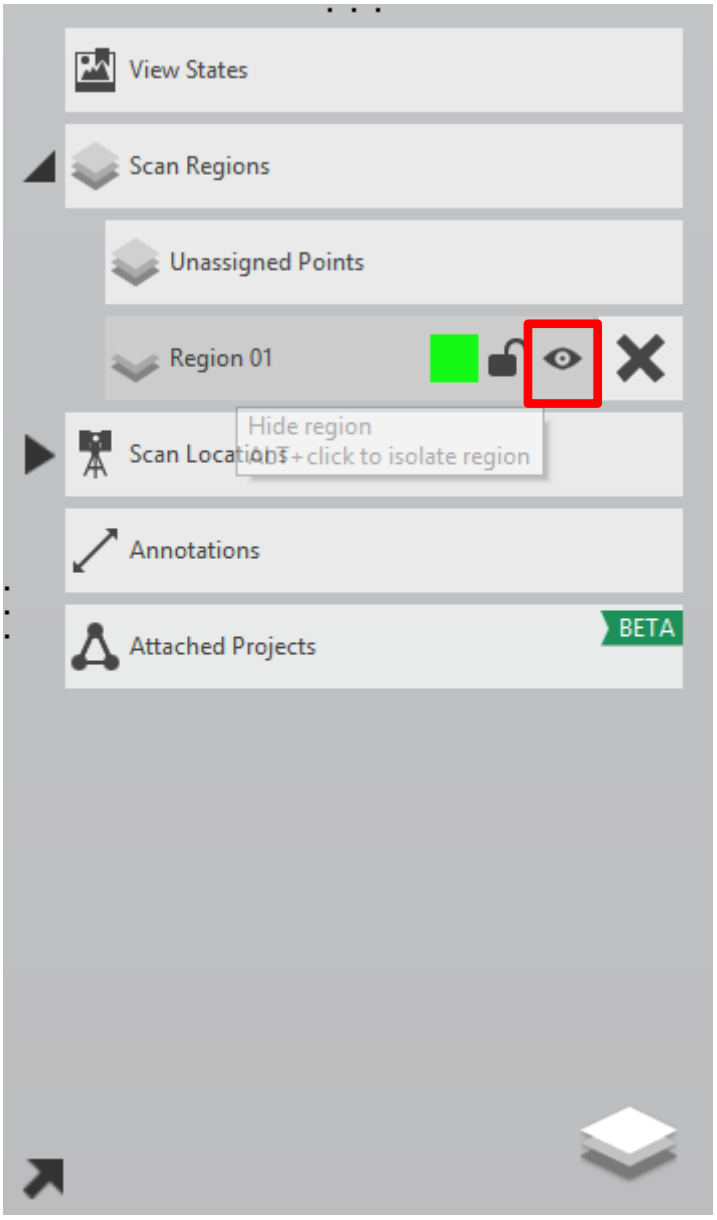
99. Box select the top of the point cloud data



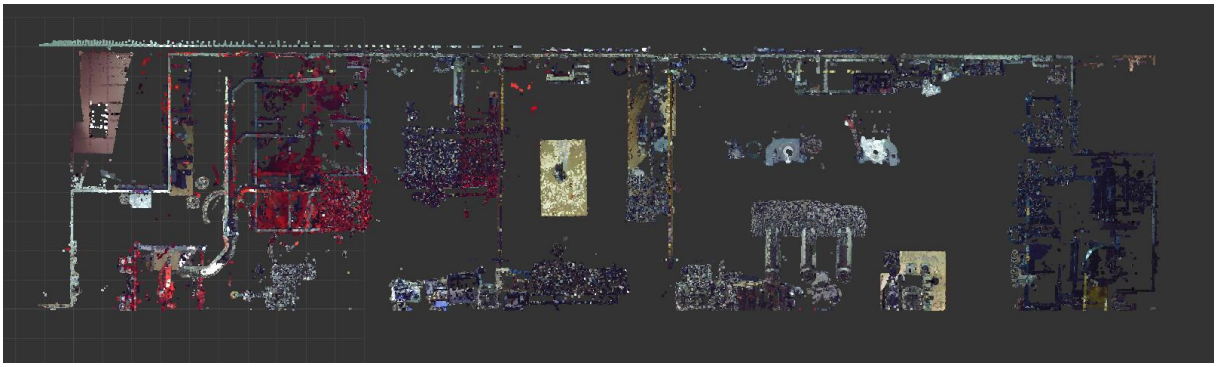
100. Create a new region



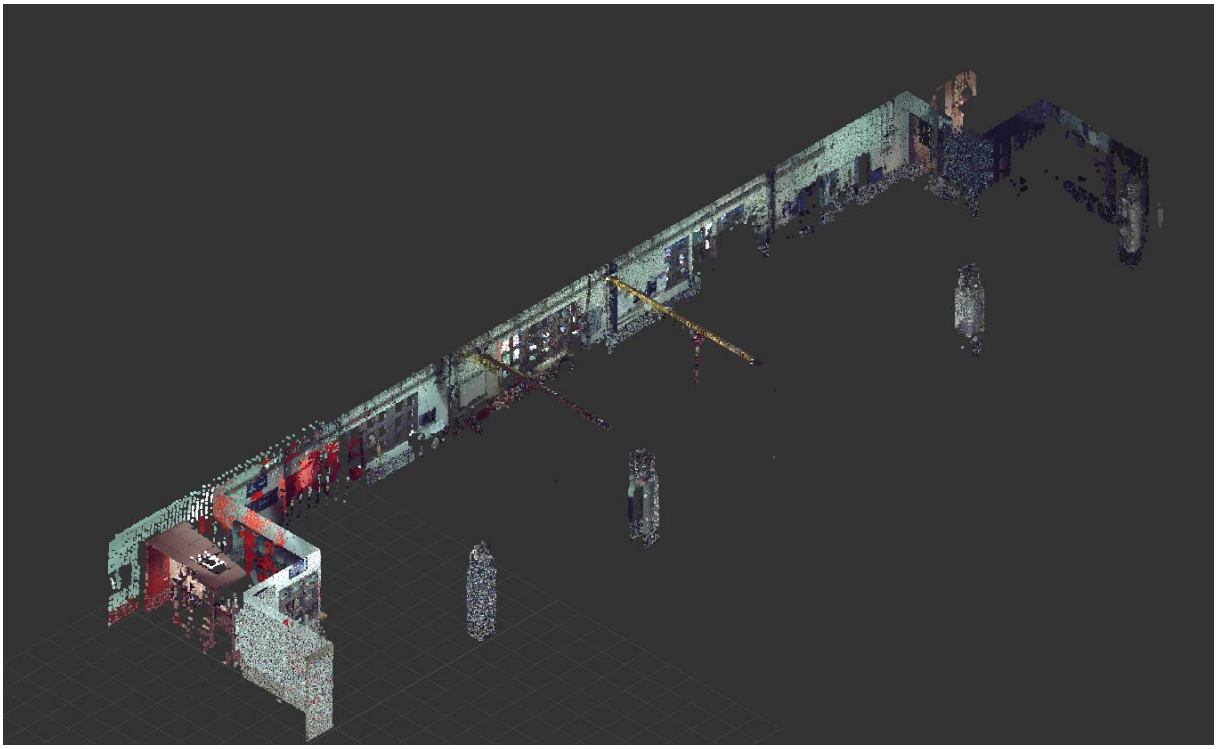
101. Hide new region



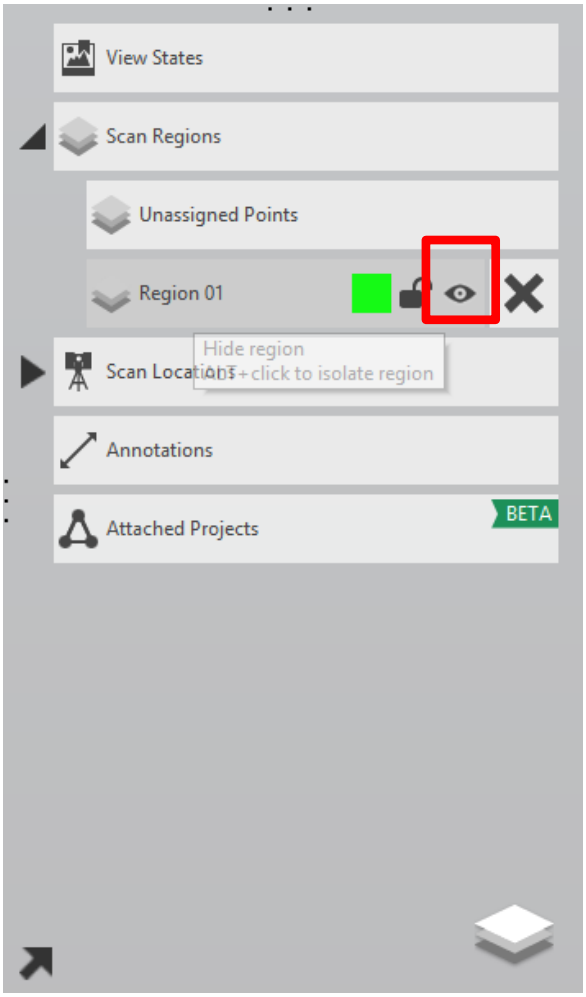
102. Go to Top view, model should look like this



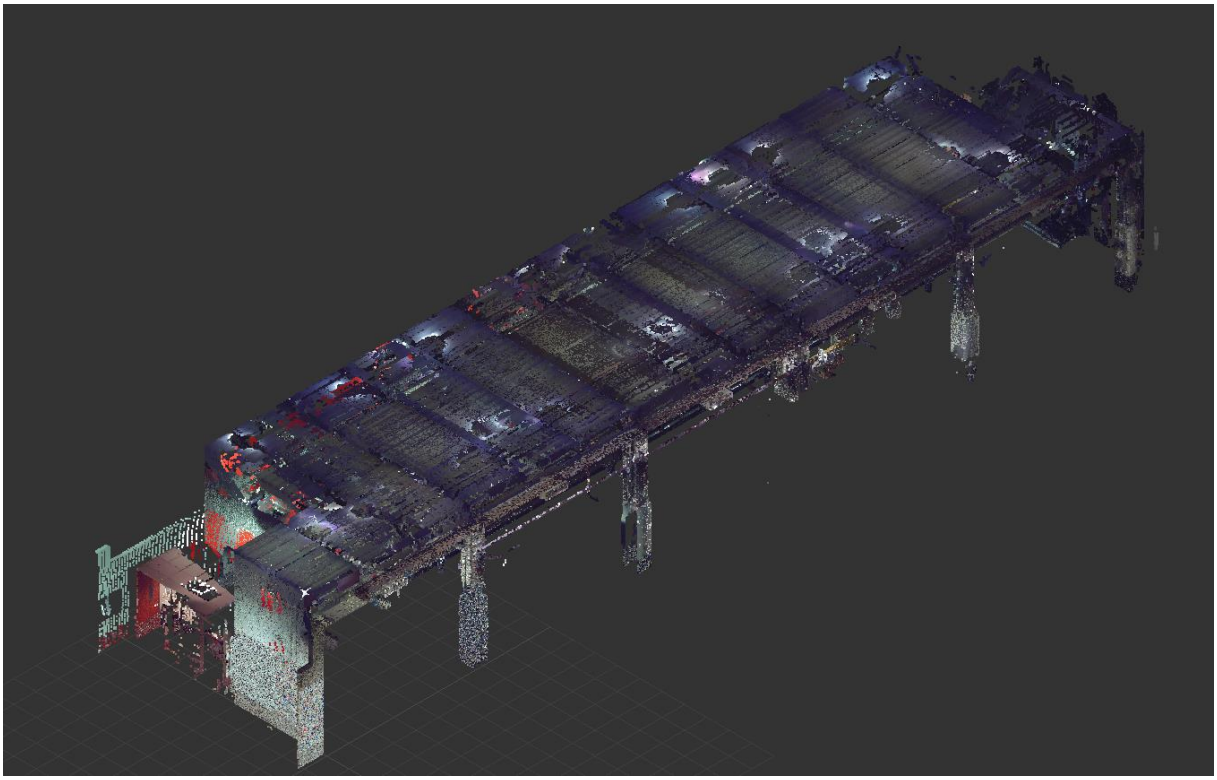
103. Clean out the point cloud data like image below



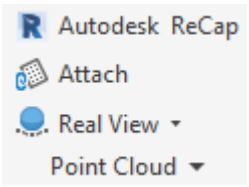
104. Make hidden region visible again



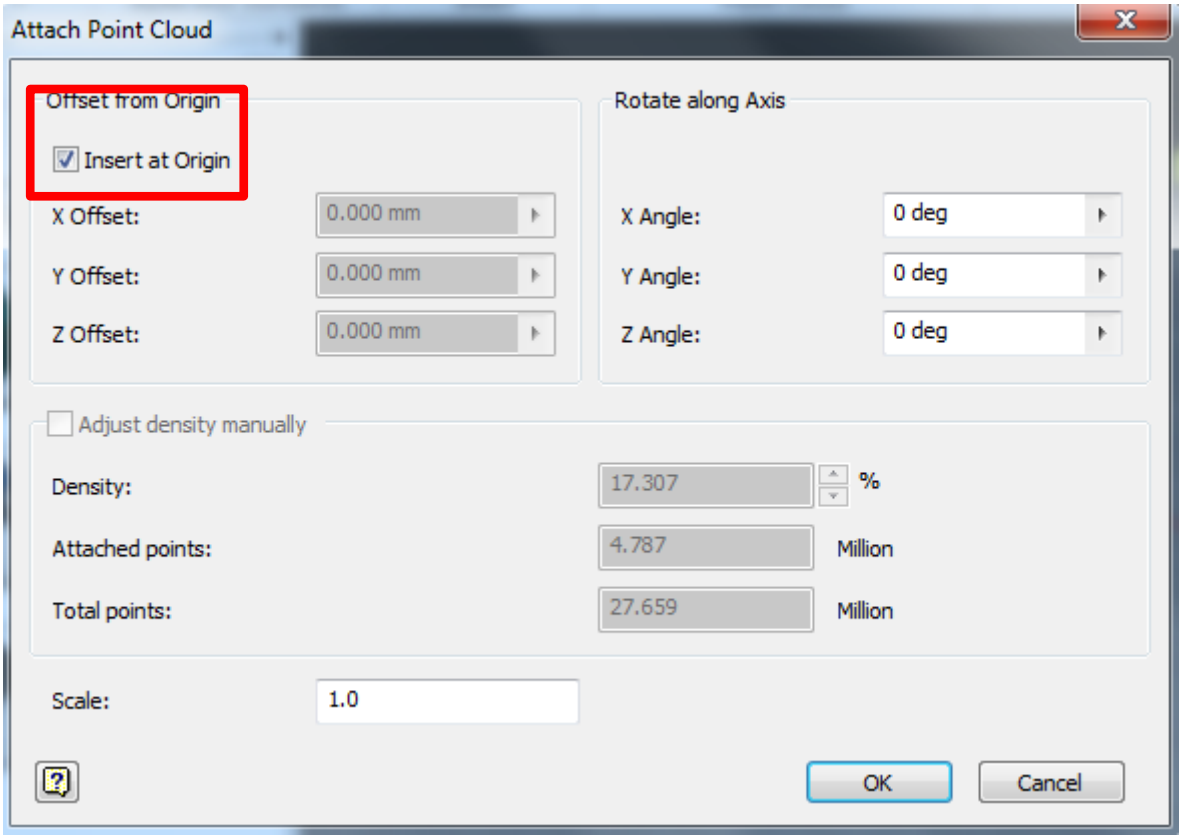
105. point cloud data should look like image below



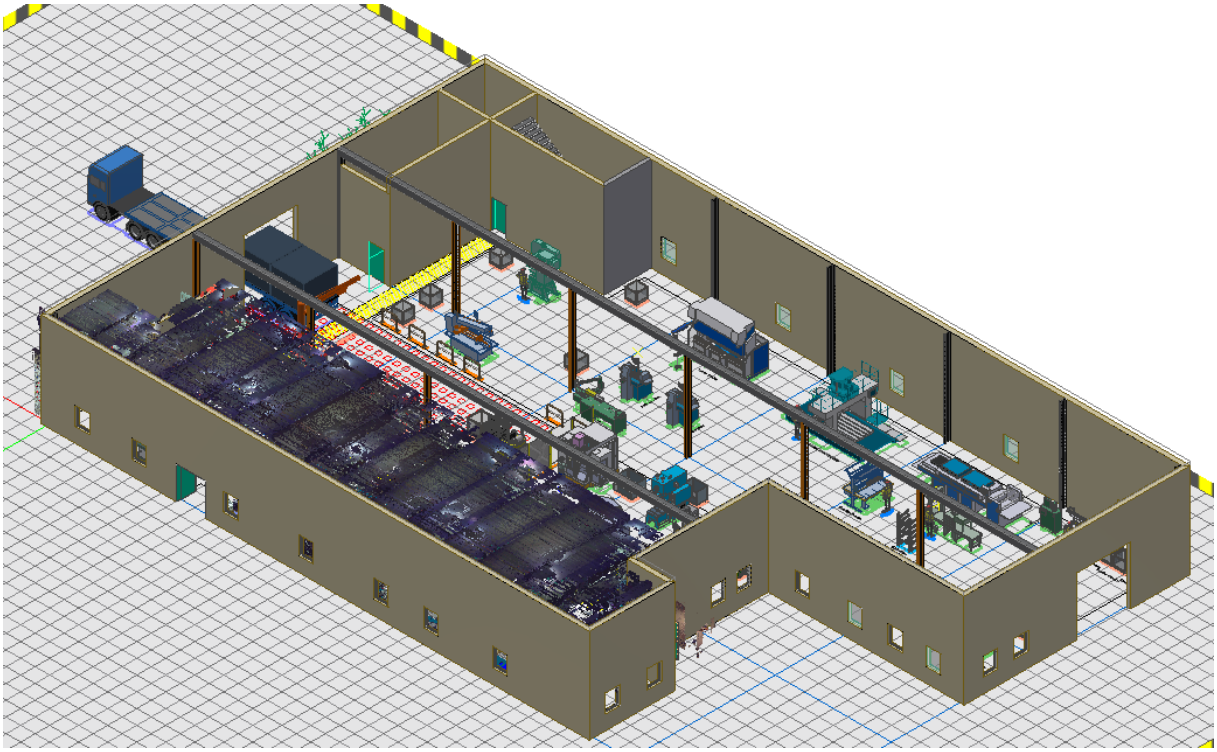
106. Save the project and switch back to Inventor



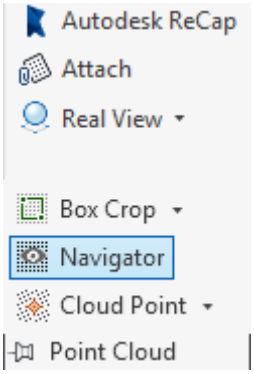
107. In Factory ribbon, select Attach
108. Select the new saved *.rcp project and click anywhere in the layout
109. In the dialog box, insert point cloud project at origin

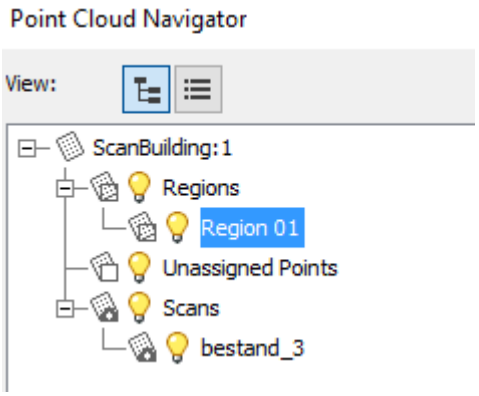

Attach Point Cloud
Offset from Origin
Insert at Origin
X Offset:
0.000 mm
Y Offset:
0.000 mm
Z Offset:
0.000 mm
Rotate along Axis
X Angle:
0 deg
Y Angle:
0 deg
Z Angle:
0 deg
Adjust density manually
Density:
17.307
%
Attached points:
4.787
Million
Total points:
27.659
Million
Scale:
1.0
OK
Cancel

110. Inventor Layout should look like this



111. In the point cloud navigator, switch on/off the region.



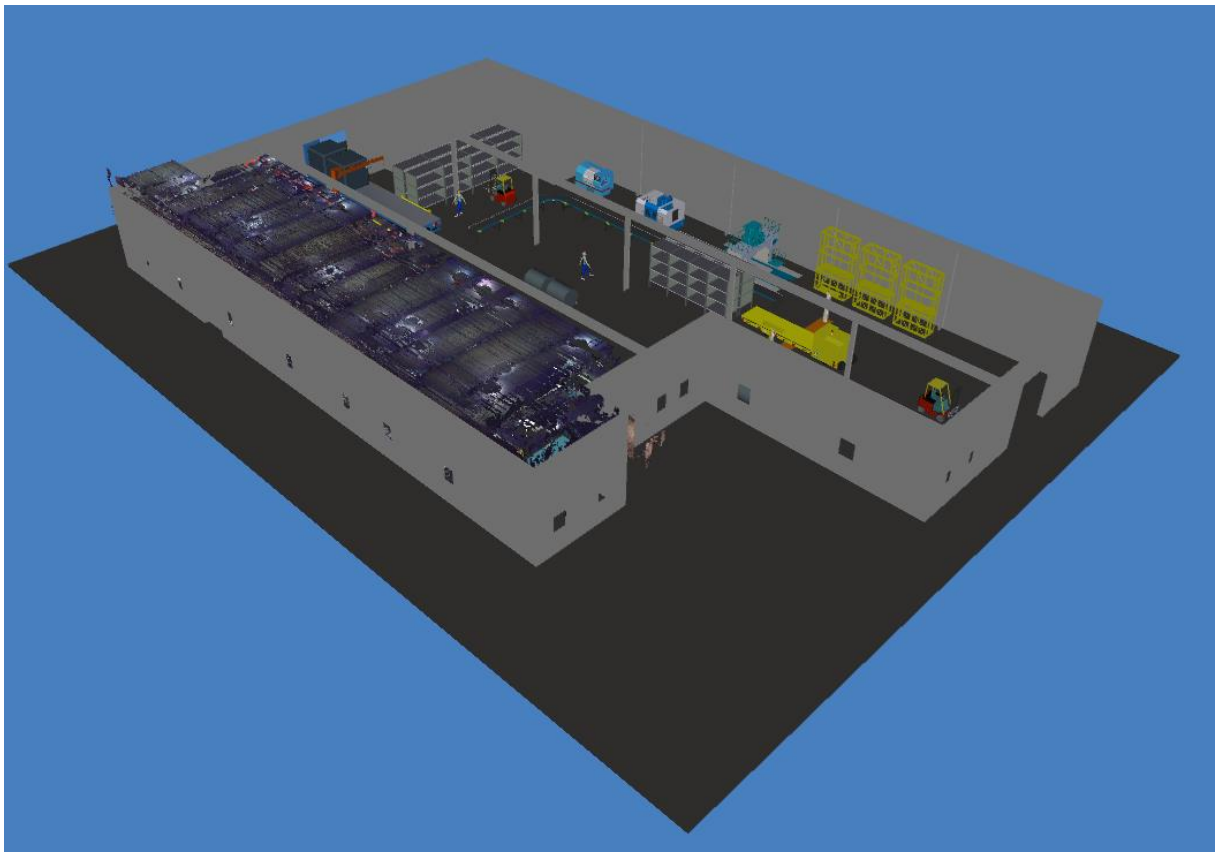


Project Overview Navisworks

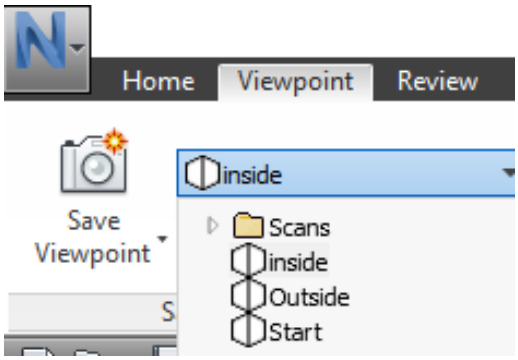
112. Open the application NavisWorks Manage

113. Open the file

…\ AU2019FDUDataset\Design\01Data\Finished_Layout\Finished_Layoutv2.nwd



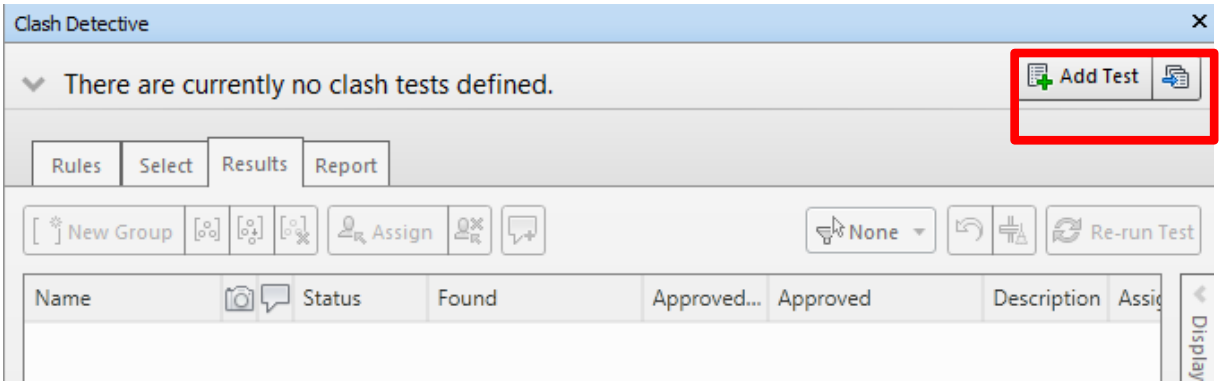
114. In the viewpoint ribbon, select “Inside” viewpoint



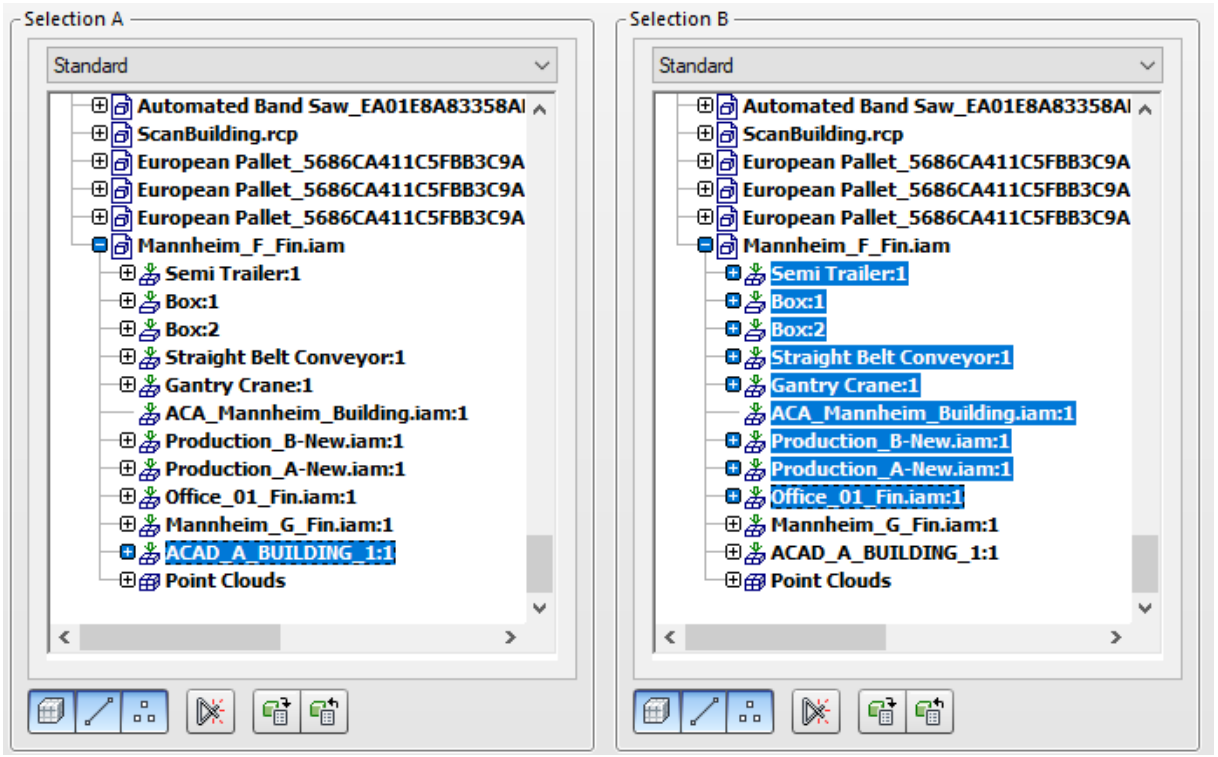
115. Walk around and look around in the facility.

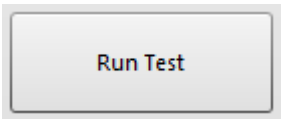
116. Let’s check for collisions, select this button 

117. Add a new test

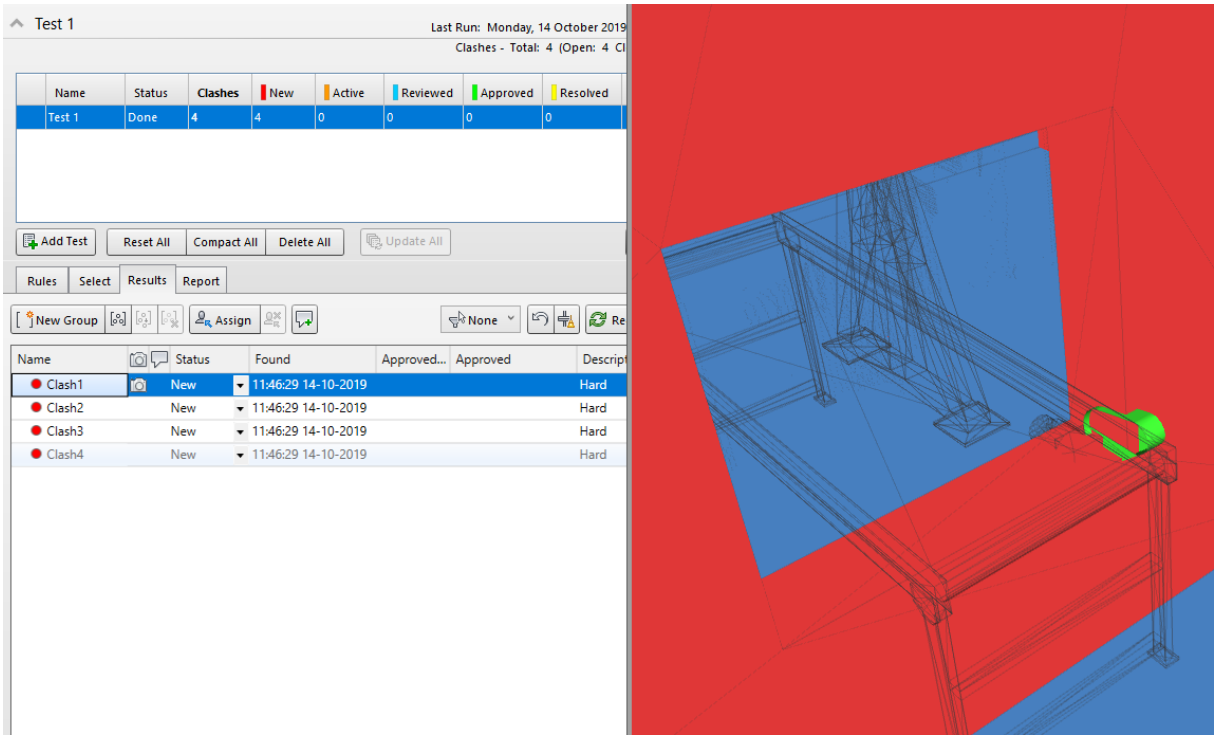


118. Scroll down and Expand the selection boxes and select models as shown

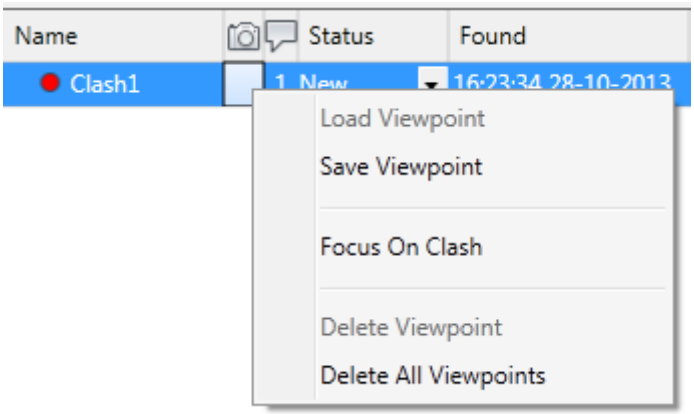


119. Run the test 

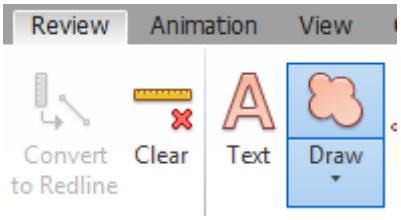
120. You will detect a collision



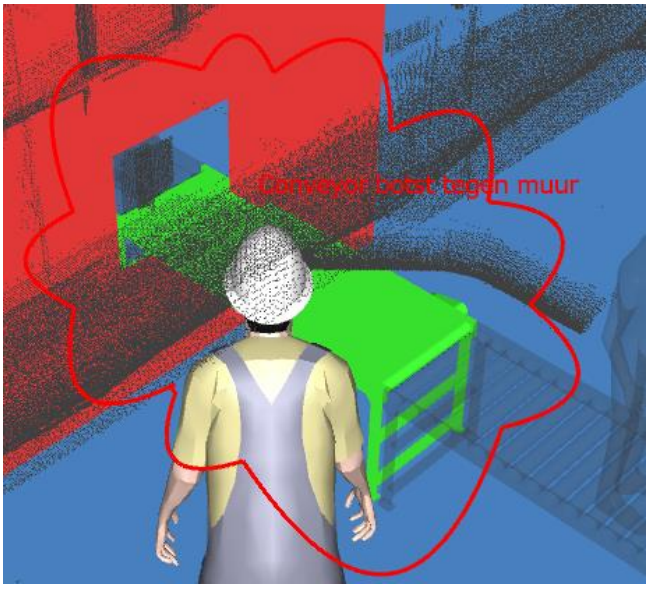
121. Let's markup this error for engineering and save the viewpoint.



122. Create a markup

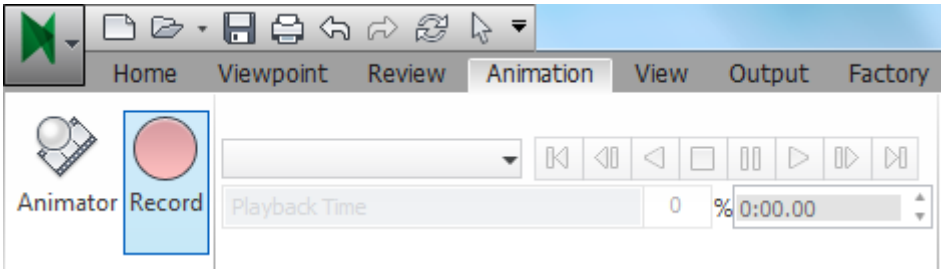


123. Add some comment



124. Go back to “start” viewpoint

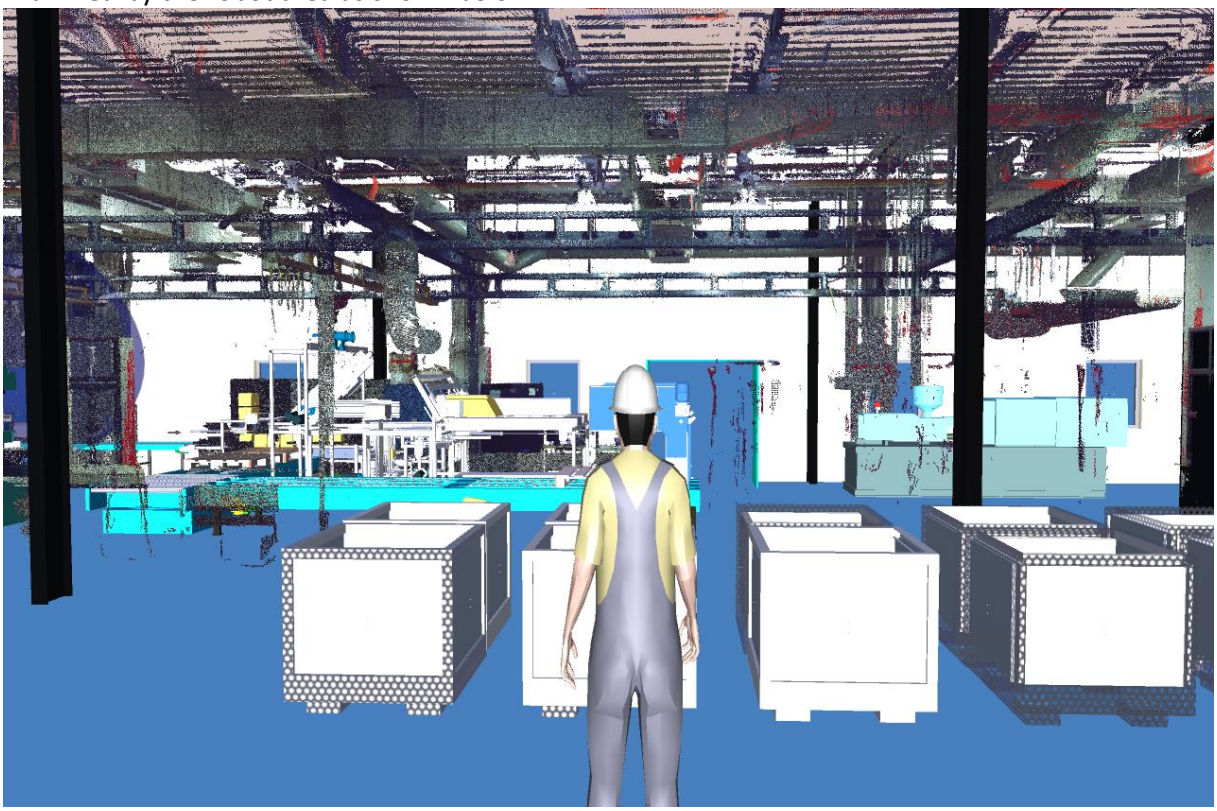
125. Access Ribbon command in Animation ribbon



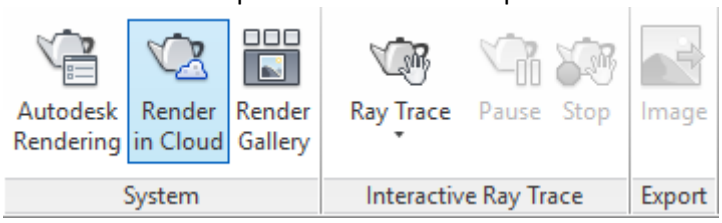
126. Record animation while walking through facility

Panorama Shaded visual

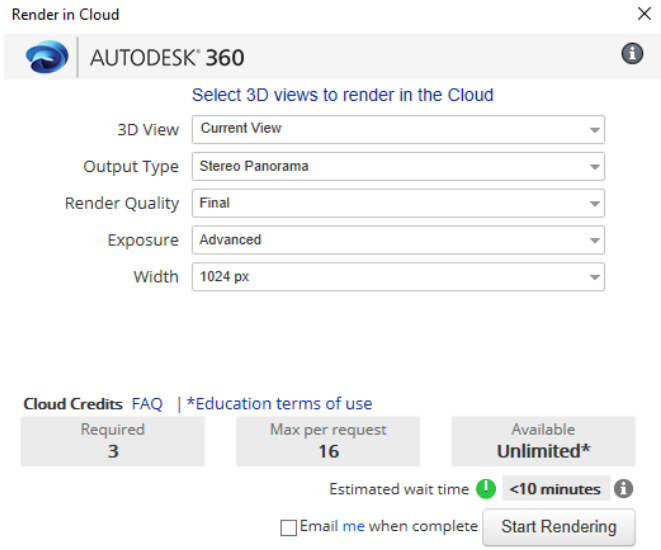
127. Walk nearby the robot area as shown below.



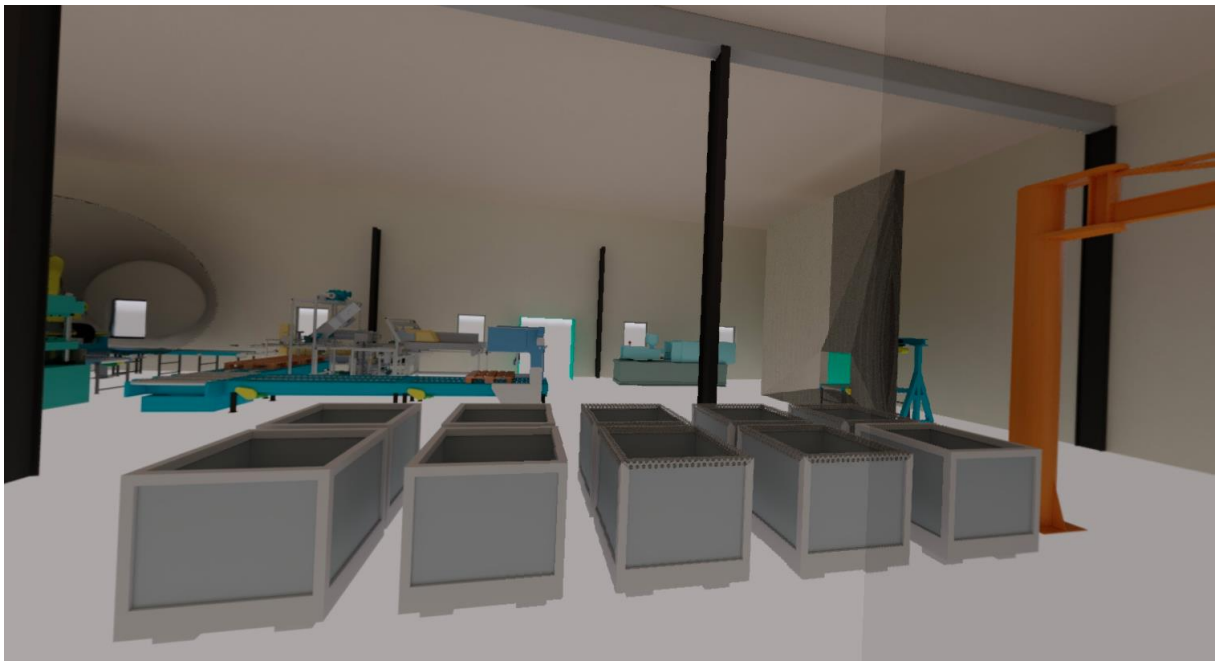
128. In “Render” ribbon pick Render in Cloud option



129. In the option box, pick the following options



130. After a short waiting time, this is the result you will see.



I hope you liked it?

Thank you!