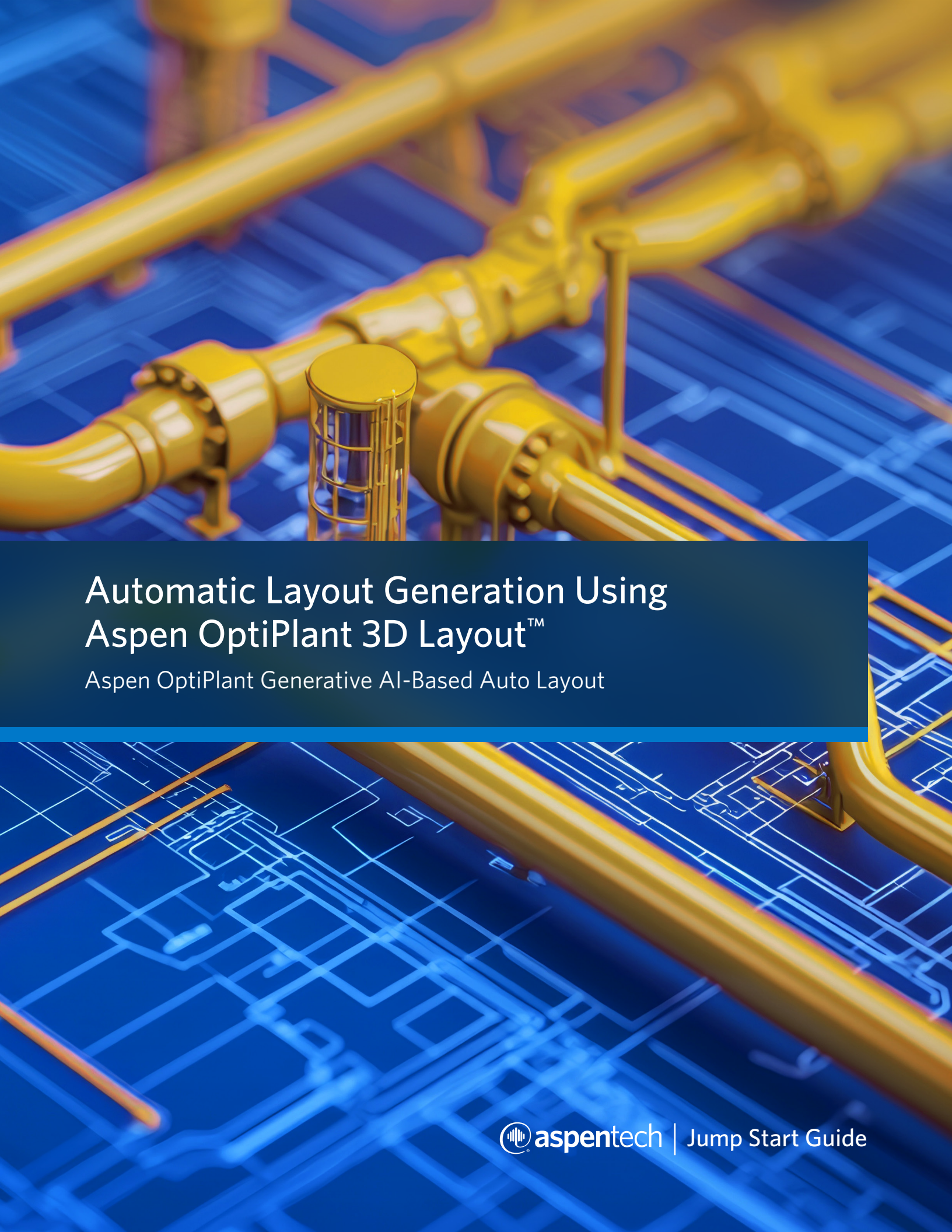




Automatic Layout Generation Using Aspen OptiPlant 3D Layout™

Aspen OptiPlant Generative AI-Based Auto Layout

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Conceptual 3D Layout Overview

In the ever-evolving world of engineering, layout and pipe routing are key levers that drive capital cost. The ability to evaluate multiple layout and routing options can help companies create better designs that satisfy space constraints and optimize safety and cost functions.

Aspen OptiPlant 3D Layout provides users with the ability to create and optioneer 3D models for engineering projects in a fast and simple way, impacting early design stages, when little information is available but decisions bring a huge influence into capital investment.

This early 3D modeling fosters better collaboration across engineering disciplines. Teams can integrate inputs from process, mechanical and civil engineers, reducing the need for back-and-forth communication. Additionally, 3D models enable teams to conduct early spatial analysis, resulting in a more efficient and sustainable design.

Aspen OptiPlant aids users in the mission of finding optimal capital alternatives to address market shifts and sustainability-driven plant modifications, making faster and more rigorous capital allocations. By leveraging Aspen OptiPlant, companies can accelerate project timelines, control costs and ensure designs are both operationally and economically viable. These models lay the foundation for a smoother transition from design to construction, ultimately enabling better project execution and long-term success.

AI-Based Auto Layout

Starting in V14.5, Aspen OptiPlant offers the capability to automatically generate 3D layout options that engineers can then use as a starting point to drastically accelerate the selection and optimization process for the design.

This feature leverages process information such as an equipment list and the connectivity between these pieces, which can be imported from other AspenTech solutions such as **Aspen HYSYS®** and **Aspen Plus®**. With this information, together with the available real state and the position of

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structures or racks, Aspen OptiPlant 3D Layout can generate three possible layout options in just minutes. All these options are designs based on PIP distance constraints, design principles and optimal cost functions, allowing users to evaluate more options in less time and accelerate the process of finding the optimal layout.

Automatic, AI-Based 3D Layout Generation

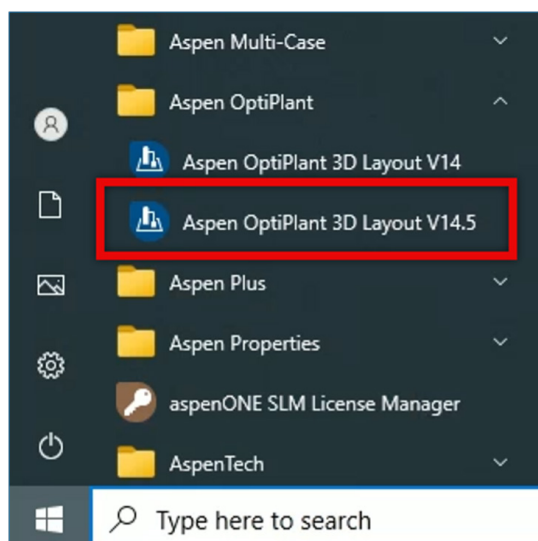
Overview

In this guide, you will learn the input required to generate a feasible layout option for an acid gas plant. You'll explore the Auto Layout settings available in Aspen OptiPlant 3D Layout and their impact on the AI-generated designs.

To focus on the workflow followed inside Aspen OptiPlant, you'll use two [starter Excel files](#) that have been created from a simulation built in Aspen HYSYS for an acid gas cleaning model. The Excel files contain the list of equipment used in the simulation and their connectivity.

Task 1 – Launch Aspen OptiPlant and Create a New Layout

1. Open **Aspen OptiPlant 3D Layout** from the Windows Start menu. The Auto Layout capability is available starting from **version V14.5**.



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- Enter the following information in the Pipe Rack Dimensional Parameters:

Distance Between Columns (D1)	25 Feet
Total Number of Frames (D4)	8 Feet
P1, X	20
P1, Y	90
Color	Yellow

H-Type Frame Dimensional Parameters

Tag/Dimensions | Member Size | Bracing | Foundation

ID (Tag): HFrame2 Description: H-Type Frame

Hard Volume Type: STRUCTURE Category: PIPEWAYS/BETWEEN UNI

☐ Auto Update Secondary Dimensions

Primary Dimensions

Distance between Columns (D1): 25 0

Depth of Columns(Typ.) (D2): 1 2

Width of Columns(Typ.) (D3): 0 5

Total Number of Frames (D4): 8

Spacing between Frames (D5): Uniform - 20

Height of Access Space (D6): 12 0

Width of Access Space (D7): 18 8

Rack Volumes

Num Levels (D8): 2 Multiple Bays

ADD	RackID	Elevation	Height	Type	% Spare	Location
☒	RAK x9	18	0	1	2	P R
☒	RAK x10	26	0	1	2	U R
☐						
☐						
☐						
☐						
☐						

Secondary Dimensions

Depth of Trans. Beams (D9): 1 2

Width of Trans. Beams (D10): 0 5

Height of Longit. Beams (D11): 1 2

Width of Longit. Beams (D12): 0 5

Rotation Z-Axis: 270 (East)

Relative Position

P1, X: 20 0

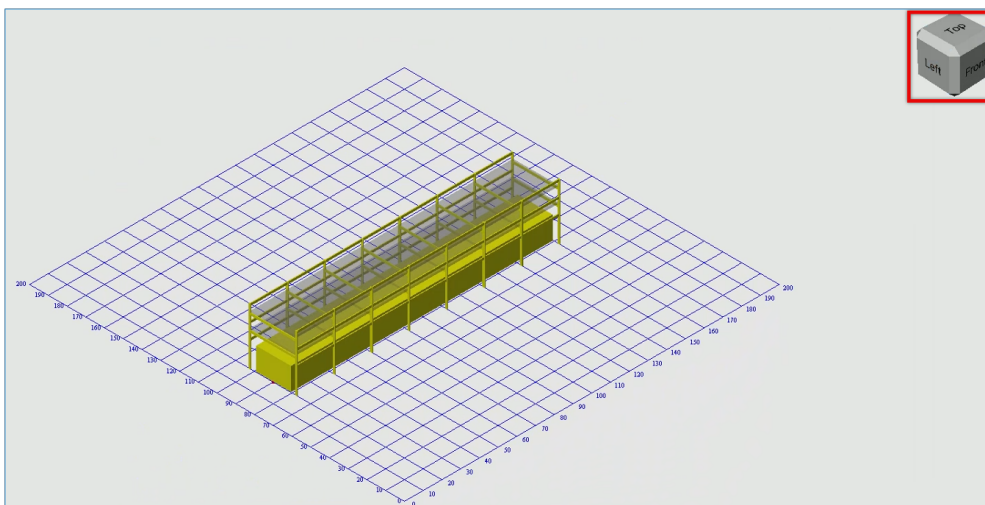
P1, Y: 90 0

Elevation, Z: 0 0

Color: Yellow

Accept Cancel

- Click **Accept**. Use the Navigation Cube to review the pipe rack. When done, go back to the **Top** view.



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7. Add a structural frame building to the plot plan by clicking on the  icon from the Structure Library, then left-click on the grid to place the object.
8. Enter the following information in the Frame Building Dimensional Parameters:

Distance Between Columns (D1)	50 Feet
Total Number of Frames (D4)	40 Feet
Number of Floors (D9)	3
P1, X	130
P1, Y	40
Color	Orange

Frame Building Dimensional Parameters

Tag/Dimension | Foundation | Member Size

ID (Tag): FrameBld3 Description: Rack Type Frame Building
Hard Volume Type: PENETRABLE Category: None

TOP **ROTATION** **FRONT** **RIGHT**

Primary Dimension

	Feet	Inch
Floor Length (D1)	50	0
Floor Width (D2)	40	0
Floor Thickness (D3)	0	1
Beam Width (D4)	0	5
Beam Height (D5)	1	2
Column Width (D6)	0	5
Column Depth (D7)	1	2
Floor Elevation (D8)	10	0
Number of Floors (D9)	3	
No. Columns in X-Direction (D10)	2	
No. Columns in Y-Direction (D11)	2	
Railing Height (D12)	3	0
No. of Railings (D13)	2	

☐ Check Pipe Interference with Railing

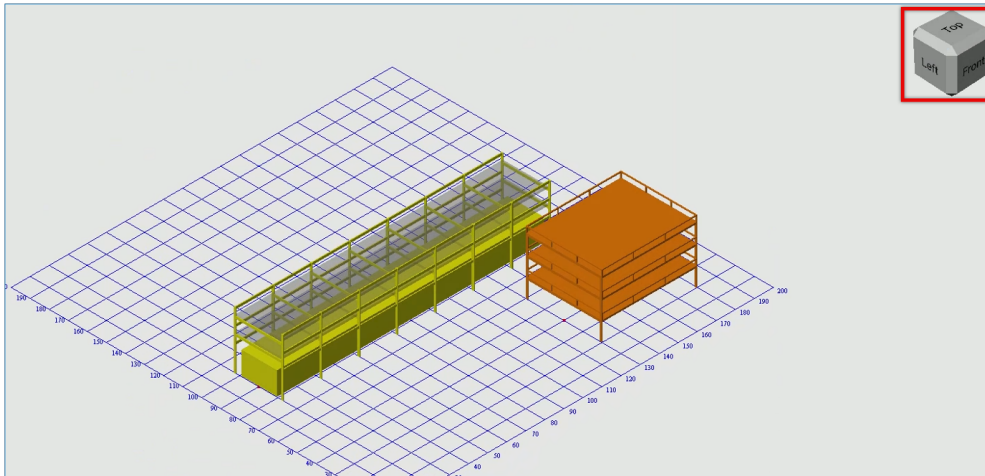
Placement

P1, X	130	0
P1, Y	40	0
Elevation, Z	0	0
Rotation Z-Axis	270 (East)	

Color

Accept Cancel

9. Click **Accept**. Use the Navigation Cube to review the structure. When done, go back to the **Top** view.

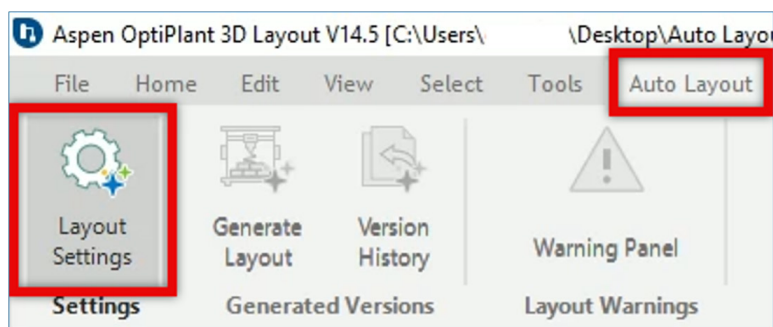


Now that the rack and structure are in place, we have all the settings needed to enable the AI-Based Auto Layout.

10. Click on **File | Save**.

Task 2 – Run AI-Based Layout Generation

- Click the **Auto Layout** ribbon. Then click on the **Layout Settings** icon.

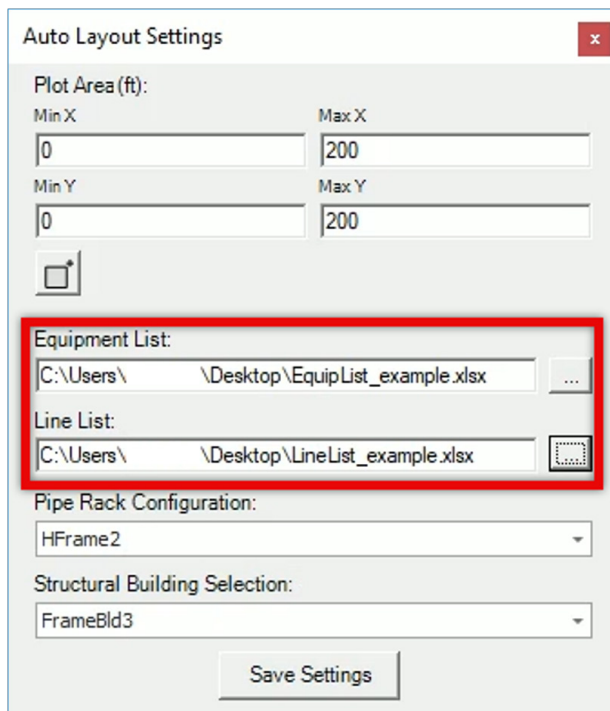


12. In the **Auto Layout Settings** window, import the Equipment List and Line List attached to this guide. You can save these files in your PC desktop for easier access. As the file names indicate, **EquipList_example.xlsx** corresponds to the equipment list, and **LineList_example.xlsx** corresponds to the line list.

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[illegible]

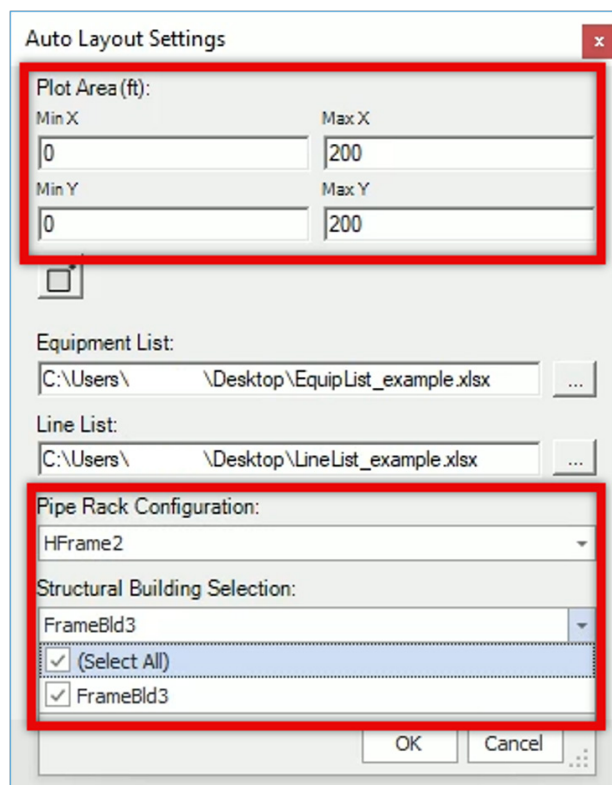
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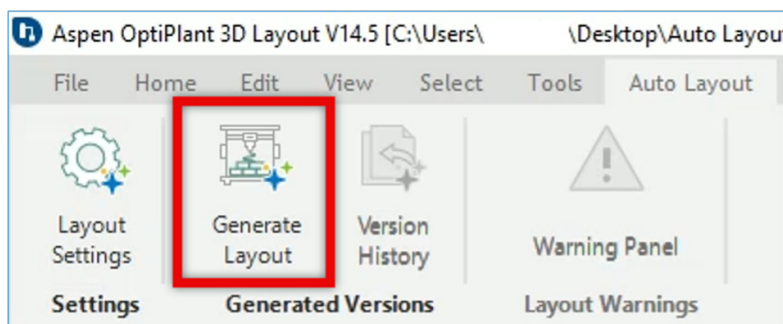
Note: The data in these files was generated from the integration between **Aspen HYSYS** and **Aspen OptiPlant 3D Layout**. Using **Aspen OptiPlant's Schematic Creator**, they have been pre-adjusted to ensure proper connectivity, linking all piping lines to the correct equipment nozzles and accurately defining battery limit connections. Typically, this intermediate step would be required to produce similar equipment and line list files.

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13. Notice the Plot Area can be modified, and limits for the Auto Layout can be set. We'll review the effect of this area in a later task. Notice as well that the pipe rack **HFrame2** and the structure **FrameBld3** we added on the previous task are available and included in the auto layout generation. We'll also review the effect of including and excluding these in a later task.

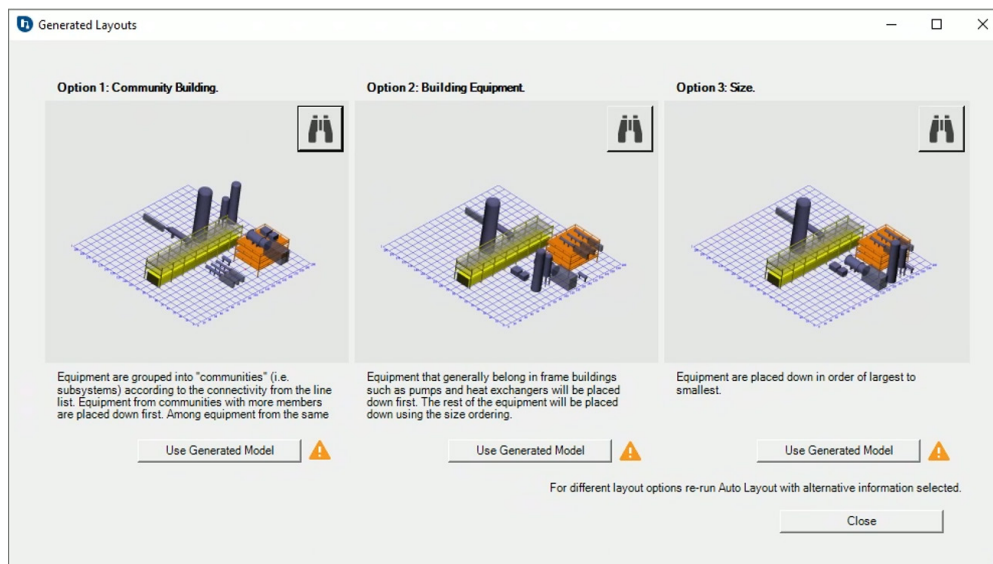


14. Click on **Save Settings**. Then click on the **Generate Layout** button.



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15. Click **Yes** on the pop-up window to get started, and wait a couple of minutes for the layout generation to complete. A progress bar will show when the 3 auto layouts are generated.
16. When the layout generation is done, a window showing 3 layout options will appear.



Each layout option is generated based on different criteria:

- **Community Building:** Prioritizes keeping connected equipment together.
- **Building Equipment:** Places equipment by importance, placing items that belong in structures first, such as pumps and heat exchangers, then placing the remaining equipment by size.
- **Size:** Positions largest equipment first.

17. Use the  icon to explore any layout option. A Read-Only view will open, allowing you to review the equipment placed in the structure, as well as which items are positioned on the north and south sides of the pipe rack.
18. Click on the **Warning Log** button to review any distance violation warnings. Close the window when done.
19. When finished, click the **Close** window. You can repeat this process for all available layout options.

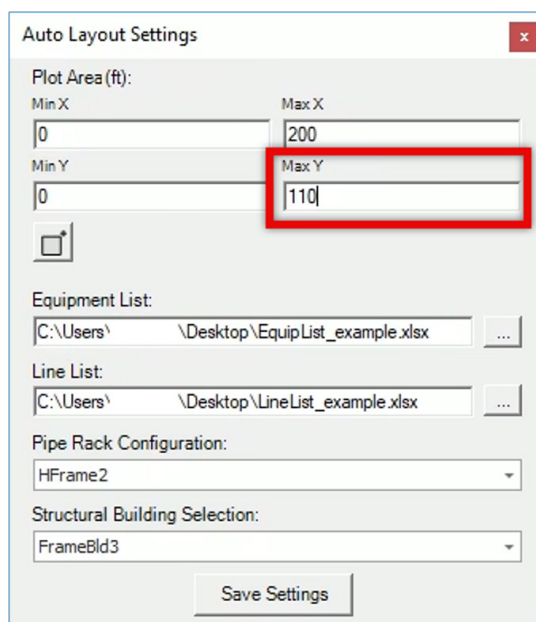
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At this point, you can click on any of the **Use Generated Model** buttons if any of these designs are suitable for your project. OptiPlant will transfer the selected layout to its editable plot plan, allowing users to review the equipment information, and re-arrange equipment as needed. For this guide, we'll explore other layout alternatives, so we will close the current options.

20. Click on the **Close** button. The layout should go back to containing only one rack and one structure.

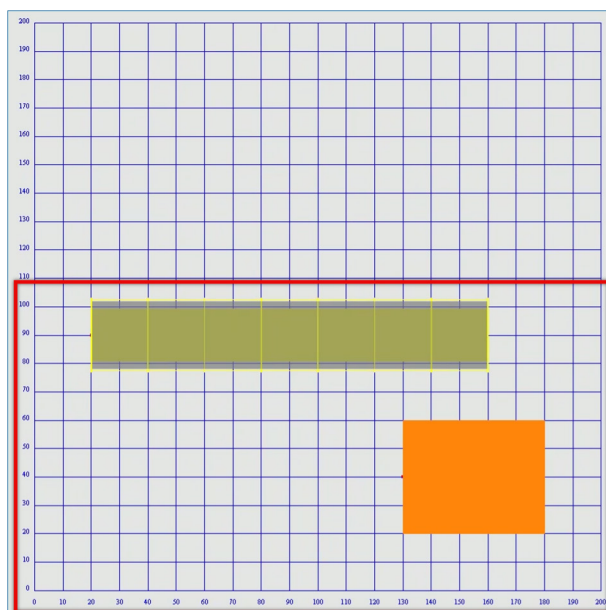
Task 3 – Investigate Different Plot Areas

21. Click the **Auto Layout** ribbon, then click on the **Layout Settings** icon. The equipment and line lists that were selected during the previous task should remain selected.
22. Change the **Plot Area** to a **Max Y** value of 110 feet. This will limit the space available for the automated equipment placement to the south section of the pipe rack.



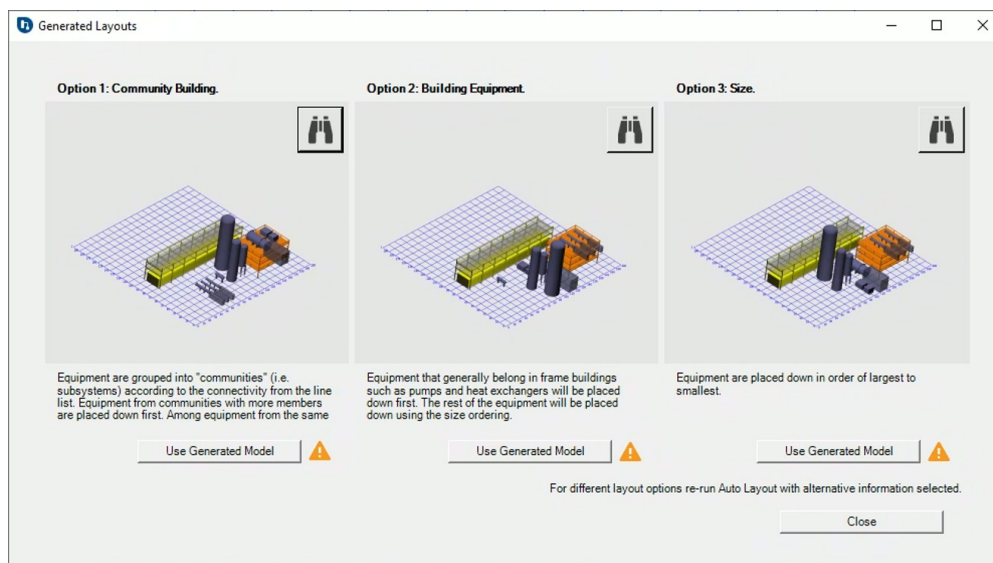
The screenshot shows the 'Auto Layout Settings' dialog box. Under the 'Plot Area (ft):' section, the 'Max Y' field is set to '110' and is highlighted with a red rectangle. Other fields include 'Min X' (0), 'Max X' (200), 'Min Y' (0), and 'Max Y' (110). Below this, there are sections for 'Equipment List', 'Line List', 'Pipe Rack Configuration', and 'Structural Building Selection'. The 'Save Settings' button is at the bottom.

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Note: The selected space area must contain the racks and structures added to the plot plan. In this example, we could not limit the vertical space (Y) from 70 to 200 feet because the structure would fall outside of this space. When this condition is not met a warning will indicate the plot area must be modified for the auto layout to run.

23. Click on **Save Settings**, then click the **Generate Layout** button.
Wait a couple of minutes to finish generating the new layout options.
24. When the new layout options finish generating, a window will appear and show the new results.



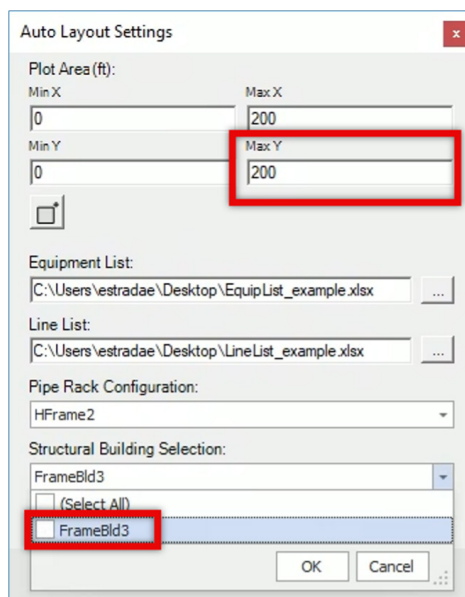
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25. Once again, you can use the  icon to explore any layout option. Notice that in all the generated layouts, equipment items are placed within the designated area in the Layout Settings.
26. Review the Warning Logs and repeat this process with all the layout options as needed. Note that in this exercise one of the equipment pieces, horizontal vessel RB6, could not be placed due to the space restrictions that were set. In this situation, RB6 would need to be placed manually, or the auto layout area should increase so the vessel is placed correctly.
27. Close the Generated Layouts window when you're done reviewing the results.

Once again, you can click on any of the Use Generated Model buttons if any design is acceptable. In this guide, we'll explore 3 more layout alternatives, so you'll close the window without choosing any option.

Task 4 - Enable and Disable Structures

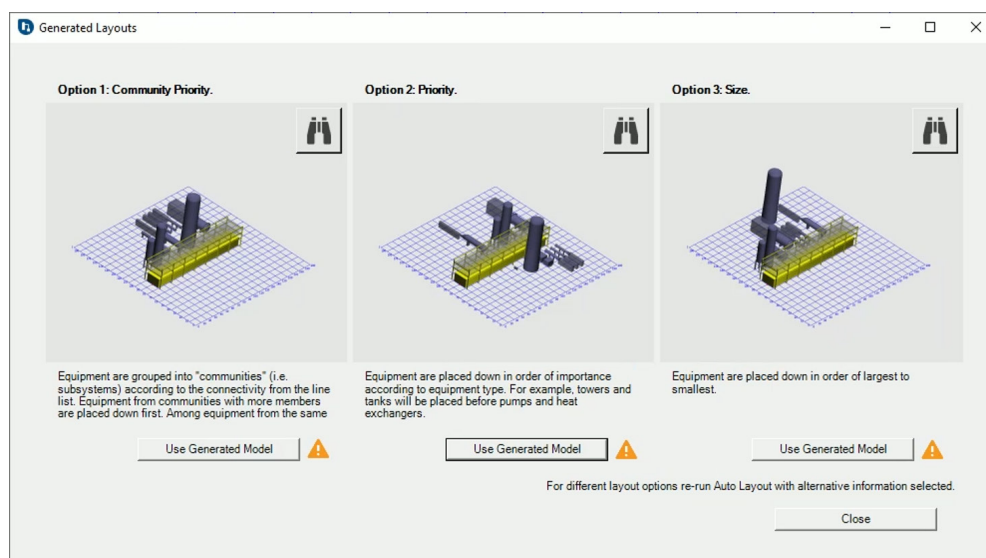
28. In the **Auto Layout** ribbon, click on the **Layout Settings** icon. The equipment and line lists, as well as the plot area that were set in the previous task should remain.
29. Return the **Plot Area** to a **Max Y** value of 200 feet.
30. In the Structural Building Selection menu, uncheck the **FrameBld3**, then click **OK**.



NOTES

Note: When a structure is not selected in the Layout Settings, the Auto Layout generation will ignore them when placing equipment. In layouts with multiple structures or modules, this setting allows for better control over equipment placement.

31. Click on **Save Settings**, then click the **Generate Layout** button.
Wait a couple of minutes to generate the new layout options.
32. When done, a window will appear and show the new layout options.



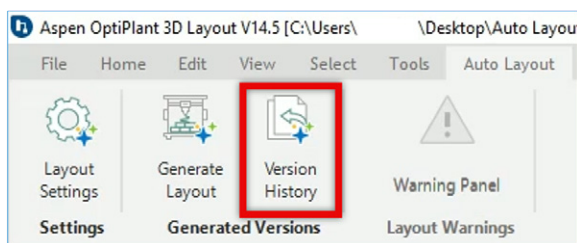
33. Feel free to investigate any layout using the  icon. Notice that all equipment items were placed ignoring the existence of the steel structure in the plot plan.
34. Review the Warning Logs and repeat this process with all the layout options as needed.
35. Close the Generated Layouts window when you're done reviewing the results.

Once again, you can click on any of the Use Generated Model buttons if any design is acceptable. For now, we'll close the menu since we want to consider the steel structure in the layout design.

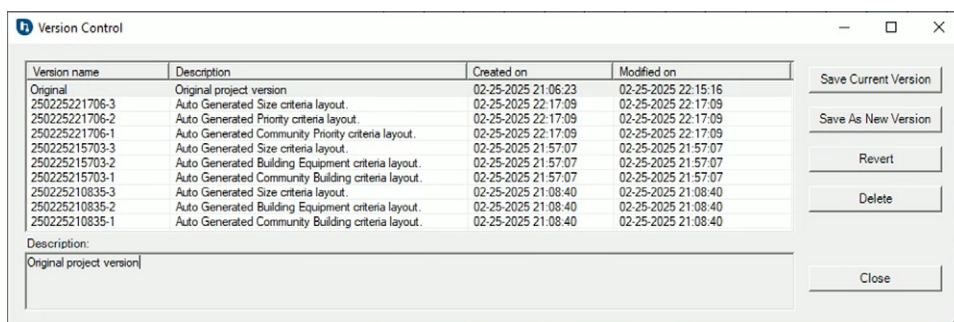
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Task 5 – Reuse Generated Layouts

36. In the **Auto Layout** ribbon, click on the **Version History** icon. This button will only be enabled after running the Auto Layout function at least once.

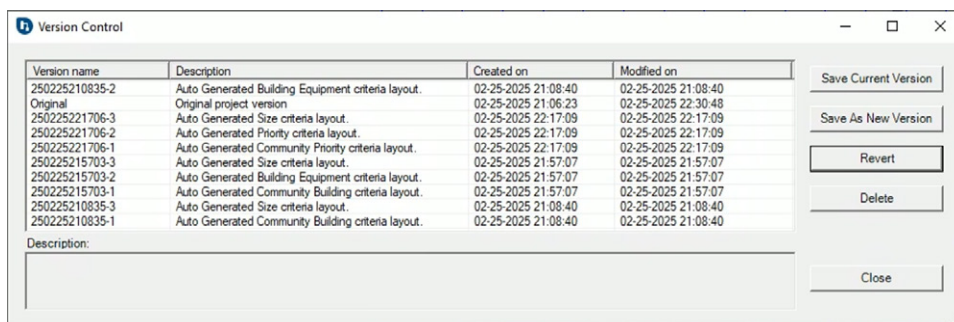


37. A window will appear showing 10 results, the original project with no equipment, and 9 other versions, corresponding to the 9 total layouts we generated though this guide.



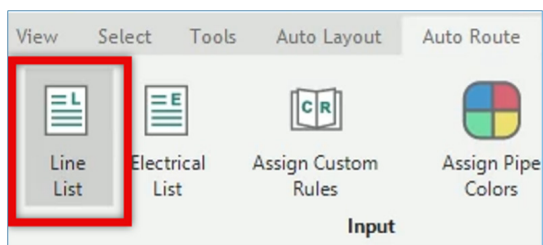
38. Click on the second-to-last option: **Auto Generated Building Equipment criteria layout**. This corresponds to the second layout we generated on the first run. Then select **Revert**.

39. **Save** the original file when prompted. A new layout will open, corresponding to the option we just reverted to. The Version Control window will now show the version we selected at the top. You can confirm this by looking at the Created On time stamp.

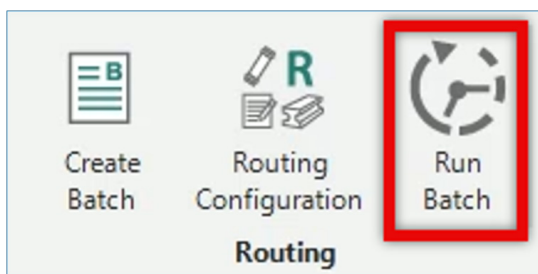


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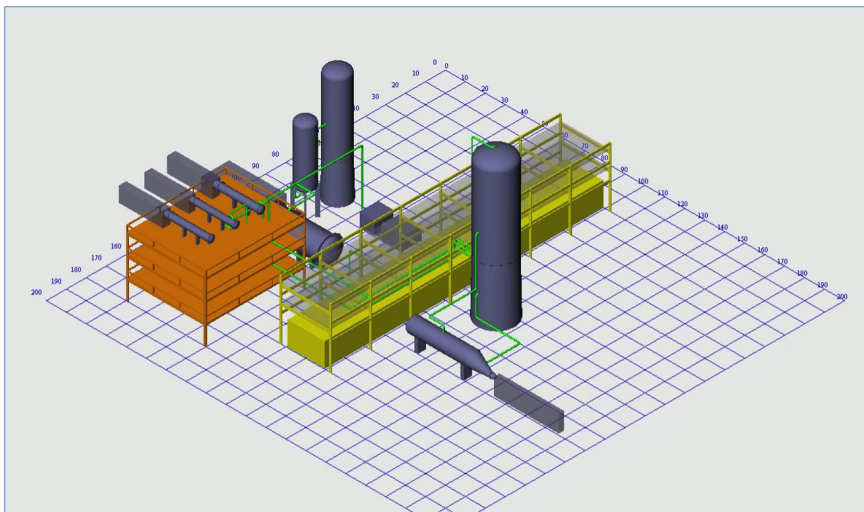
40. Close the Version Control window and navigate the selected layout. As mentioned in Task 2, this layout has no space constraints and uses all the structures in the plot plan.
41. Click the **Auto Route** ribbon, and then click **Line List**.



42. Click **Import** on the bottom part of the window, then browse for the file **LineList_example.xlsx** we used for the auto layout. Click on **Save** to close the line list window when done.
43. Click **Run Batch** in the Auto Route ribbon. Wait a minute for the pipe auto-routing process to finish.



44. Explore the resulting layout.



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Conclusion

Aspen OptiPlant 3D Layout transforms the way engineering teams approach conceptual design, bringing unprecedented speed, automation and intelligence to early-stage layout development. By leveraging its integration with other AspenTech solutions, engineers can quickly generate, evaluate and refine multiple layout alternatives—optimizing safety, cost and space.

With Aspen OptiPlant, organizations can make data-driven design choices that minimize project risks, reduce capital costs and accelerate time to market. By embracing AI-based automation, companies can stay ahead in an increasingly competitive and sustainability-driven landscape. Aspen OptiPlant empowers engineering teams to accelerate designs and drive better project outcomes.



About Aspen Technology

Aspen Technology, now part of Emerson, is a global software leader helping industries at the forefront of the world's dual challenge meet the increasing demand for resources from a rapidly growing population in a profitable and sustainable manner. AspenTech solutions address complex environments where it is critical to optimize the asset design, operation and maintenance lifecycle. Through our unique combination of deep domain expertise and innovation, customers in asset-intensive industries can run their assets safer, greener, longer and faster to improve their operational excellence.

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