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Design Validation for Industrial Piping with AutoCAD Plant 3D

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Learning Objectives

- Learn how to act on untagged item in AutoCAD Plant 3D
- Learn how to identify property conflicts between P&IDs and 3D models
- Learn about navigating between P&IDs and 3D models with one click
- Find the most complex design issues that need resolution

Description

Industrial piping projects routinely run into difficulties validating model design against P&ID schematics. Missing tags and incorrect descriptions wreak havoc on schedules as designers work to transition from drawing-focused design to data-centered design. Engineering managers and project managers need clarity in design quality. Learn how estimating design points as part of your AutoCAD Plant 3D modeling gives you and your project management team better insight into project progress, identifying critical paths, and helps your projects stay on time and on budget.

Speaker(s)

David Wolfe - Develops sales and technical software approaches for Autodesk products in the plant and process industry. Identifies product development opportunities for clients and organizational growth. Grows team skills and implements best practices into services execution.

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Piping Design Review Practices

Piping design tends to be stuck behind the technology curve. Even with the massive digital migrations we have seen toward cloud-enabled systems, many of our review processes are mostly manual effort redlining drawings, or fixing typos in Excel spreadsheets. Plant Vision from PCloud Innovations is the best way to change review processes and improve design communication for a piping design team.

Continuous Validation

One aspect of technology evolution over the last decade has been the rise in continuous integration and continuous deployment. For developers, the deployment process meant stopping work, building installers, testing and writing documentation for 3-5 days (for a small project). By creating scalable automation that does these processes automatically, dev teams get to reclaim the time spent on integration and deployment and instead release more features.

For piping designers, the validation process is somewhat similar in that it ends up being pushed to the last minute and creates its own schedule slip as errors get reviewed and corrected. The goal of continuous validation is to allow the thinking and manual efforts to be focused on critical design issues and allowing software to close the gap on data inconsistency.

Design Score

Piping designers develop an intuitive sense for complexity and difficulty as the mature in their process. Taking some best practices into account, Plant Vision builds a score to model complexity and risk. While imperfect, the design score should help provide a scale of effort which can steer management and design effort. Here are a couple scenarios the demonstrate the value of a design score.

The design score formula has the following components:

- Points for the type of item (eg 3 for tanks, 5 for vessels, 1 for pumps)
- 1 point for each connected nozzle (nozzles without piping are excluded)
- 1 point for each P&ID the equipment appears on (equipment that appears on multiple P&IDs are generally more complex)
- 1 point to appear in a plan or section (every item should appear labeled at least once)
- 1 point to appear in an isometric (every item should appear in the set of isos at least once)

Tank in Tank Farm

A tank has 5 nozzles, 3 of which have connected piping. One of the 5 nozzles is a vent, and the other is a drain.

Tower in a Process Building

The tower has 46 nozzles, 38 have connected piping and appears on 3 P&IDs.

Scenario	Values	Design Score
Tank in a Tank Farm	3 + 3 + 1 + 1 + 1	9
Tower in a Process Building	5 + 46 + 38 + 3 + 1 + 1	94

Velocity

The term velocity in the agile development world is a way to measure how quickly a team is executing on their workload. In development, they will assign "story points" to a programming item. Based on the team developing a shared language to estimate work difficulty and duration, a project can be estimated by how many story points a team can work through in a week. Extrapolating that pace out for the duration of the project yields the project estimated completion date.

The design score concept correlates to the story points concept in that is (hopefully) a useful measure of how hard it is to design something. The key factor that allows us to determine a velocity is that validation must be complete to consider a design "done." The implementation of a continuous validation process will yield more predictable and practical estimates of schedule than the former estimates based on man-hours, simply because it is a measure of skill and effort, not effort alone. In Plant Vision, the velocity is measured in a weekly basis since that is a common standard to work in for project management.

The following example may help clarify. A design team with 2 pipers has a weekly velocity of 24. Using the previous example of a tank in a tank farm and the tower, the project has a design score of 103. The design score (103) / weekly velocity (24) will yield the number of project weeks needed (4.29). If the work is started on a Monday, the project should finish around 11:39 am (just in time for a piper's lunch) on Tuesday of the 5th week. Obviously, we don't look for that kind of accuracy, but perhaps one day, it will be that easy.

Acting on Untagged Items

While everyone appreciates the value of tags, assigning tags in the design process can be a complex endeavor. In some cases, engineering firms are dependent on their client to provide tag numbers which can delay the design process weeks. A strong, agile tagging workflow (like pre-assigning blocks of tag numbers to use on a project), enables the design process to happen more rapidly by preventing data re-entry and starting validation sooner in the design lifecycle. Plant Vision provides tools to quickly identify how many tags remain to be filled, and ways to quickly navigate to them.

Identify Property Conflicts between P&IDs and 3D Models

P&IDs are the bible for a process plant. While everyone piping designer agreements with this statement, many design firms find the cost of maintaining/using intelligent P&IDs too high. One reason is that ensuring the data and text matches between the P&IDs, isos, plans and sections is too difficult. Firms end up short cutting the process by eliminating the intelligent P&ID effort. The downstream effect though is that the P&IDs no longer reflect an as built design from the data perspective, and any effort in moving towards a digital twin is incapacitated. Plant Vision

enables fast resolution of property conflicts lowering the effort to maintain a 2D and 3D as built package.

Navigating P&IDs and 3D Models with One Click

Find TK-1001 in this set of 80-120 P&IDs. One task performed daily, maybe even hourly, of locating a project item in a drawing package ends up costing hundreds of unnecessary project hours. Project manager, piping designers, fitters, and anyone else on the team has dreamed of the day when they don't have to flip sheets, scroll through 50 different search results, or learn wild card searches. Plant Vision enables 1-clik navigation through search results or related drawings, cutting out unnecessary page flips.

Complex Design Issues

Any industrial design job brings complexity especially compared to commercial or residential projects. Project managers spend hours and weeks trying to identify where they have the most risk, and they rely on meetings and planning sessions that take designers away from executing their work to sus out the required information. By applying industry best practices, Plant Vision evaluates the most complex items on a project, allowing project managers to focus their efforts where they are needed most.