Structural Workflows for Autodesk® Plant Design Suite Projects

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Learning Objectives

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

• Describe the structural workflows in an Autodesk® Plant Design Suite environment
• Explain workflow integration within Autodesk® Plant Design Suite
• Design correct steel and concrete structural models for documentation, analysis, and fabrication
• Update structural models in AutoCAD® Plant 3D

About the Speakers

Abraham joined Autodesk in 2005 and has worked in various positions in Product Management for the AEC team, as a Program Manager for the Sustainable Design Analysis team and finally joined the Technical Specialists Team to evangelize the value of Autodesk’s Plant Solutions in Central Europe. He lives close to Munich, Germany.

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Alexandre is a structural engineer and has trained customers for 3 years (2005-2008) to Autodesk® Robot™ Structural Analysis, AutoCAD® Structural Detailing and Revit® Structure. In 2008 he joined Autodesk and started working on Plant in addition to Structure. Currently he is a technical specialist for Autodesk, and is involved in spreading BIM and Plant messages. He lives in Paris, France.

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Introduction

We designed this class for people involved in Plant projects who are eager to implement better workflows around structure design, from early stages to fabrication. Audience involved in piping design will understand the structural designer/drafter/engineer's needs and particular workflows and vice versa. We will also study model/data modification to understand how to shorten/optimize this very time consuming project phase.

Portfolio

Plant Design Suite

Autodesk® Plant Design Suite 2013

Autodesk® Plant Design Suite provides comprehensive plant design software in a convenient, cost-effective package. Design, model, and review plant projects more effectively. The suite helps you innovate ahead of the competition and communicate with greater clarity. Keep projects on schedule and within budget.

Standard
Streamline P&ID Design and 2D Drafting

Premium
Efficient 3D Piping, Design & Visualization

Ultimate
Multidiscipline Plant Layout & Piping Design Tools

Autodesk® Plant Design Suites are designed as full packages intended for the following main purposes:

- Standard Edition: process and instrumentation diagrams (P&ID) and 2D drafting
- Premium Edition: 3D design (piping, structure, equipment, review and fabrication) + standard features
- Ultimate Edition: clash detection and equipment/skids mechanical design tools
We will focus on Premium and Ultimate versions during this presentation covering 3D modeling, documentation and structural design and detailing.

**The Autodesk® 360 offer**

Autodesk 360 is a cloud computing platform (you use our servers) providing access to multiple services and products, such as data storage, design, simulation and mobile device integration.

In this class we mainly manipulate drawing (2D and 3D files) and data which can be reviewed and shared through this platform.

**Autodesk® Robot™ Structural Analysis Professional (RSA) 2013**

RSA is finite element software engineers use to perform structural analysis on multi material models. For example steel and concrete structures can be analyzed and code check can be performed. Most of the international used codes are available and if an advanced analysis such as dynamic or nonlinear are needed, RSA can also perform them as well.
Structural Workflows

This presentation describes one of the many possible workflows users can adapt to their everyday tasks. We think this workflow is relevant in a large multidisciplinary environment, but can also be applied to smaller companies. In this last case parts of workflow can be used.

We focused on what we think is optimal, in terms of file integration and methods and when a direct link doesn't exist we will use some workarounds.

As shown on last picture, we will learn about early stages design and analysis performed with AutoCAD® Plant 3D (P3D) and Revit® Structure (RST). RSA direct import/export integration of Revit models will also be covered and code check analysis/dimensioning as well. We will then use ASD to create steel fabrication drawings and quantities. The final step of our presentation will show the final import into Plant 3D so piping designers can use the finalized structural model for visualization and/or clash detection purpose.
Early stages design

Structural design

Users can create and manage structural steel elements (beams, columns, railings, stairs, ladders with/without cage, plates/gratings), grid axes and concrete footings. All these objects are 3D intelligent (linked to database) AutoCAD based objects.

Users can, for example, manage materials, sections and orientation of steel members.

Some cutting operations are also available to adjust steel bars to your needed length or shape.

These operations are mostly meant for Plant visualization, as they are not exportable through the typical workflow presented here. We can perform other adjustments, like regular AutoCAD® object properties lengthen/shorten operations, via coordinate changes.
Design of other elements

Usually, the advised/most used way to organize a project is based on zones/disciplines criteria. We mainly used the standard “Related files” Windows/project file to group all structural imported and exported drawings. Smart organization before creating the Plant project saves a lot of production time. We will see details on this kind of task and give you a feedback of our experience. Optimal external referencing (xref’s) is also a part of this optimal project organization and will be presented as a best practice.

Other exports such as dwg (plain AutoCAD) export will also be covered and massively used in our workflow.

We will present general considerations on piping, equipment and focus on specific example about piping supports model preparation. Some of these supports properties are exported to Revit Structure for analysis.

Design and basic analysis

What is Revit

As an introduction to Revit Structure, this part of the presentation will explain basic features of the software and again, how to organize your model (template, families, units, origins, families, etc...). Concrete modeling will complete the steel structure created with Plant 3D.
A particular focus on the analytical model (model we can send to analysis software) will allow the adjustment of Revit model to analysis specific needs.

**Subscription Revit Extensions**

This part of the workflow presents this Autodesk subscription Revit add-in and will be illustrated by steel frame easy modeling and previously designed SDNF import of Plant structural steel members.
Plant structural data

Once Plant data is imported via SDNF, loads will be created matching piping supports position and we will also extend this part of the workflow to equipment data exchange (Plant to Revit).

Last steps towards basic analysis

This section will cover loading completion and an introduction to code load combination. When model is ready Cloud analysis will be performed.

Revit Structure will also allow us to generate formwork concrete drawings and quantity reports.

Code check

For more detailed analysis, direct export to RSA will cover code check considerations. Dimensioning of steel members and their connections, concrete element sections and reinforcement using international codes are the main tasks presented in the next part of the presentation.

We can then update the Revit model so it reflects changes made in RSA.
Fabrication and deliverables

Fabrication drawings and steel member’s final quantities will be our scope here. This section explains how to set up detailed numbering and grouping of elements so data in the model can be extracted for comparison to the early design data. This allows users to evaluate budget conflicts and save time by minimizing risk errors.

Final workflow deliverables are also completed by publishing/printing/sharing the Revit Structure drawings and quantities (mainly concrete formwork and concrete quantities) and AutoCAD Plant 3D ortho drawings generated on complete models (steel from ASD, concrete from RST, Plant piping, equipment and supports).

Wrap up

We hope a passionate Q&A session will end our journey around Structure and Plant, where assistance will be invited to react to the proposed workflow and shortly share their experience.