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Integrating Design to Fabrication Workflows for Industrial Projects

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MSF8577 Integrating Design to Fabrication Workflows for Industrial Projects

Learning Objectives

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

- Understand the business case for using Advance Steel to produce both civil engineering and steel fabrication drawings from the same model.
- Know the transitional steps for a civil drafting department to become a successful contributor in a Design-Build company.
- Use valuable lessons learned to leap frog straight to success in integrating drafting with fabrication.
- Measure Success.

About the Speaker

Geoff Butt is the Lead Civil Designer at Gemini Engineered Solutions. His drafting career began with precast concrete detailing, and continued with decades of structural drawing production and site inspections for buildings, bridges, and industrial projects. He has been a CAD Coordinator since 1995, and a Project Manager within that same multi-discipline consulting firm for 10 years. He is currently responsible for all aspects of drafting within the Civil Engineering Department at Gemini, an Oil & Gas EPCM company. His team produces earthworks drawings using Civil3D, but uses Advance Steel to produce both engineering and steel fabrication drawings. Surprisingly, Advance Steel is also used for some concrete IFC and buildings IFD drawing production. Geoff is passionate about Civil Design!

Understand the business case for using Advance Steel to produce both civil engineering and steel fabrication drawings from the same model.

Main distinction between engineering and fabrication drawings

Engineering drawings:

- ***direct the fabricator in all design aspects, materials, coatings, specifications, and governing codes.***
- ***specify delegated connection engineering loading.***
- ***provide just enough dimensions for the fabricator (minimize duplicated dimensions).***
- ***packages vary greatly in the amount of detail provided.***
- ***almost never contain Mark Numbers.***
- ***identify temporary members.***
- ***identify erection and assembly constraints.***

Fabrication drawings:

- ***always contain Mark Numbers.***
- ***set includes erection, assembly, single parts, and Bill Of Materials (BOM).***
- ***show every dimension (includes tolerances, and adjust to field measurements).***
- ***should stand alone. The fabrication personnel should not have to refer back to the engineering drawings. (This is more important on large projects, but the rule is sometimes broken on small projects to save drafting duplication and cost).***
- ***package can include numerical control (NC) files that are used by a machine's software to cut steel.***
- ***alert the Engineer Of Record (EOR) of any proposed deviation from their specified design.***

Business Case for why we use Advance Steel to produce both engineering and steel fabrication models and drawings is primarily based on improvements in:

SCHEDULE improvements:

- ***can advance the model to a fabrication level detail during the engineering modeling stage when the designers have any kind of downtime.***
- ***can engage our fabrication checkers to check the model earlier.***
- ***do not have to take time to export the engineering model and import into the fabrication software.***
- ***don't have to wait for the IFC drawings bid period, bids review and selection, and award.***

QUALITY is better because we:

- ***lower any chance of a discrepancy between the engineering model and the fabrication model, because it's the same model.***
- ***have standardized the 3 types of fabrication drawings and BOMs using drawing templates, so that each designer's drawings have the same presentation.***
- ***spend less time checking the drawings and more time making sure that the model is perfectly correct.***

COST is lower because we:

- ***do not have to create 2 models.***
- ***do not have to take time to export the engineering model and import into the fabrication software.***
- ***have improved the automated standardization.***
- ***spend less time checking.***

Know the transitional steps for a civil drafting department to become a successful contributor in a Design-Build company.

Brief Description of our previous workflow:

- ***Produced the model in CADWorx and then IFC drawings also in CADWorx***
- ***Recreated the model in Advance Steel and then produced IFF drawings also in Advance Steel***
- ***BOMs required substantial checking time***
- ***We did not have a beam profiler***

Brief Description of the new workflow:

- ***Produce engineering model and drawings using Advance Steel.***
- ***Make a copy of the same model to produce fabrication drawings using Advance Steel.***
- ***Automatically generate BOMs and nc files for the fab shop***

Working with other disciplines:

- ***The other disciplines are currently using CADWorx.***
- ***Our Advance Steel Model is xreffed in to the full model.***

Working with our two remote fabrication shops:

- ***Fab shop representatives are invited to model reviews to verify constructability and cost efficiency.***
- ***Fabrication drawings are sent through our Document Control to the fab shops.***
- ***nc files are sent up to the Fort Saskatchewan shop to feed the PythonX robotic computer numerical control (CNC) plasma cutting system.***
- ***Cut steel is also assembled and welded there, or trucked to our Ponoka fab shop.***
- ***We have one designer on site in Fort Saskatchewan.***

Designer training:

- ***We used a 30 hour Advance Steel basic course put on by Graitec (www.graitec.com). It is offered online 3 hours/day over 10 days, which worked best for most users. They had Advance Steel actual projects to work on for the remainder of the day.***
- ***We have also tried using Graitec's trainer at Gemini over 3 full days. Users found this more difficult to absorb.***
- ***We had a half day course for the checkers using the Advance Steel read-only version.***
- ***We selected one designer for advanced training in order to be able to customize and create templates. This consisted of 2 full days at Gemini.***
- ***More courses are available, but the above is what we used.***

Customizing and automating drawing production:

- ***Creating a block library of Advance Steel 3D objects***
- ***Using templates to automate drawing production***
- ***Erection drawing example***
- ***Assembly drawing example***
- ***Single Part drawing example***
- ***BOM example***

Use valuable lessons learned to leap frog straight to success in integrating drafting with fabrication.

Advance Steel:

- ***Research the available software options and get first-hand accounts of the implementation process.***
- ***Train and transition a spearhead team first in order to work through any issues.***
- ***Put your best customizer through advanced training.***
- ***Begin customization of blocks and templates.***
- ***When the workflow and drafting system is proven to be more efficient than the current system, then train the remainder of the operators.***
- ***Put "click by click" instructions in a CAD Manual.***
- ***Keep on top of any Advance Steel fixes and versions.***

PythonX:

- ***See the CNC machine in action and know what issues crop up.***
- ***Train each designer regarding what each line of nc code does.***
- ***If you cannot resolve a file, send it to the machine's help desk;***
- ***in our case, Burlington Automation.***
- ***Start a file structure for storing repeatable standard products (ex. pipe shoes).***

From the fabrication shops:

- ***Know their workflow and drawing requirements. Every shop is different; for example:***
- ***Visit the shop floor and ask what they like and do not like about the fab drawings.***
- ***Where they have a choice of handrail type, what connections are the most cost-effective and best?***
- ***Advance Steel renumbers Mark Numbers (ex. for re-issue of revised items). This can cause the fab shop a lot of confusion and extra work. "Lock down" any part numbers that have been issued.***

Measure Success.

Satisfied internal and external clients:

- ***Usually on time, error-free, and under budget does the trick!***
- ***Let it be known up front that feedback is requested***
- ***Track Lessons Learned along the way and conduct a Lessons Learned review at the end. Action any improvements needed for the next project(s).***
- ***Communicate any improvements learned for the next project(s) with the fab shops and the client as needed.***

Schedule:

- ***Start an IFF drawing deliverables schedule before the IFC engineering drawings are even provided, and keep it up to date.***
- ***Communicate any IFC potential date slippage with all concerned.***

Quality:

- ***Drafting memos are distributed to all so that not just one designer learns.***
- ***New items get put into the Civil Department's CAD Manual.***
- ***Quality concerns are also discussed for resolution at monthly civil designers' meetings.***
- ***Regular checkers' meeting to resolve any differences in checkers' redmarks.***
- ***We escalate any problem issues***

Cost:

- ***We track all fab project drafting hours with kg of steel per hour of drafting.***
- ***We keep standard estimating spreadsheets with typical hours per unit (ex. a tank base). We multiply that by both a complexity factor and quantity of tank base types.***

Designers' morale:

- ***Standardization and bug removal (or work-arounds) is key.***
- ***Must communicate expectations***
- ***Must communicate bigger picture and how designers are an integral part of success***
- ***Tracking productivity gives everyone a goal and purpose for improving. Provides proof of success.***