Structural Steel Fabrication Package
A Paradigm Shift
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Outline

• Current state of the industry
  – Steel delivery challenges
  – Observations about where we are
  – Why it needs to be transformed

• The Solution – The Complete Structural Package™ (CSP)
  – Criteria to define solution
  – How software was used

• Case Studies

• What is the (transformed) deliverable?

• Working relationships
Fitzpatrick Engineering Group

- Doug Fitzpatrick, P.E.
  - President and Founder
  - Structural design of buildings
  - Actively involved in day-to-day engineering
  - BIM advocate since 2006

Innovations in Infrastructure Conference
Innovation in Structural Engineering

London, England
Amsterdam, NE
History

• Process of designing and constructing (commercial) steel buildings has remained essentially unchanged for decades.

• Design-Build, IPD, fast-track, etc. speed up process but don’t make it more efficient
Workflows

Traditional Design-Bid-Build

Structural Design → Construction

Detailing → Fabrication

IPD, Design-Build, etc.

May include one-time electronic hand-off of information

Confusion

The earlier the Detailing starts, the less information is available to transfer electronically.
More data has to be recreated by hand.

All of this work is completed manually.

Time savings? Cost savings??
Fabricator selected based on GMP

IPD, Design-Build, etc.

Structural Design

Construction

Detailing

Fabrication

Confusion

Opportunities for change orders and RFIs to fuel change orders

The earlier the Fabricator gets involved
Less accuracy in GMP
More opportunities for change orders in the ensuing confusion as design gets finished
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Workflows

There is a limit!

Fabricator selected based on GMP

Design-Build, etc.

Construction

Fabrication

Collision

The earlier the Fabricator gets involved

**Less** accuracy in GMP

**More opportunities** for change orders in the ensuing confusion as design gets finished
The tipping point

- Summer of 2012
  - Received “pitiful” set of shop drawings
  - Sent out incomplete / poorly checked to “maintain the schedule”
  - 50% more time checking
  - Any adjustments -> submitted as change orders
    - But *justified* based on the process
  - Spreadsheet of *changes* in excruciating detail
  - AND, the *detailer* asked for *more money*
Reflection

• If fabricators were using technology to track (justifiable) changes…

• Why couldn’t we use technology to eliminate opportunities for changes and make the entire process more efficient?
  – Transform the process from scratch
Solution Requirements

- Electronic data transfer
- Sent incrementally
- Overlap the design phase
- Reduce or eliminate change orders
- Save significant time
- Leverage inherent efficiencies
- Reduce or eliminate RFIs
Transfer of Information

- Fall of 2012 found detailing software package that could *incrementally* read CIS/2 files with global IDs
- Found detailer with same *enthusiasm*
- Requested *enhancement* to CIS/2 exporter to include global IDs
- These three key elements combined to provide a basis for a new process that eliminated the “confusion” by:
  - Electronic transfer of information
  - *Incremental* updates
  - During the design phase
  - Fewer opportunities for change orders
FEG Project Data

- But, could we save time?

- Looked at 45 of our existing steel projects
  - Time has been tracked in our timesheets
  - Knew exactly when CDs were issued
  - Knew about when we started receiving shop drawings to earnest
  - Knew about how long to review shop drawings

- Graphed data (size of building in square feet vs. time) to see where the opportunities might be
FEG Project Data

Shop drawing preparation time
Time to recreate data and deliver 2D shop drawings for review

8-9 weeks
FEG Project Data

Shop drawing review time

FEG time

6-7 weeks
Fabrication package time

- Preparation: 8-9 weeks
- Review by Contractor: 6-7 weeks
- Review by Architect: 6-2 weeks
- Review by Engineer: 5-6 weeks
- Mailing/shipping time: 1-2 weeks
- Total: 14-16 weeks

Difference: 8 weeks

Significant time savings
Leveraging Fabricator Preferences

• Changes (outside model) cost detailer time
  – Changing in 3D = 1x
  – Tracking changes on paper = 3x
    • Change provenance important for AISC certification

• Solution – stay in 3D as long as possible
  – Make modifications easily
  – Easily incorporate fabricator preferences
  – Commit to paper as late as possible

✔ Leveraging fabricator’s shop efficiencies

• But, could we actually put this all together?
Southeastern Medical Office Building

- Three story, 60,000 sf (5,600 m²)
- Structural frame 320 tons, all-in 352 tons
- **Six (6) week** turnaround from fabricator’s notice to proceed to delivery of fabrication package
- **No RFIs** and **no change orders**

- “This [process] was a lot better for us in the plant and the field. This [process] was by far the best experience I have had in a long time. [The elimination of the RFI process] saved a tremendous amount of time.”

  Greg Sain, Project Manager, CM Steel (fabricator)
Case Studies – Summer 2013

• Otarre Medical Office Building
  – Two story, 73,000 sf (6,800 m²)
  – Structural frame 318 tons, all-in 368 tons
  ✔️ Five (5) week turnaround from fabricator’s notice to proceed to delivery of fabrication package
  ✔️ No RFIs and no change orders

  – “The detailed drawings were some of the best ever. Any question we had got resolved quickly. All electronic files were excellent…. The whole process was a good experience for D & T. We saved erection time in the field.”
  Travis Crumpton, President, D&T Steel (fabricator)
Case Studies – Fall 2013

• Octapharma
  – Two story, 87,000 sf (8,100 m²)
  – Structural frame – 340 tons
  – Same process as the previous two projects
  ✔ No RFIs
  – Change orders?

  – Based on previous case studies – similar tonnage
    • Saved 8 weeks = 2 months = $2,000,000 savings to owner
Transforming Deliverables

Traditional Design-Bid-Build

Structural Design

Detailing

Construction

Fabrication

FEG Process

Detailing complete in 3D model at CDs

8 weeks

5-6 weeks for fabricator optimization

Time savings

Dollar savings

Traditional Design

Construction

Fabrication

FEG Process

Detailing
Transforming Deliverables

• What is the actual deliverable?
  – Traditional 2D Construction Documents
  – 2D PDFs to fabricator for their shop personnel
  – Electronic CNC files for the selected fabricator’s equipment
  – Not a connected model – everything fabricator needs to fabricate

• Value
  – Shortened construction schedule – earlier revenue for owner
  – Lower financing costs
  – Virtual elimination of RFIs and change orders
Closing Remarks

• “Typical” workflow for FEG Complete Structural Package™ looks like design-build

• Who works for who?
  – Detailer works for FEG, this is not engineers doing shop drawings
    • No formal partnership, separate entity
  – FEG works for
    • Architect (during design)
    • Contractor (during or after design)
    • Owner (during design)
    • Fabricator (during or after design)
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Thank you

Questions?