Structural Detailing Services by Structural Engineers – Who, How, When, and Why?

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Class summary

With Revit software and Advance Steel software, structural engineers have tools available to enable them to take their designs past construction documents and into fabrication and construction. Construction schedules are faster, integrated project delivery is more common, and the Who, How, Why and When of structural shops drawings and fabrication models are changing. This presentation will show how US-based structural engineers who already create their design models and drawings with Revit software can use this same software to create shops drawings from their fabrication models for rebar, precast, and structural steel, and also create concrete lift drawings. Attendees will learn why these services are offered, how engineers can offer them, and best practices to follow to offer Building Information Modeling (BIM)-based structural shop drawings. This session features Revit Structure and Advance Steel.

Key learning objectives

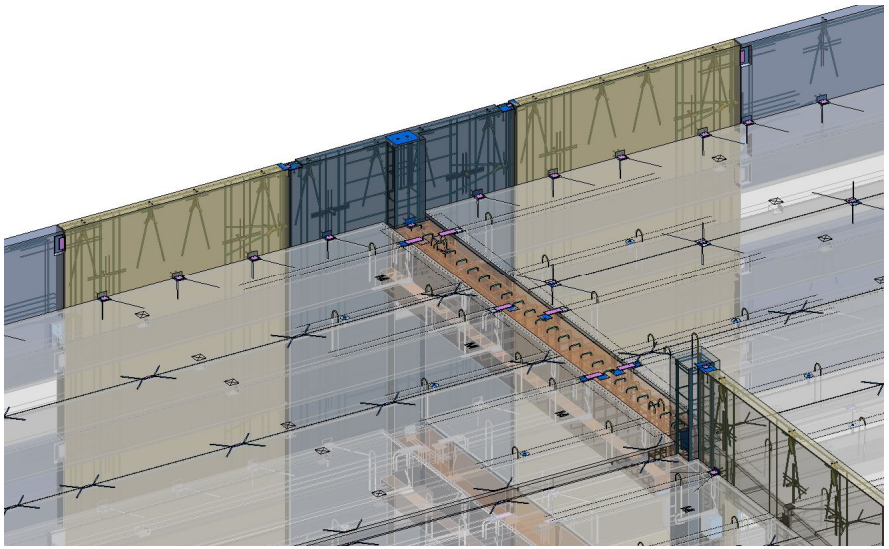
At the end of this class, you will be able to:

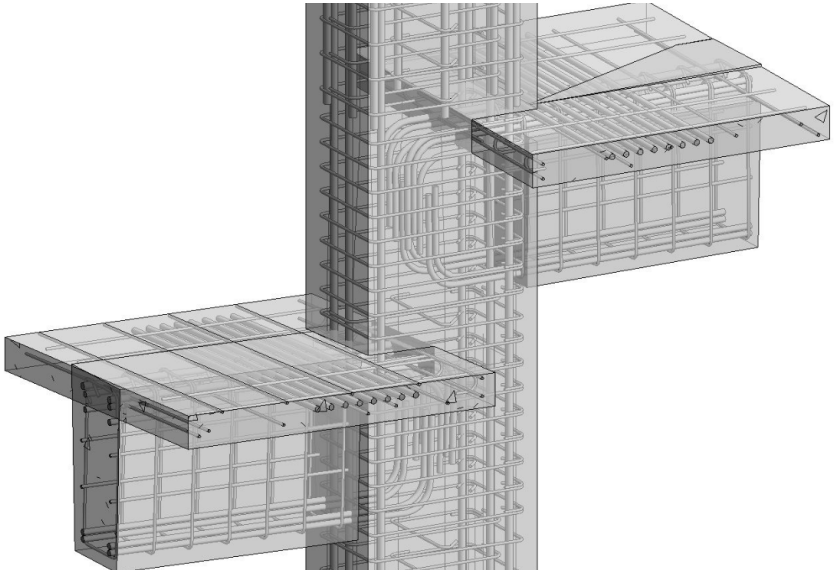
- Learn how BIM can be used to bridge the information gap between design and construction for a typical project.
- Learn how design data can be utilized to start construction activities earlier than a typical design-bid-build process.
- Learn what types of construction services can be readily offered by entities acting as the link between design and construction.
- Learn what the advantages and disadvantages of such BIM-based delivery are to common project participants

MB BIM Solutions

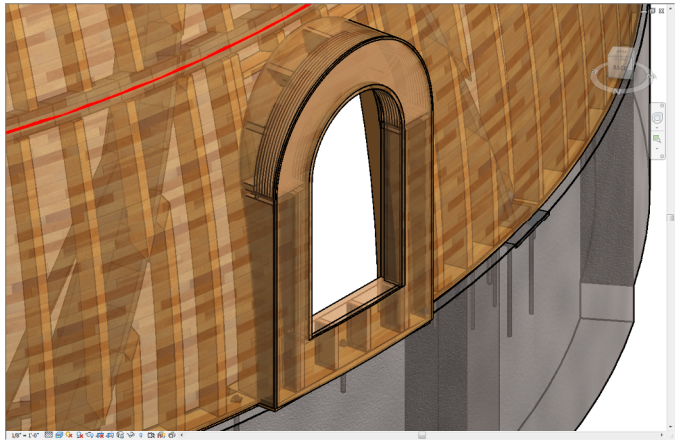
A Quick Overview of What We Do:

- Fabrication Level Models (and Shop Drawings from these models):
  - Rebar, Precast, Structural Steel and Miscellaneous Metals



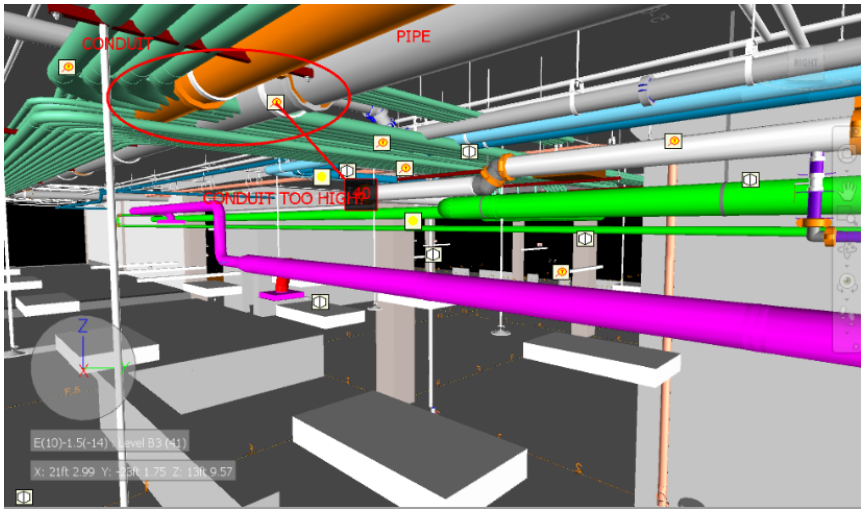


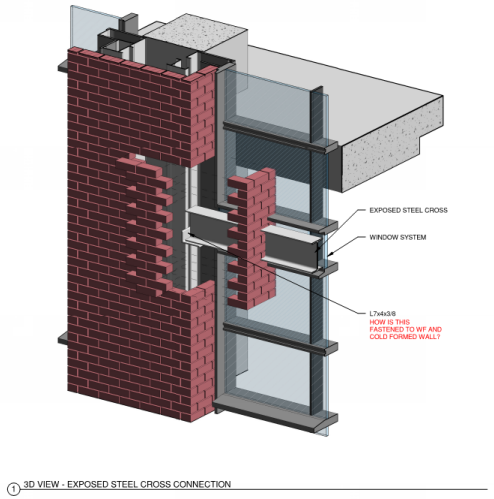
MB BIM Solutions

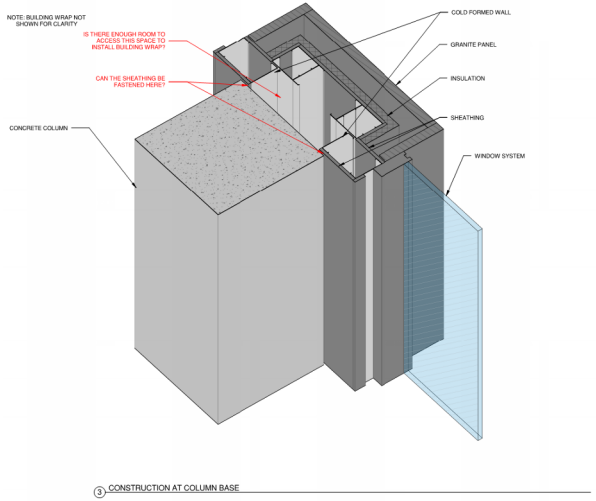


A Quick Overview of What We Do:

- Navisworks Coordination
- Custom Modeling
  - Virtual Mock-Ups, Constructability Studies



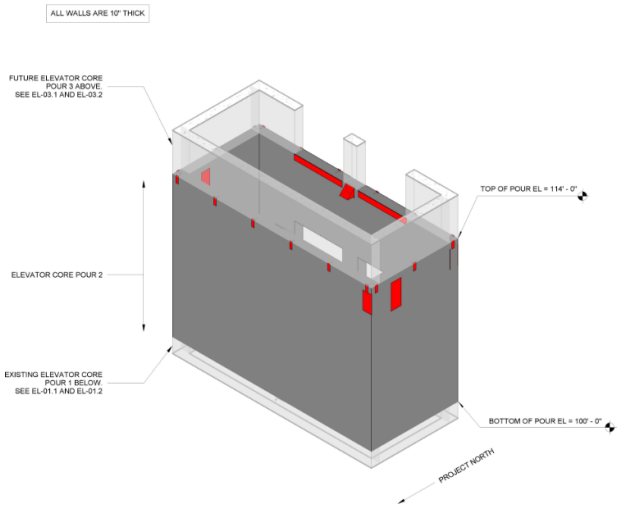


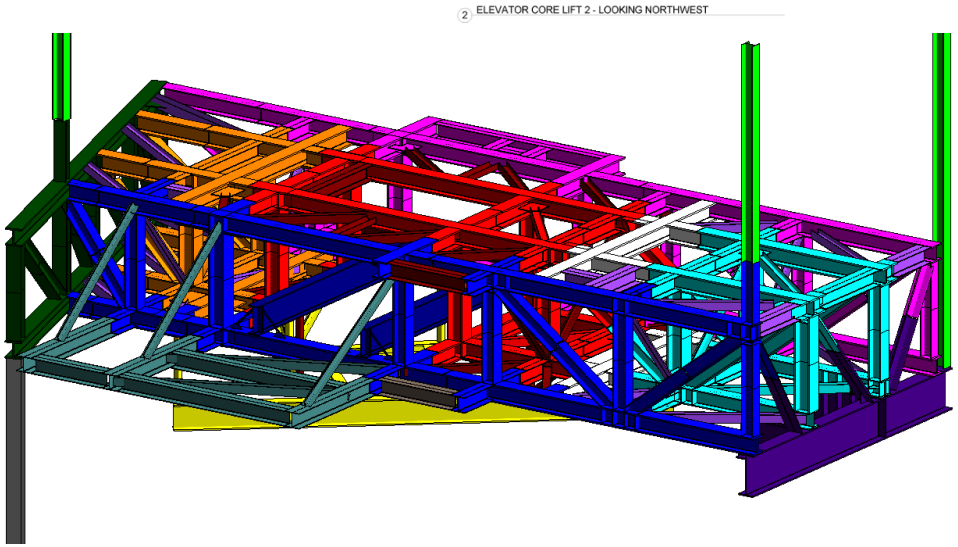


MB BIM Solutions

A Quick Overview of What We Do:

- Concrete Lift Drawings
- Construction Sequence Modeling/Animations
- Model-Based Estimating





Introduction

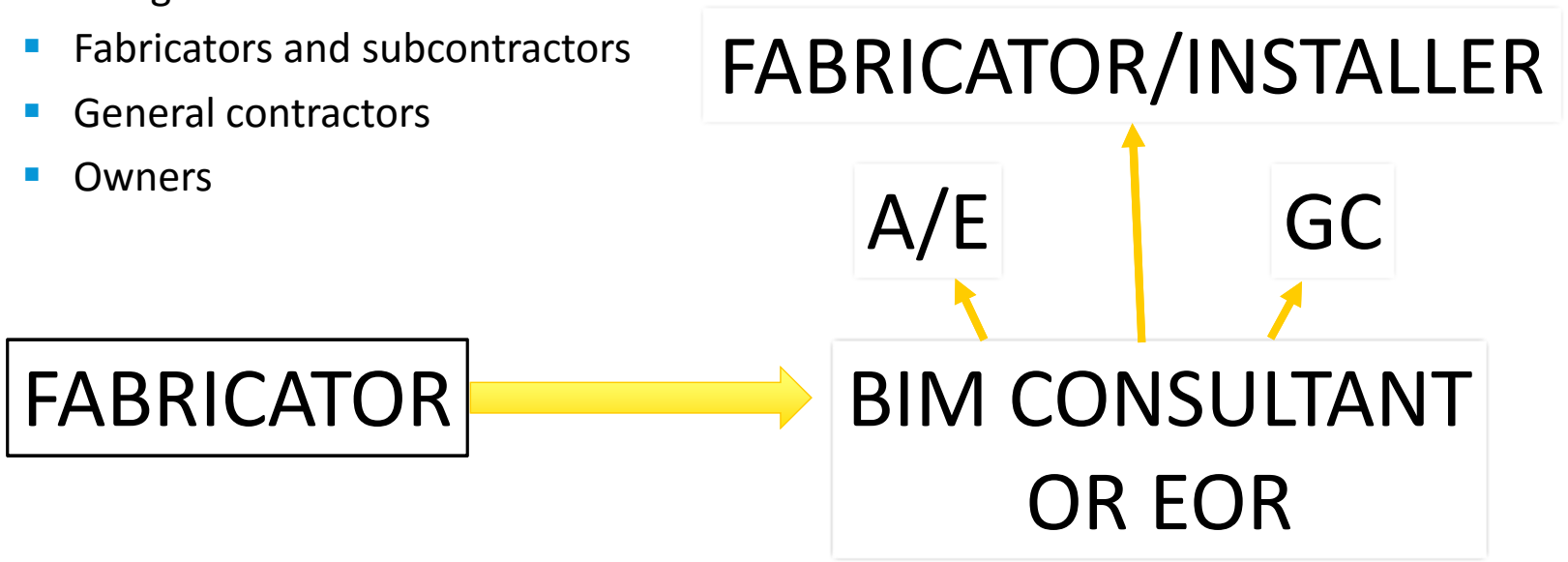
Outline:

- General ‘who’, ‘how’, ‘when’ and ‘why’ BIM is being used to create fabrication drawings and how it applies to:
- Rebar Shop Drawings
- Concrete Lift Drawings
- Steel Shop Drawings
- Precast Shop Drawings

Introduction

BIM is changing ‘who’, ‘how’, ‘when’ and ‘why’ fabrication drawings are being created

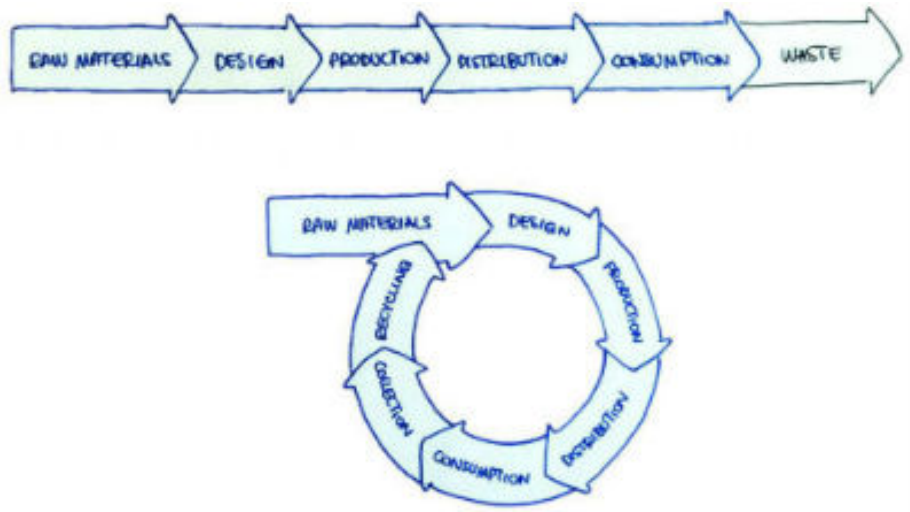
- Who (and why): From Fabricators and subcontractors to engineers and BIM consultants
  - Design team
  - Fabricators and subcontractors
  - General contractors
  - Owners



Introduction

BIM is changing ‘who’, ‘how’, ‘when’ and ‘why’ fabrication drawings are being created

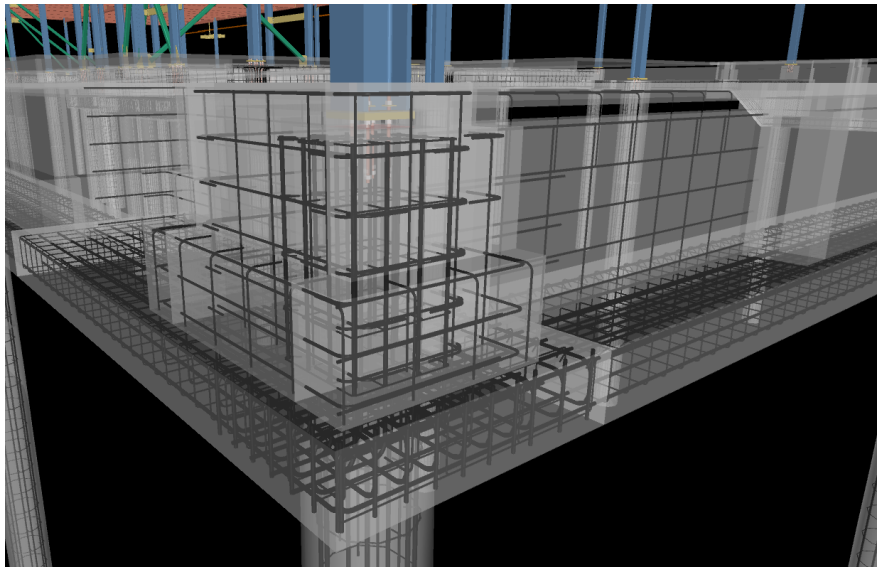
- When: From design-bid-build approach to collaborative (during design)
  - As early as possible!
  - Varies based on service offered



Introduction

BIM is changing ‘who’, ‘how’, ‘when’ and ‘why’ fabrication drawings are being created

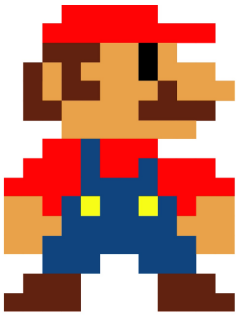
- Why: Result of faster construction schedules and improvements to BIM
  - Advantages
  - Disadvantage



Introduction

BIM is changing ‘who’, ‘how’, ‘when’ and ‘why’ fabrication drawings are being created

- How: From 2D Cad and Tekla or SDS/2 to Revit and Advance Steel
  - **Leveraging design team models**
  - Models from other subs
  - Models as a communication tool
  - Common Software
  - Modeling Techniques

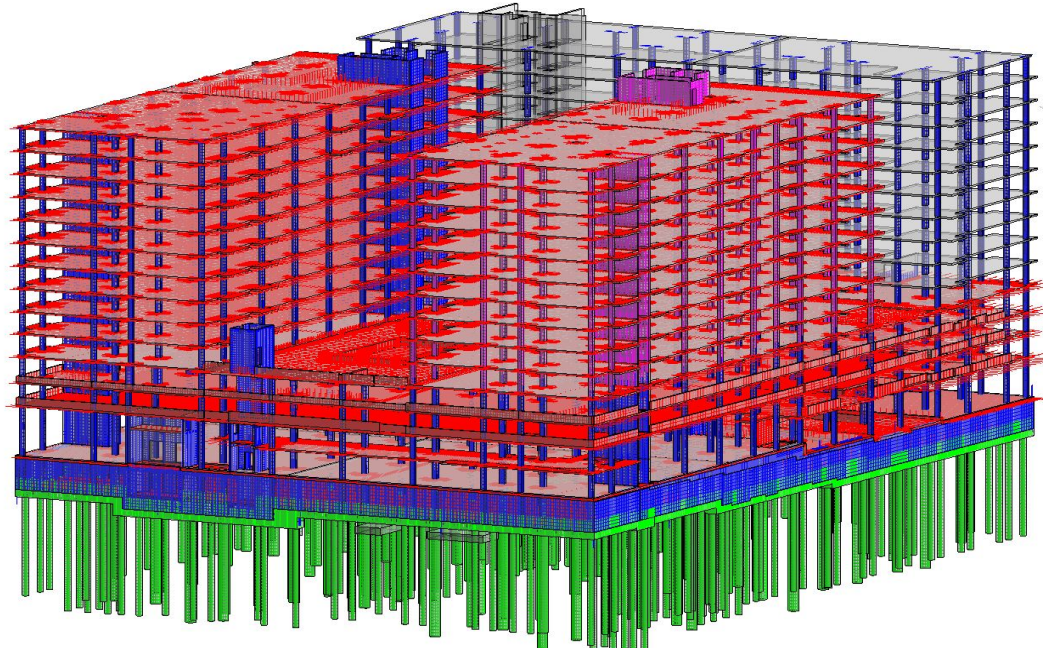


VS.

Rebar Modeling and Shop Drawings in Revit

Who?

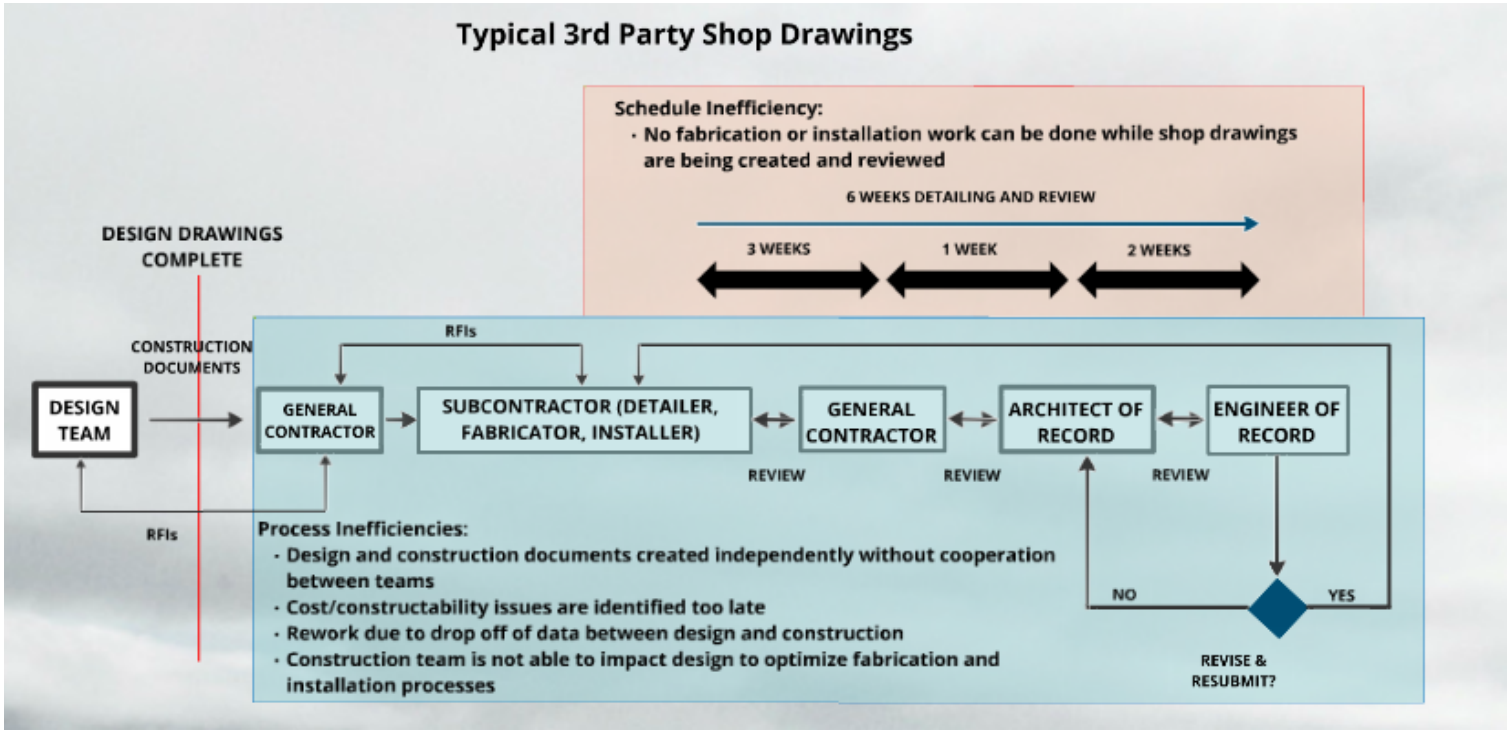
- **BIM Consultant** (or **EOR**) hired by the **concrete sub** or **CG**
- Works with the **EOR**, **fabricator** and **installer**



Rebar Modeling and Shop Drawings in Revit

When?

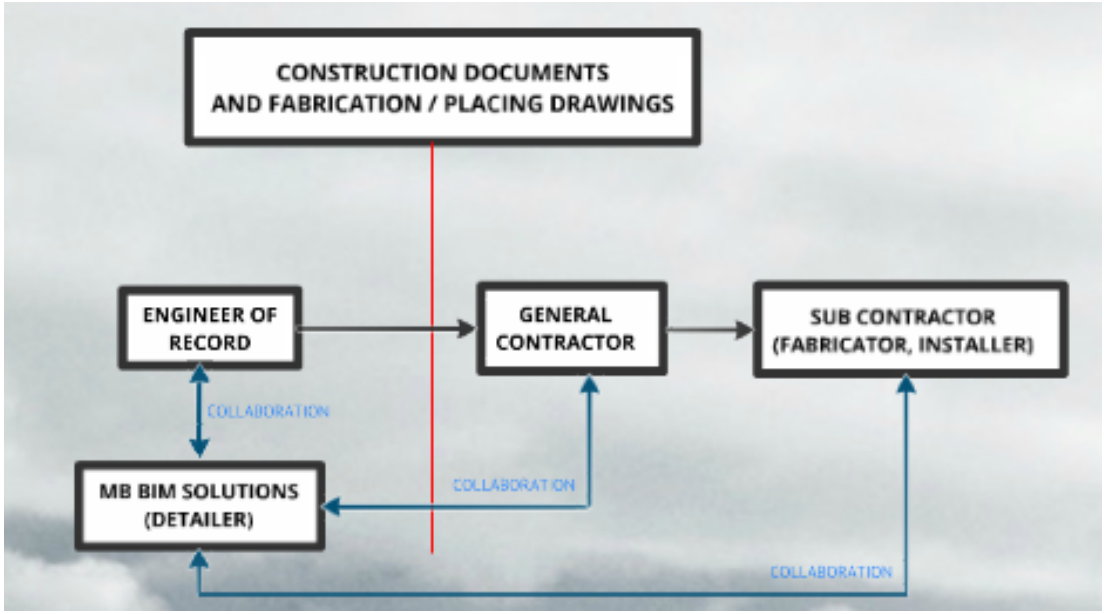
- Typical Process



Rebar Modeling and Shop Drawings in Revit

When?

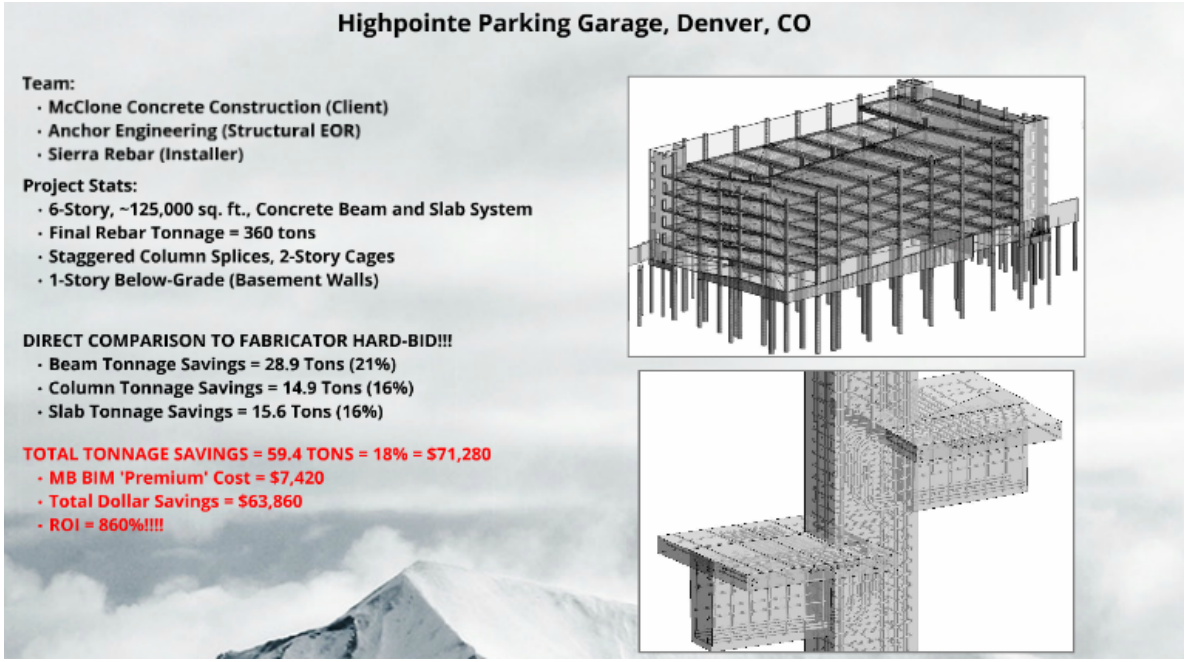
- Integrated Process
- “Red light / green light”



Rebar Modeling and Shop Drawings in Revit

Why?

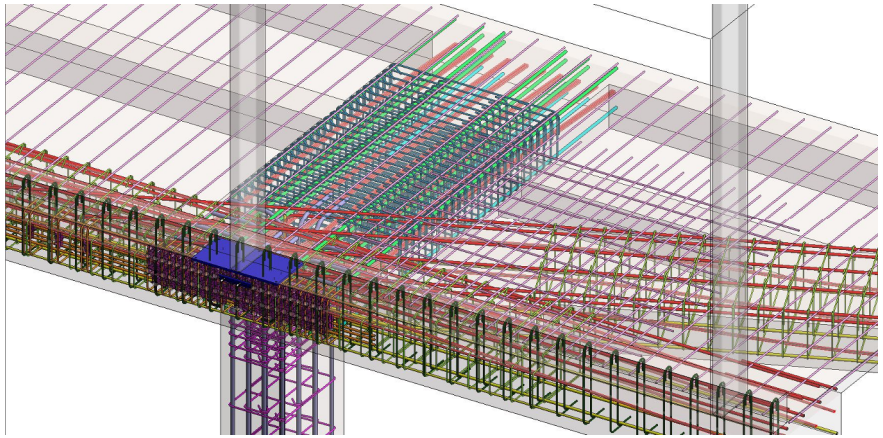
- Advantages:
  - Schedule
  - Reduced tonnage

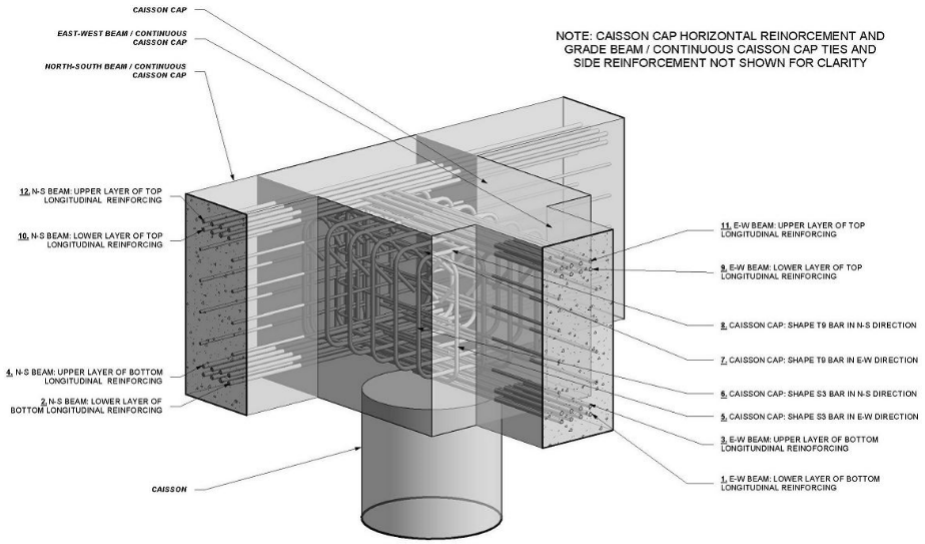


Rebar Modeling and Shop Drawings in Revit

Why?

- Advantages:
  - Schedule
  - Reduced tonnage
  - Efficiency / enhanced coordination
  - Reduced Congestion
  - Accuracy



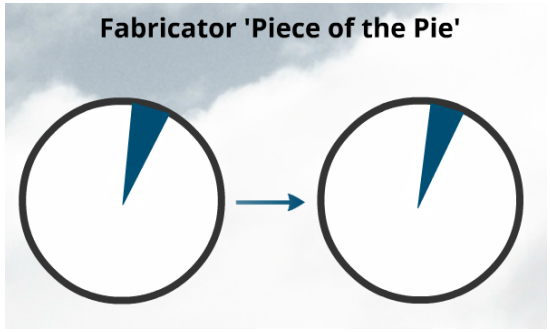


CAISSON CAP AND GRADE BEAM / CONTINUOUS CAISSON CAP SAME DEPTH

Rebar Modeling and Shop Drawings in Revit

Why?

- Disadvantages:
  - Change in risk
  - Knowledge of industry standards / preferences
  - Fabricator Involvement
  - Aesthetics
  - Type of Job



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3															
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5															
6	Placing Instructions	Grade	Unit	Qty	Item	Typ	Total	Part	Tot Lgt	Cut Lgt	Mark	Bend	A	B	C
7	COLUMN POUR 3A	60		77	1		77	4	7-3.3	7-3.3	4T200	T2	0-4.2	1-9	1-9
8	6.494 tons	|		78	2		78	4	7-6	7-6	4T201	T1	0-4.2	1-9	1-9
9		|		49	3		49	4	9-3.3	9-3.3	4T202	T2	0-4.2	2-9	1-9
10		|		49	4		49	4	2-5	2-5	4T203	T9	0-4.2	1-9	
11		|		13	5		13	4	7-7.3	7-7.3	4T204	T2	0-4.2	1-11	1-9
12		|		13	6		13	4	10-2	10-2	4T205	T1	0-4.2	3-1	1-9
13		|		49	7		49	4	3-10.2	3-10.2	4T206	02	0-8	2-9	
14		|		6	8		6	4	6-10	6-10	4T209	T1	0-4.2	1-7	1-7
15		|		5	9		5	4	8-3.3	8-3.3	4T210	T2	0-4.2	2-6	1-6
16		|		1	10		1	4	6-7.3	6-7.3	4T212	T2	0-4.2	1-8	1-6
17		|		7	11		7	4	6-3.3	6-3.3	4T213	T2	0-4.2	1-6	1-6
18		|		4	12		4	11	28-2.2	28-2.2	11T235	31		18-8.2	2-6.1
19		|		54	13		54	11	28-0.2	28-0.2	11T236	31		18-6.2	2-6.1
20		|		24	14		24	11	17-5	17-5	11T237	31		7-11	2-6.1
21		|		4	15		4	11	28-0.3	28-0.3	11T242	31		19-0.3	2-0.1
22		|			16										
23	COLUMN POUR 3B	|		127	17		127	4	7-3.3	7-3.3	4T200	T2	0-4.2	1-9	1-9
24	5.682 tons	|		57	18		57	4	7-6	7-6	4T201	T1	0-4.2	1-9	1-9
25		|		17	19		17	4	9-3.3	9-3.3	4T202	T2	0-4.2	2-9	1-9
26		|		17	20		17	4	2-5	2-5	4T203	T9	0-4.2	1-9	
27		|		17	21		17	4	3-10.2	3-10.2	4T206	02	0-8	2-9	
28		|		5	22		5	4	6-10	6-10	4T209	T1	0-4.2	1-7	1-7
29		|		2	23		2	4	8-3.3	8-3.3	4T210	T2	0-4.2	2-6	1-6
30		|		11	24		11	4	6-3.3	6-3.3	4T213	T2	0-4.2	1-6	1-6
31		|		56	25		56	11	28-0.2	28-0.2	11T236	31		18-6.2	2-6.1
32		|		12	26		12	11	17-5	17-5	11T237	31		7-11	2-6.1

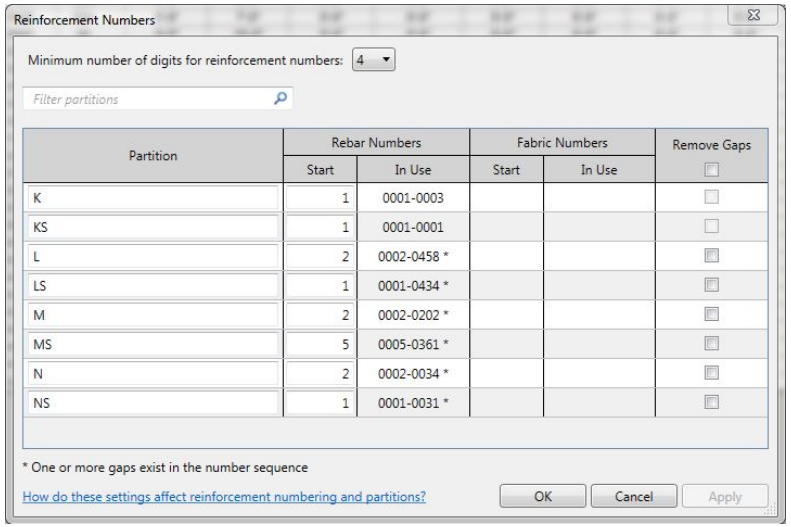
Construction Contingency:

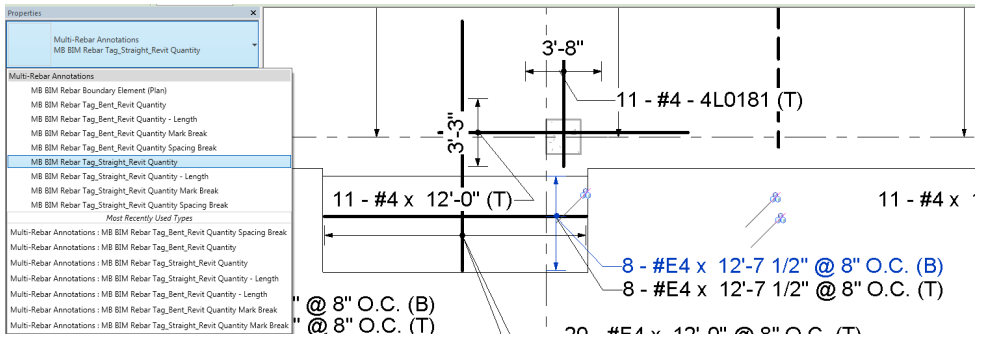
CONTRACTOR will carry a construction contingency to cover detailing errors and/or omissions that result in material reorder and/or rescheduling of work.

Rebar Modeling and Shop Drawings in Revit

How?

- Revit
  - EOR – Same model??
  - Rebar Numbering
  - Multi-rebar tags
  - Rebar tools
- Add-ins
  - SOFiSTik
  - Graitec PowerPack

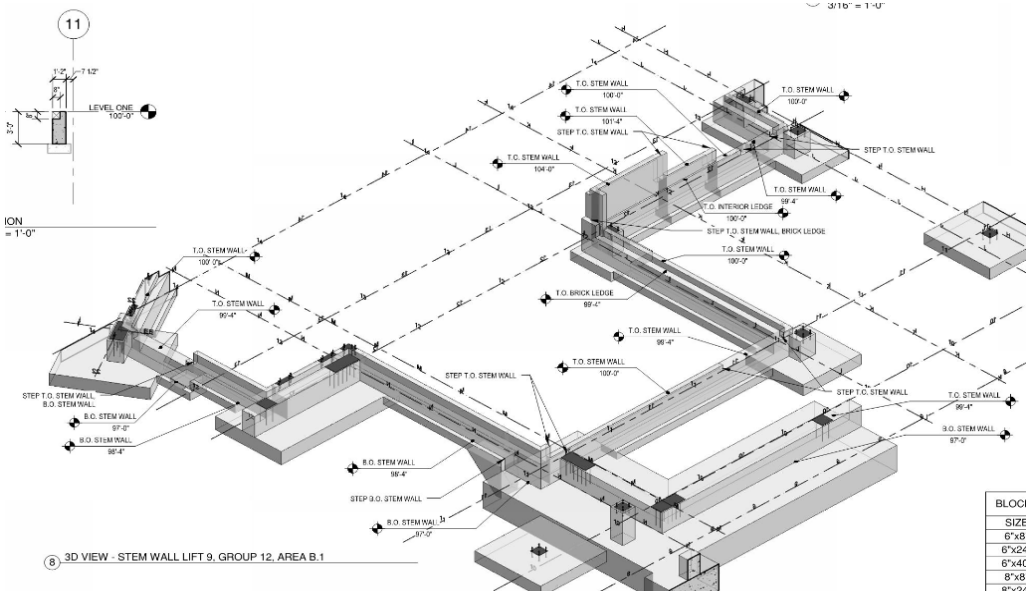


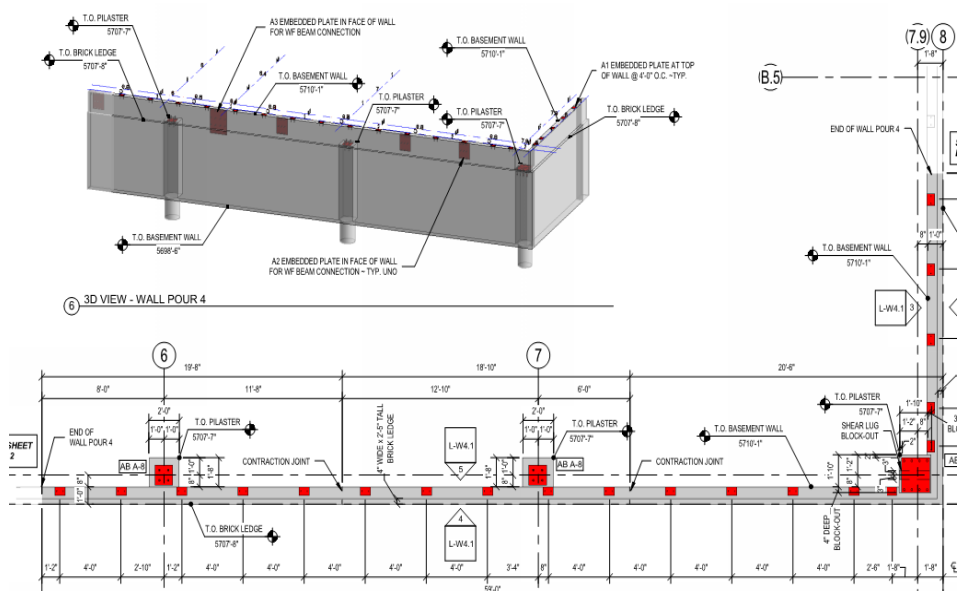


Cast-in-Place Concrete Lift Drawings in Revit

What Are in Concrete Lift Drawings?

- All concrete edges and items embedded in concrete

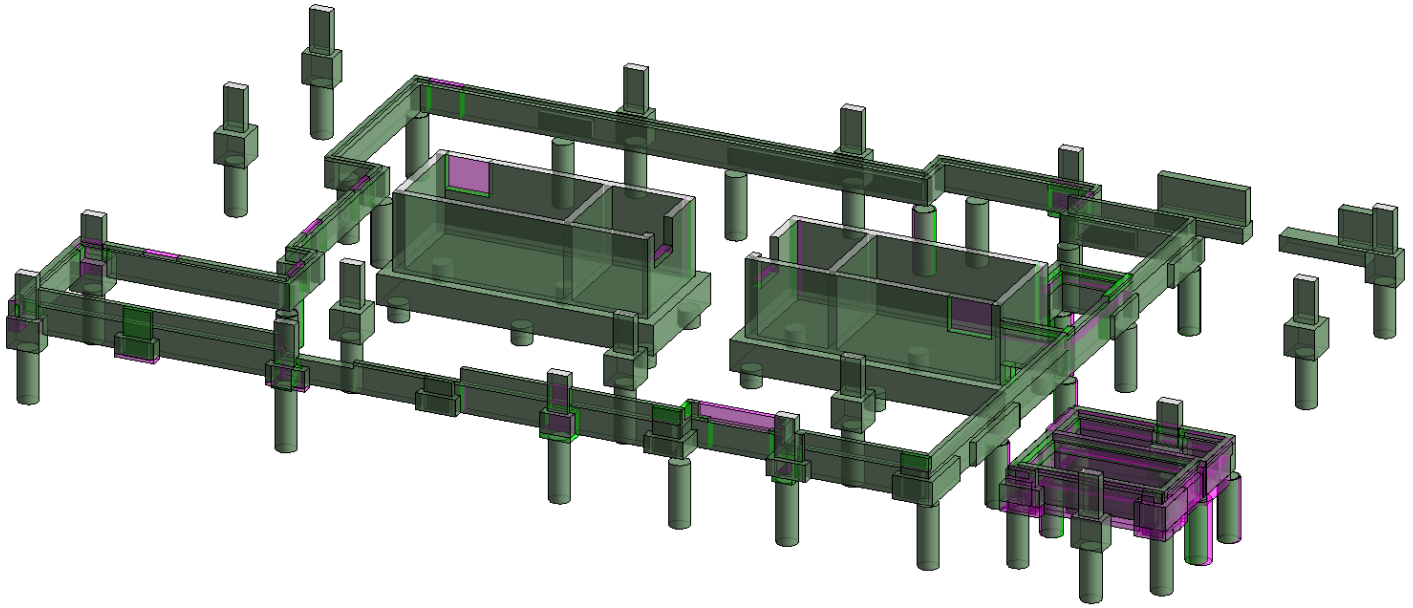




Cast-in-Place Concrete Lift Drawings in Revit

Who?

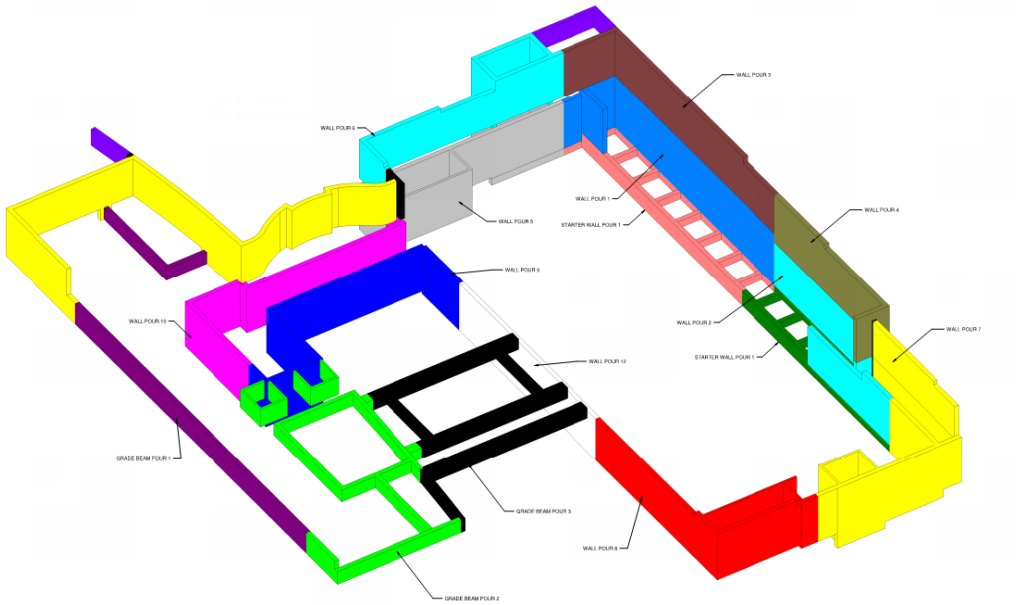
- **BIM Consultant** hired by the **concrete sub** or **GC**
- Works with the **EOR**, **concrete sub** and **other trades**
- **EOR** for lift Drawings???



Cast-in-Place Concrete Lift Drawings in Revit

When?

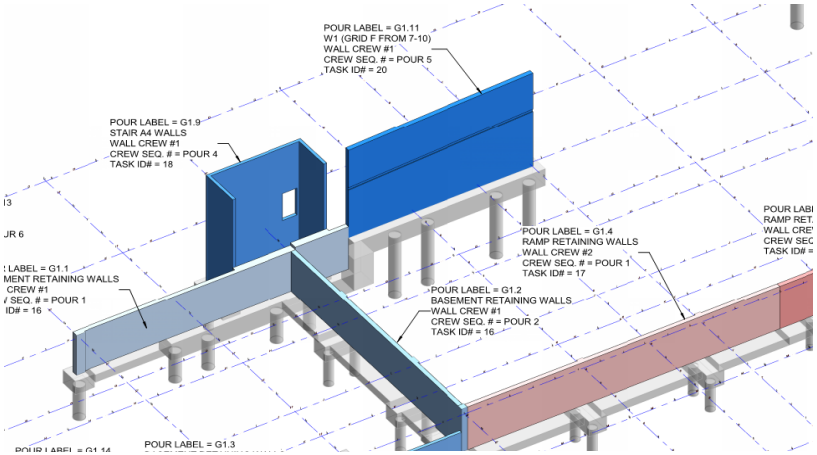
- Early in design to assist with:
  - Pour Planning, sequencing, material estimates
- Later in design for drawing production



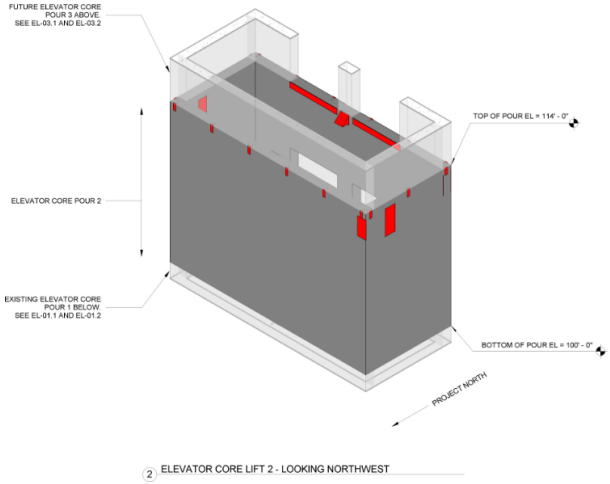
Cast-in-Place Concrete Lift Drawings in Revit

Why?

- Advantages:
  - Enhanced Productivity
  - Field Labor Visualization
  - Model Sharing
  - Enhanced Coordination
  - Quantity Management
  - Schedule Management
- Disadvantages:
  - Lack of participation by CIP internal team
  - Type of Job



BLOCK-OUTS - GROUP 14	
SIZE	LENGTH
2"x6"	2'-1 5/8"
4"x8"	10'-4"
6"x6"	41'-7 1/8"
6"x16"	13'-5 1/2"
8"x8"	61'-2 1/4"
8"x16"	5'-4 3/4"
14"x8"	16'-0 1/4"
16"x16"	5'-4 1/4"
16.5"x16"	24'-0 1/8"

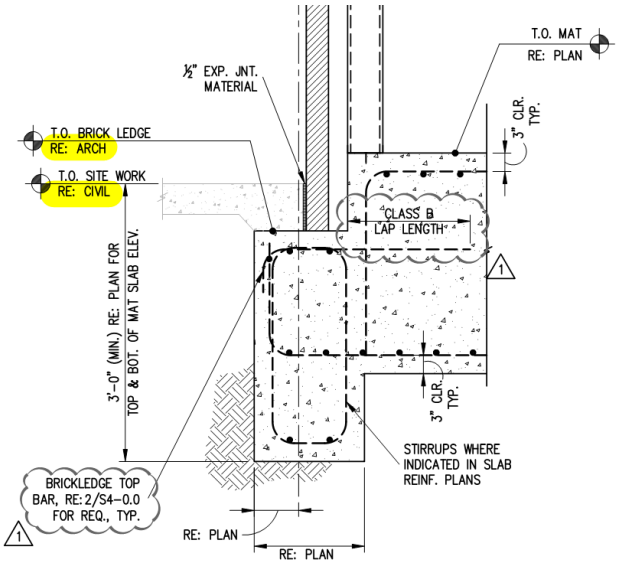


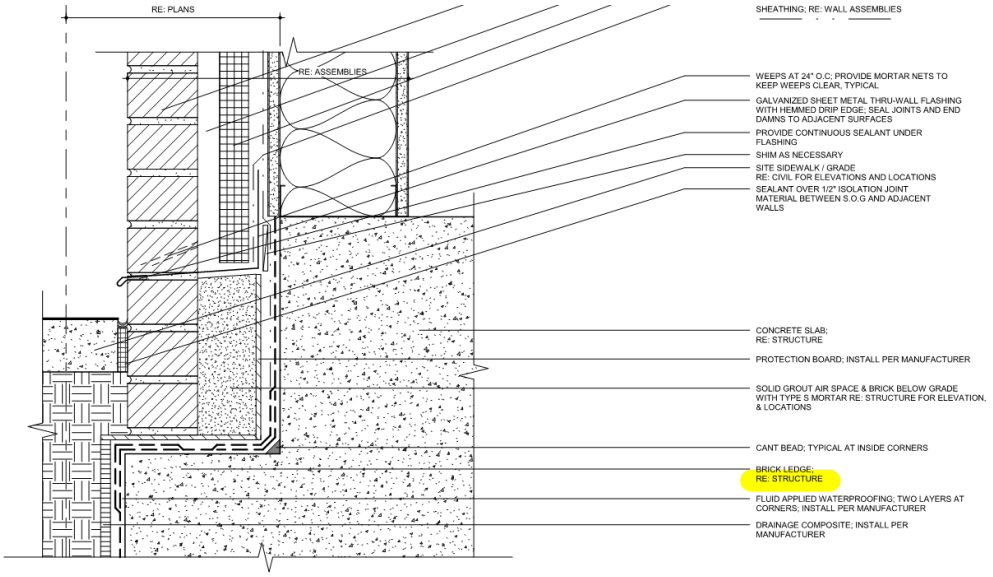
2 ELEVATOR CORE LIFT 2 - LOOKING NORTHWEST

Cast-in-Place Concrete Lift Drawings in Revit

How?

- Use structural and architectural models as linked models
  - Design drawings reviews for all concrete – RE: ARCH and RE: STRUCT
- What to look for?
  - Constructability, sequencing, access, design discrepancies

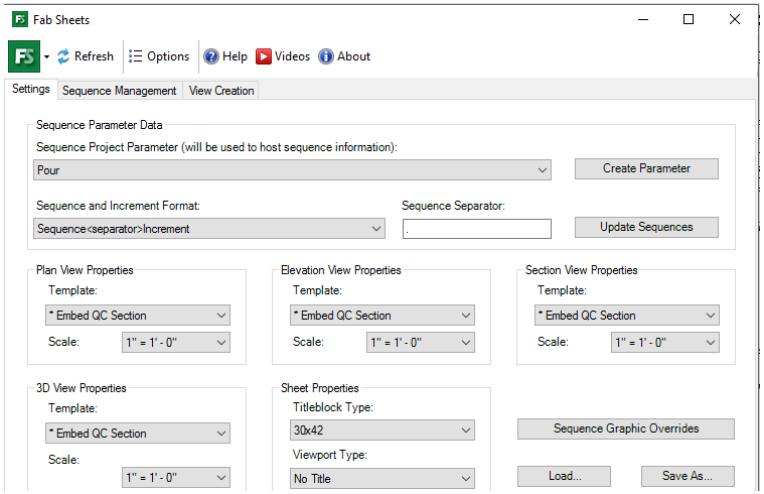


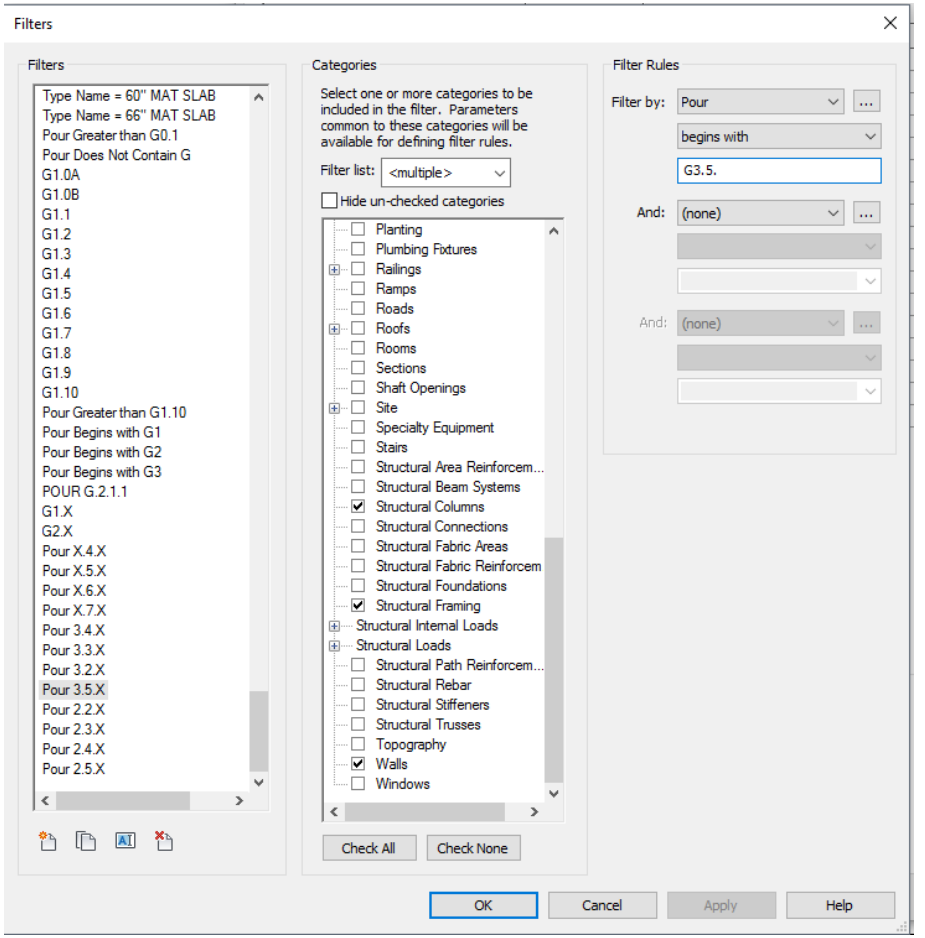


Cast-in-Place Concrete Lift Drawings in Revit

How?

- Revit
  - Pour Parameter Controls Everything
  - Parts
- Add-ins
  - Fab Sheets by CTC





Steel Shop Drawings in Revit and Advance Steel

Steel Shop Drawing Background

- Modeling in 3D is not new to steel detailers
- EOR's and BIM Consultants now have the tools to detail steel

Who?

- **BIM Consultant** (or **EOR**) hired by the **GC**
- Works with the **EOR**, ***fabricator** and **installer**

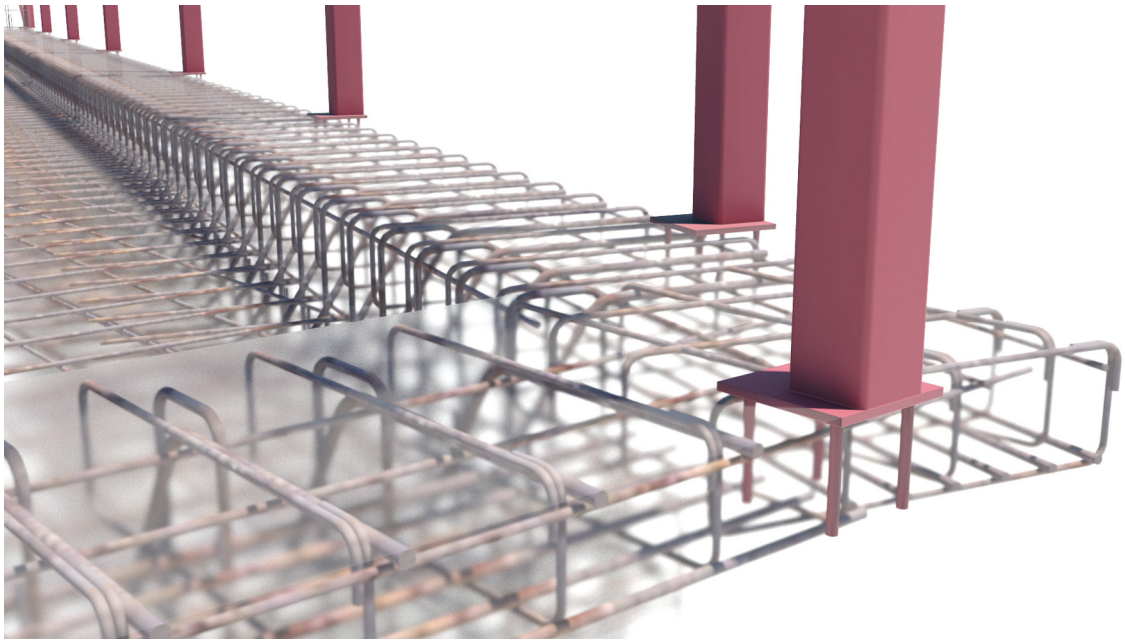
When?

- Different based on project delivery method
- "Red light / green light"
- Integrated approach

Steel Shop Drawings in Revit and Advance Steel

Why?

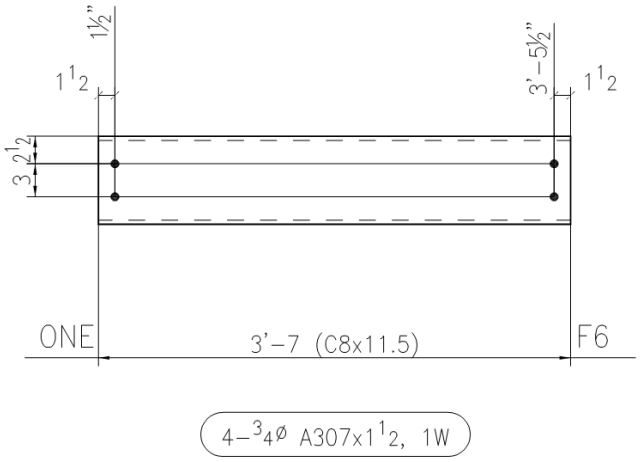
- Advantages:
  - Schedule
  - Efficiency Savings / Enhanced Coordination
  - Accuracy

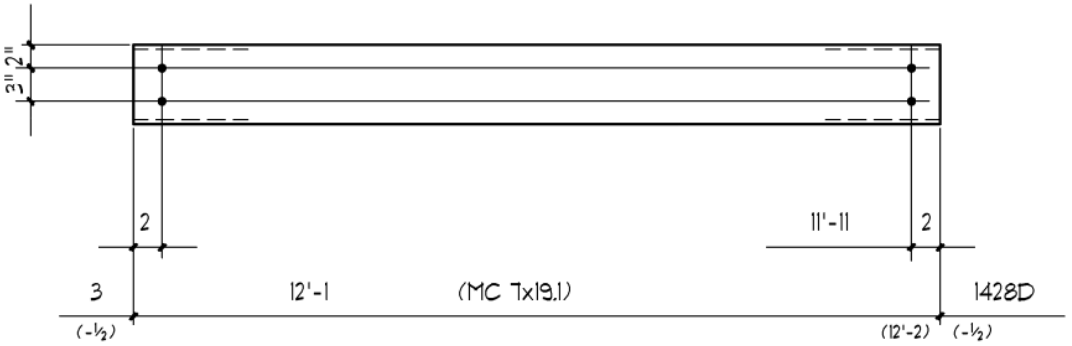


Steel Shop Drawings in Revit and Advance Steel

Why?

- Disadvantages:
  - Knowledge of industry standards / preferences
  - Aesthetics
  - Change in risk

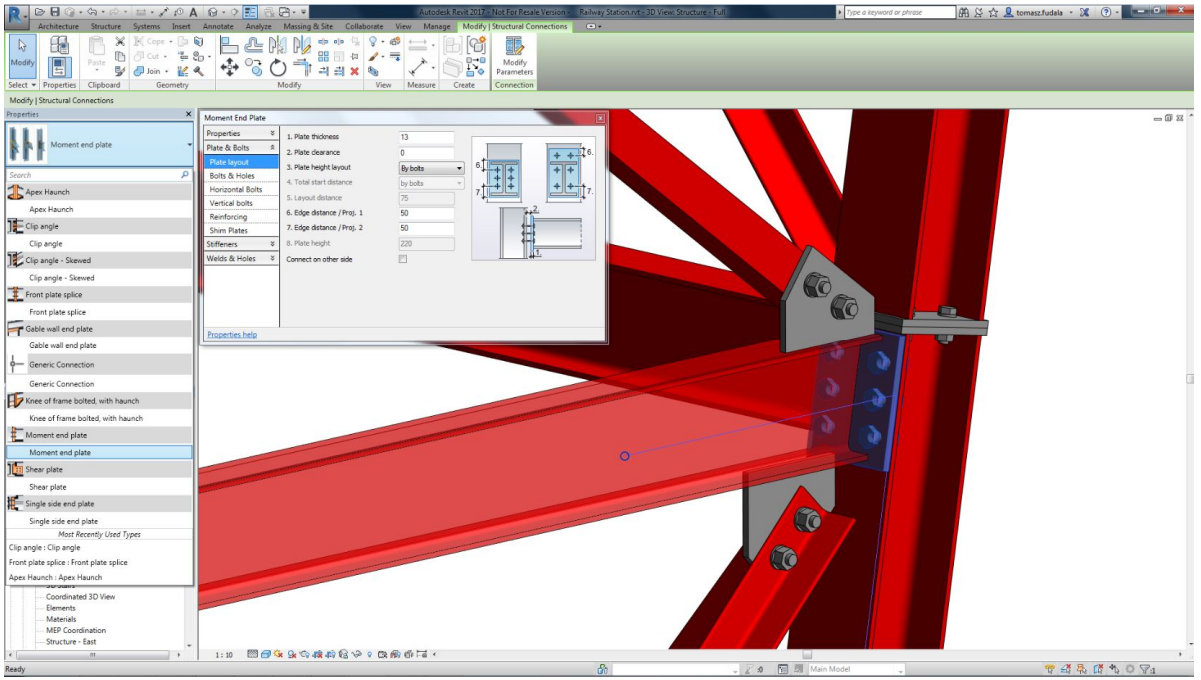




Steel Shop Drawings in Revit and Advance Steel

How?

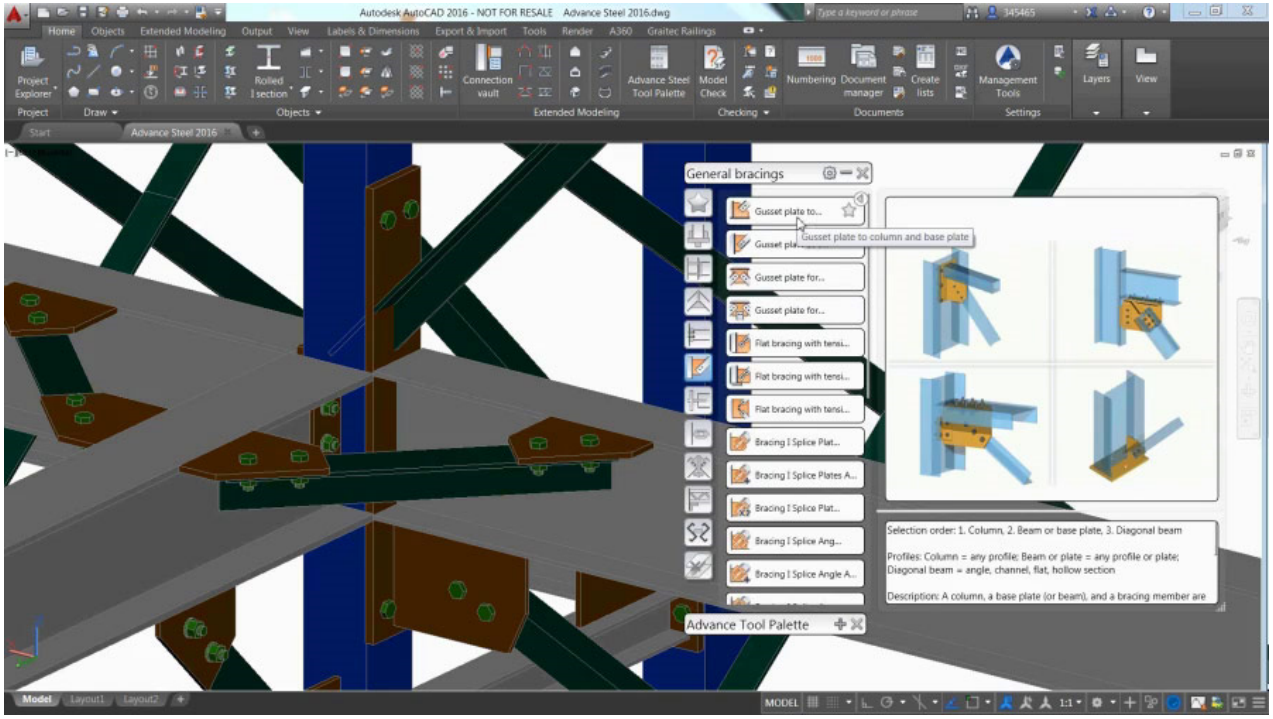
- Use the models!
- Revit
  - Structural connection add-on
  - Assemblies (connections cannot be included in assemblies)



Steel Shop Drawings in Revit and Advance Steel

How?

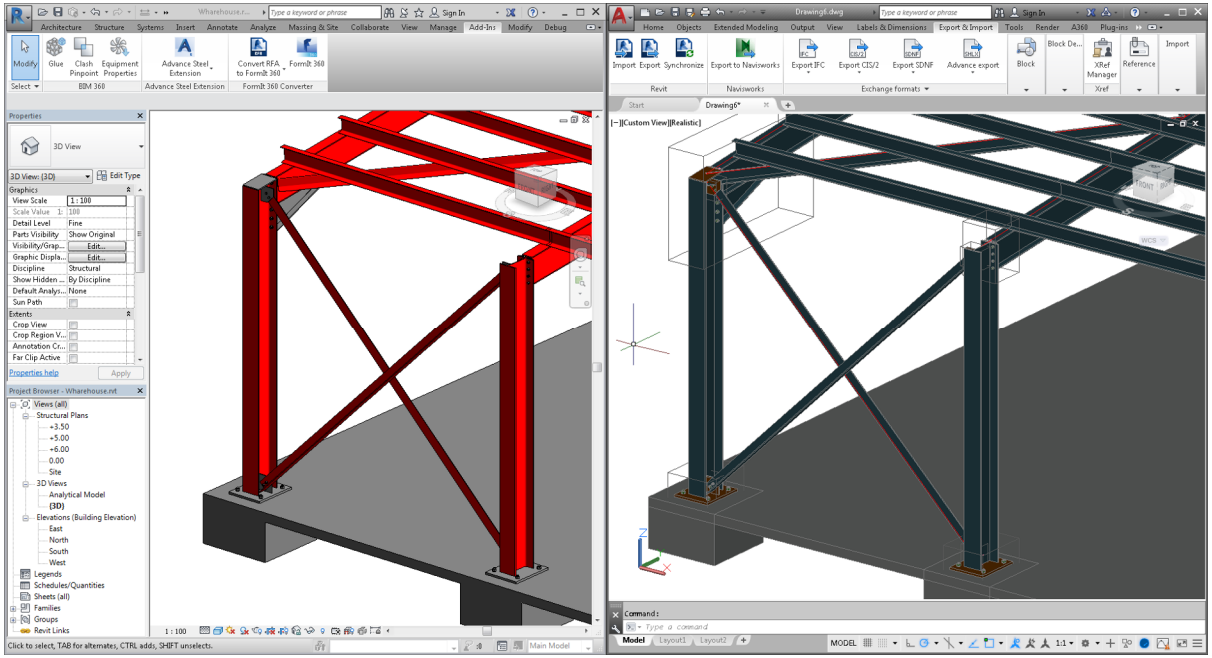
- Advance Steel
  - Sheet creation
  - Advance steel connections
  - CNC Output



Steel Shop Drawings in Revit and Advance Steel

How?

- Revit and Advance Steel
  - Linking models
  - Workflow: Revit -> AS
  - Connection checking



Precast Modeling and Shop Drawings in Revit

Introduction to Precast

- Precast background
- Old (current) process

Who?

- **BIM Consultant** (or **EOR**) hired by the **precast fabricator**
- Works with the ***precast fabricator** and **design team**

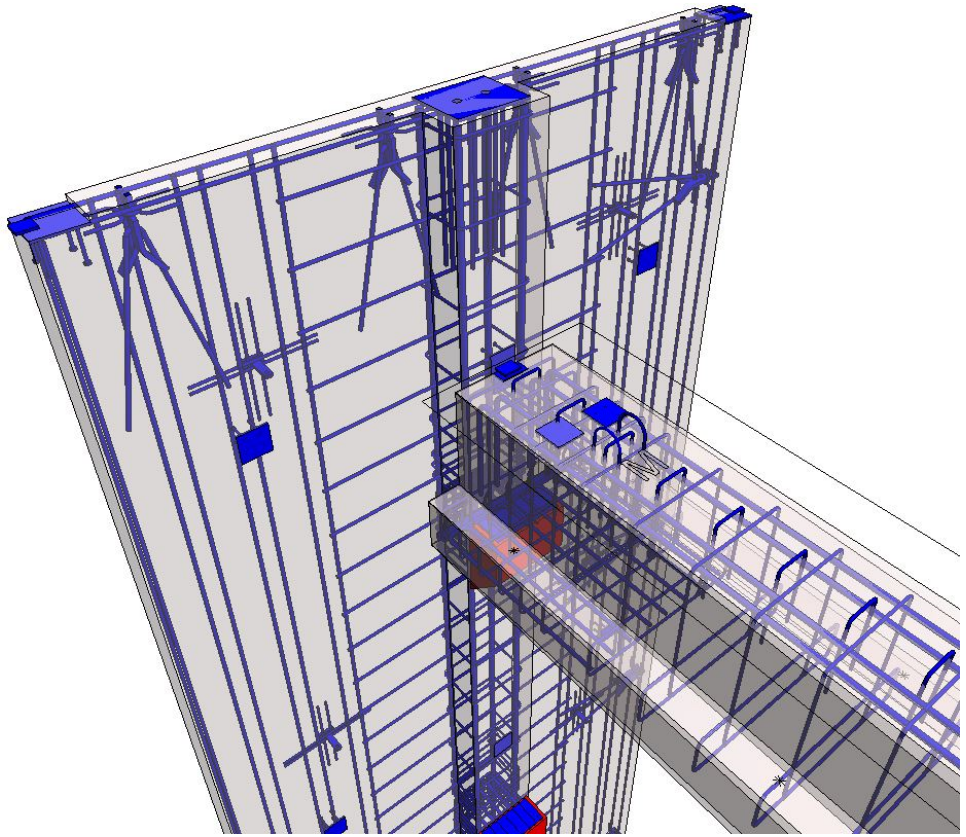
When?

- Should be involved during design
- “Red light / green light”
- Integrated approach

Precast Modeling and Shop Drawings in Revit

Why?

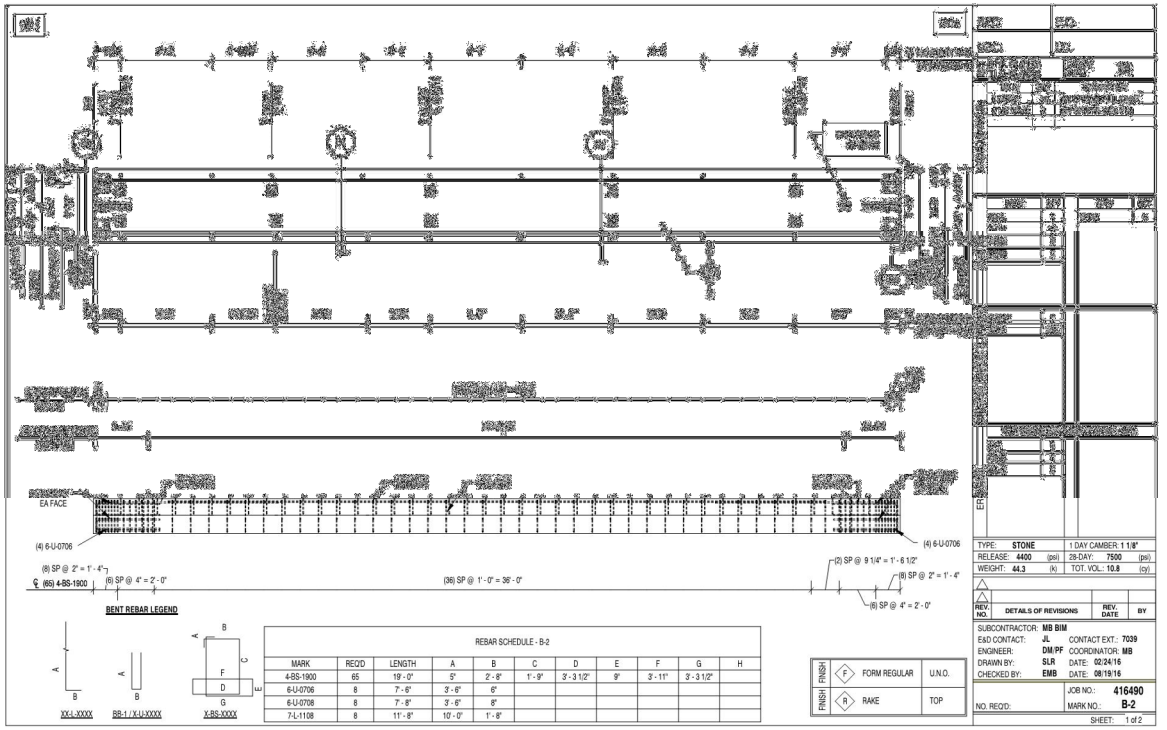
- Advantages:
  - Schedule
  - Efficiency Savings / Enhanced Coordination
  - Winning the job
  - Accuracy



Precast Modeling and Shop Drawings in Revit

Why?

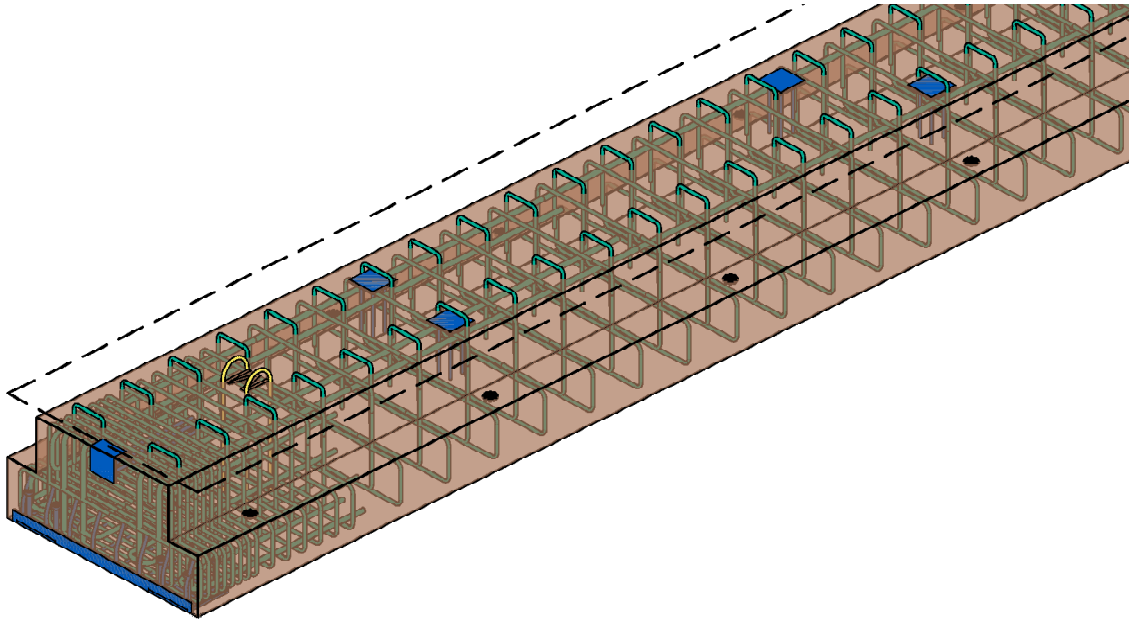
- Disadvantages:
  - Knowledge of industry standards / preferences
  - Aesthetics
  - Tools and Resources



Precast Modeling and Shop Drawings in Revit

How?

- Use the models!
- Revit
  - Model Components
  - Rebar Tools
  - View Templates
  - Assemblies
- Add-ins
  - AGACAD Precast Concrete Suite
  - Edge for Revit



How did I do?

- Your class feedback is critical. Fill out a **class survey** now.
- Use the AU mobile app or fill out a class survey online.
- Give feedback after each session.
- AU speakers will get feedback in real-time.
- **Your feedback results in better classes and a better AU experience.**