Utilizing Supplemental Modeling in Coordination – Responsibility of General Contractors

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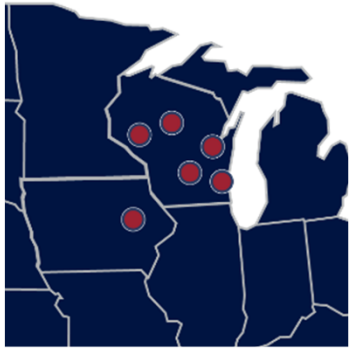
AUTODESK. UNIVERSITY

About the speaker

Matthew Selle

Matt Selle’s involvement within the AEC industry spans 16 years, with the first 10 years in design roles as a CAD/Revit specialist. Transitioning to the construction industry, Matt spent four years as a BIM department lead at a Top 100 ENR General Contractor, and currently serves as a virtual construction specialist at Miron Construction Co., Inc. (also a Top 100 ENR company). Matt has been the VDC lead on more than $1 billion in construction work and has played an integral part in moving many of Miron's cloud-based technologies forward, establishing Miron as a VDC leader in the Midwest. He has been utilizing Autodesk products since 2000. Matt’s speaking engagement experience includes local ASHRAE and AUGI events. Hobbies Include: Volleyball, Curling, and the Outdoors. Wife (Addy), Son (Nolan), Daughter (March 2020).

About Our Company



Miron Building Excellence

- 100+ year heritage, third-generation, family-owned corporation
- One of the largest builders in the Midwest serving diverse industries, with 1,500+ employees
- Drivers:
  - Relationships
  - Sustainability
  - Solutions
  - Community
  - Dreams
  - Innovation
- $1 Billion Volume

Supplemental Modeling in Coordination

In today's BIM environment, which is focused on the leading edge of technology, it is important for BIM/VDC departments to **stay connected to drawings**, submittals, and other information in order to **identify any gaps** and ensure that all necessary elements are incorporated in a model.

Learning Objectives

- Provide project management use cases to obtain submittal and shop drawing information
- Create a thorough checklist of what to look for when reviewing construction documents
- Provide assurance for subcontractors that they are coordinating against all known elements
- Make a clear path for third-party subcontractors (not usually a part of BIM coordination) for ease of installation

MEPFP Coordination Issues on Project Sites


FIRE AUTO SPRIN

Uncommon Components Potentially Leading to Jobsite Issues

Impacts of Failed BIM Coordination

- Schedule delays
- Re-coordination
- Multiple stakeholders are involved
- Change Orders
- Wasted Material
- Project Morale

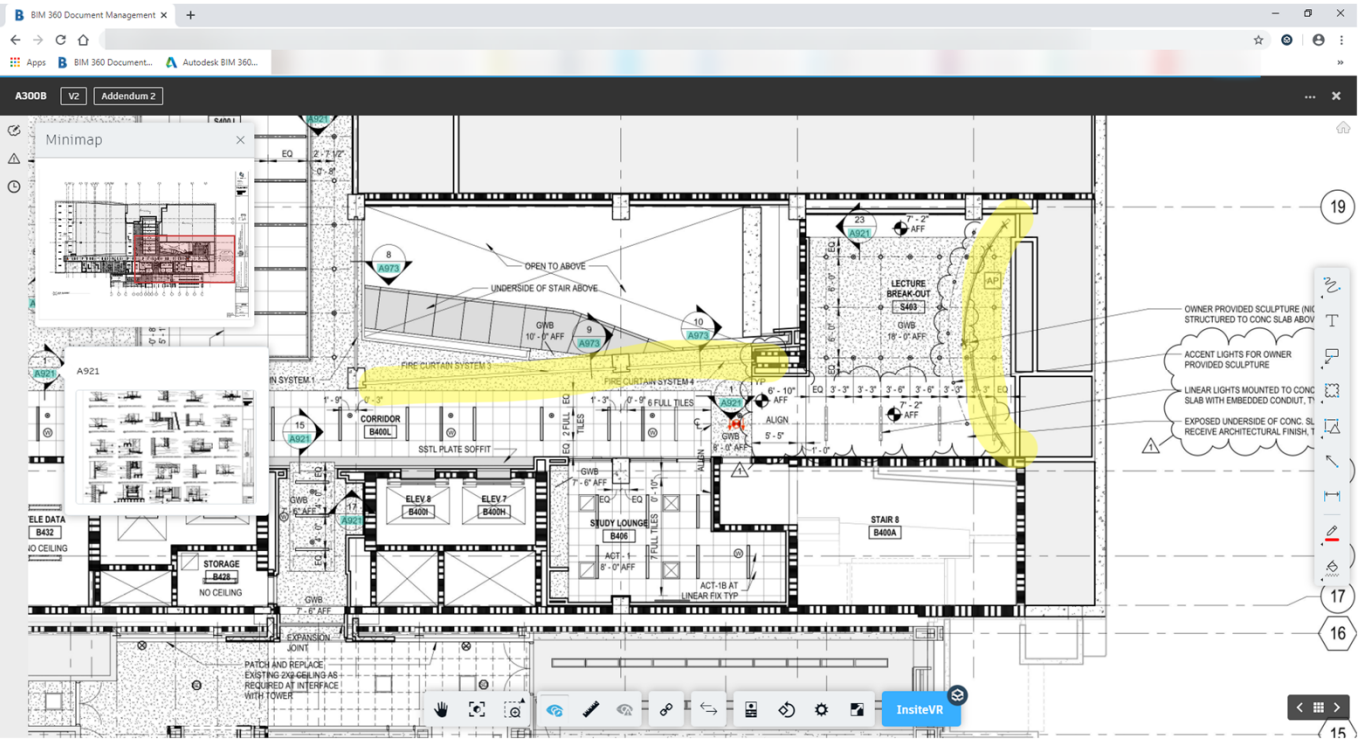
F/P/S foundations - Mockup - Extended Due To Weather	18	0	20-Feb-19 A	30-May-19 A
Corridor 1300W floor infill- Daniels's 1st (Out of sequence reques	20	0	01-Mar-19 A	28-Mar-19 A
Sub Basement Sequence 2D Pour (Footings and Walls)- 1/2 Hei	4	0	26-Mar-19 A	30-Apr-19 A
Sub Basement Sequence 2E Pour (Footings and Walls)	4	0	26-Mar-19 A	03-May-19 A
Sub Basement Sequence 2A Pour (Stair 9 and Deep Fdn Pads)	11	0	01-Apr-19 A	16-Apr-19 A
Sub Basement Sequence 2B Pour (Footings, Walls, Columns) - 1	8	0	01-Apr-19 A	08-May-19 A
Sub Basement Sequence 2C Pour (Fottings, Walls, Columns)	10	0	01-Apr-19 A	06-May-19 A
F/P/S (2) Test Slabs. One SOG and One Elevated Deck - Mockup	8	0	16-Apr-19 A	24-May-19 A
Sub Basement Sequence 2H Pour (Crane Pad)	7	0	19-Apr-19 A	29-Apr-19 A
Sub Basement Sequence 3A Pour (Footings and Walls)	4	0	19-Apr-19 A	18-Jun-19 A
Sub Basement Sequence 2F Pour (Footings and Walls)	5	0	26-Apr-19 A	07-Jun-19 A
Pour tower cranebase 2nd half	1	0	29-Apr-19 A	29-Apr-19 A
Pour tower crane pad 1st lift	1	0	30-Apr-19 A	30-Apr-19 A

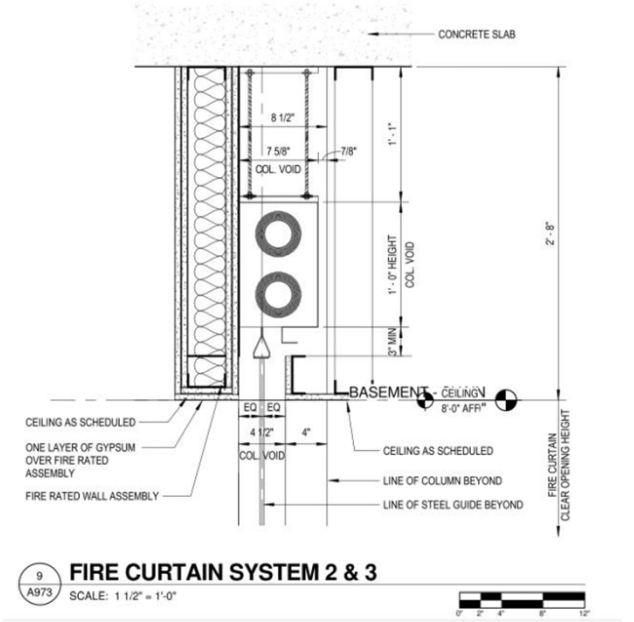

BIM


TELL ME MORE ABOUT
HOW EVERYTHING IS INSTALLED PER THE BIM MODEL
egenerator.net

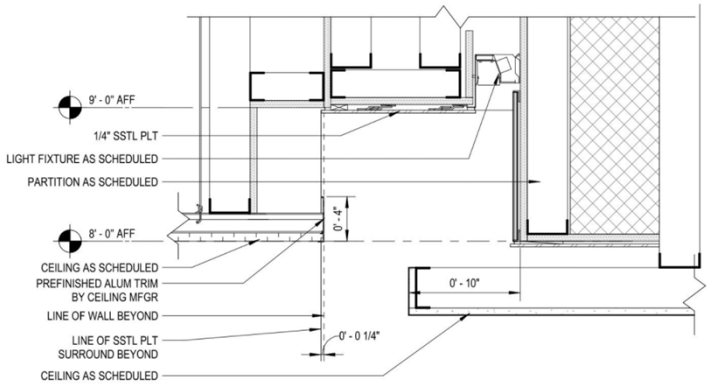
How to Avoid Post-BIM Coordination Issues

Drawing Reviews





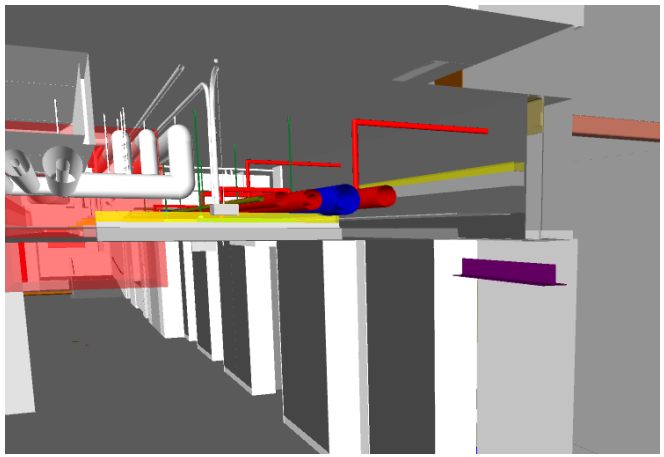
9 A973 **FIRE CURTAIN SYSTEM 2 & 3**
SCALE: 1 1/2" = 1'-0"

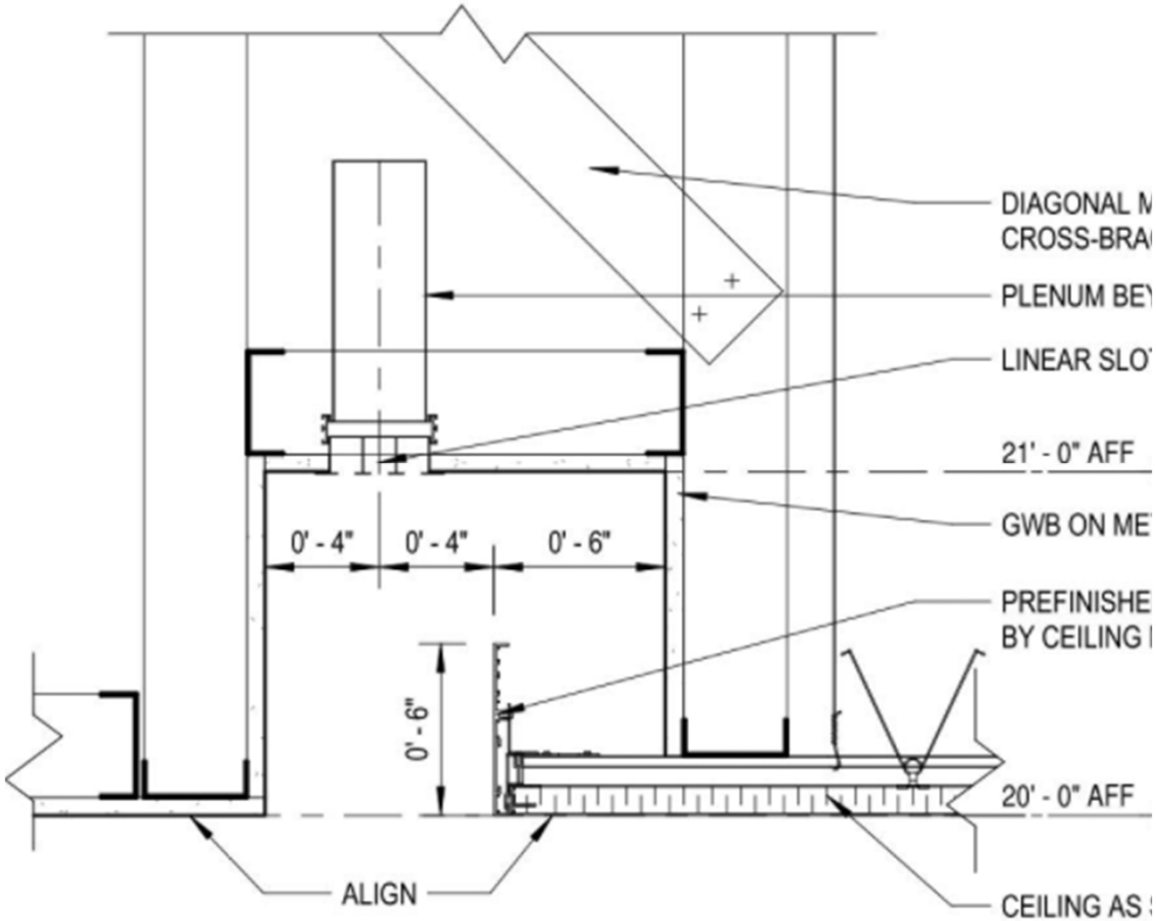


15 A921 **ELEVATOR CORE**
SCALE: 1 1/2" = 1'-0"

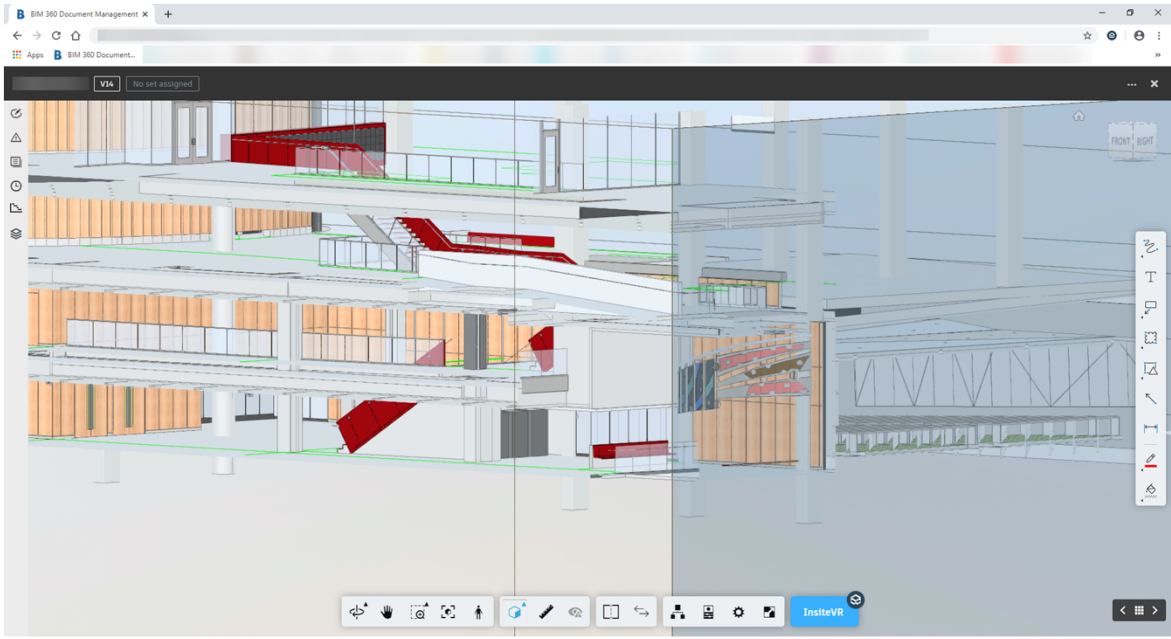
Drawing Reviews

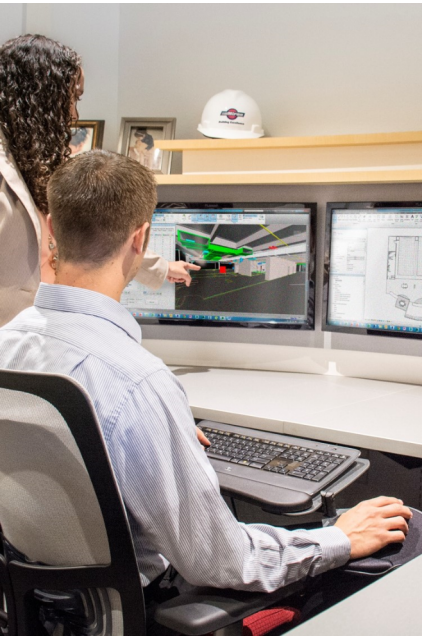
- Floor Plans
  - RCP's and General Notes
- Details
  - Call-outs
- Elevations
- Sections





Model Review

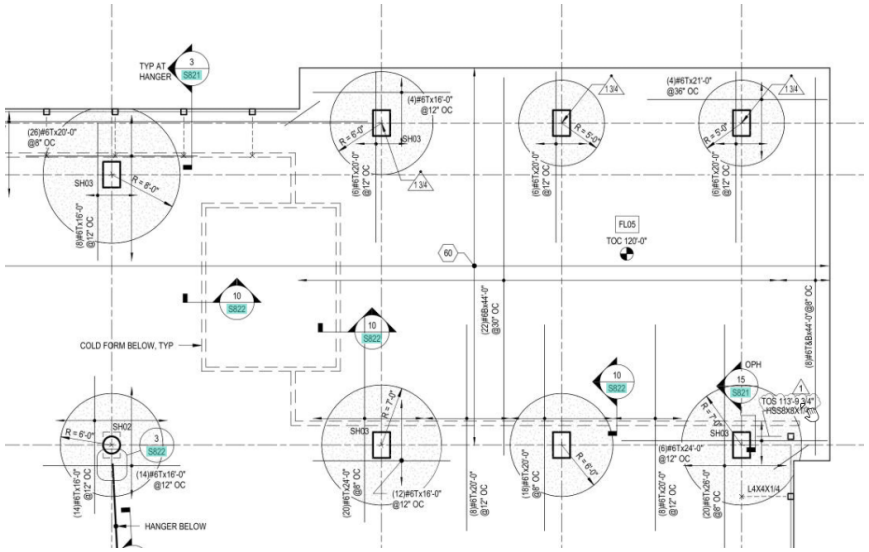




- The model is a reference; comparing the drawings to the model is important
  - What's in the model versus what is called out in the drawings
  - LOD

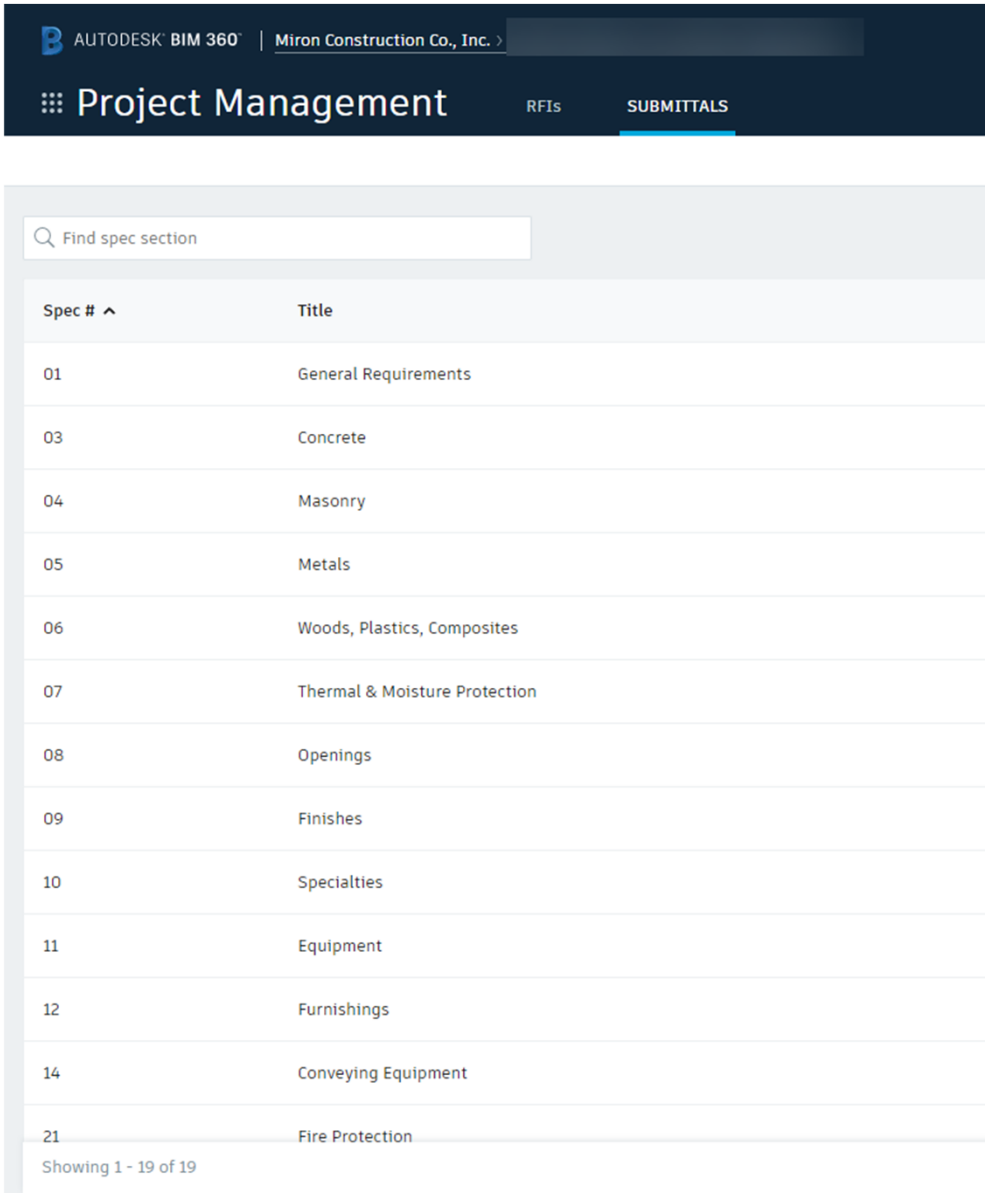
- Understand the frequency of receiving your models
  - It's likely you will not receive an updated A/E model with every RFI/Change Order
  - Document clashes with RFI numbers.

Project Team Review



Submittals / Shop Drawings

- Submittals in construction management are shop drawings, material data, samples, and product data
- Submittals are required for the architect and engineer to verify the correct products will be installed for the project
- Identifying where to view information is needed for modeling efforts
- Review scheduled due date information in reference to your BIM Coordination Timeline



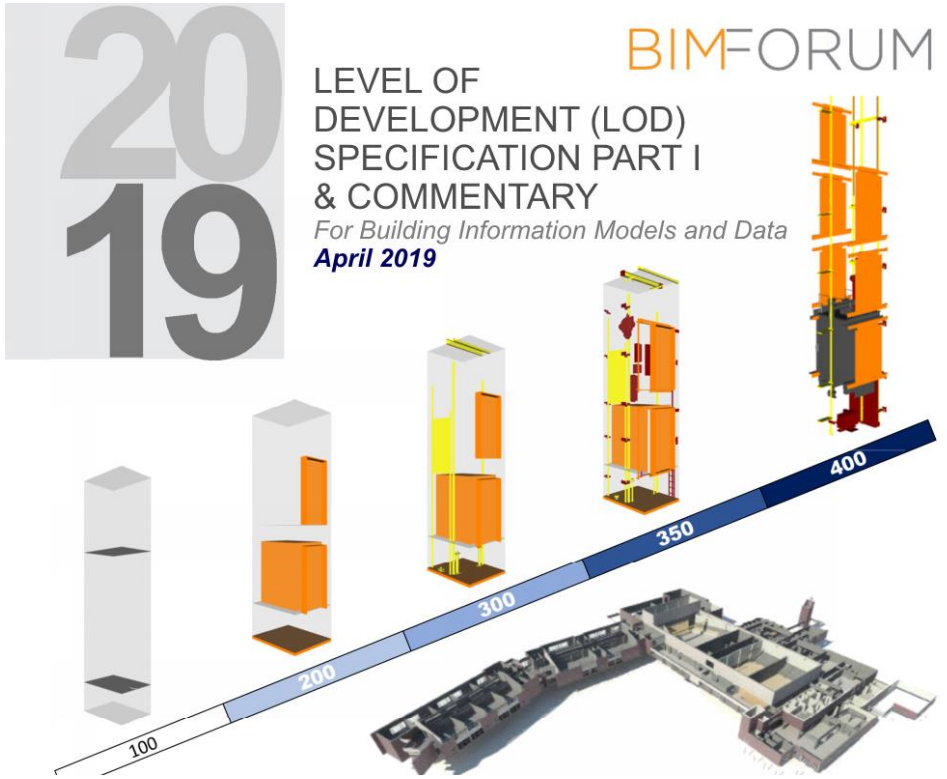
How detailed are your models?

What should you expect from the A/E Model(s)?

- Level 200 Typically.
- Factored into Model Review.
- Handoff of model(s) should be an “ever-living” model.

What should you be modeling your Supplemental Information?

- Model as detailed as you can (based on the information you have).
- Unknown sizing of component should have a “safe” zone.
- Based upon your congested spaces within the model, a detailed geometry of your component may be required.



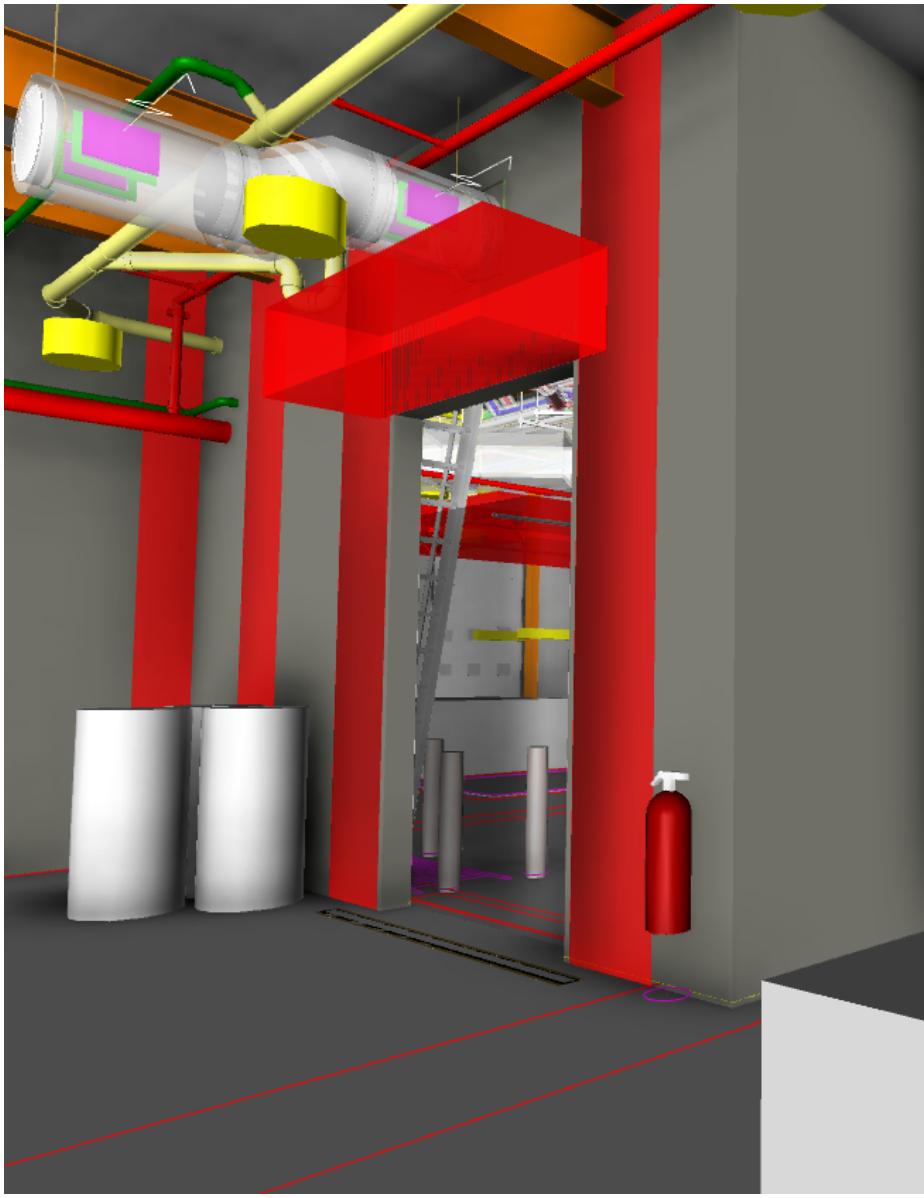
Design	Construction Documents	Pre-Construction	Construction	Commissioning and Handover	Operations

Bond Beams / Lintels

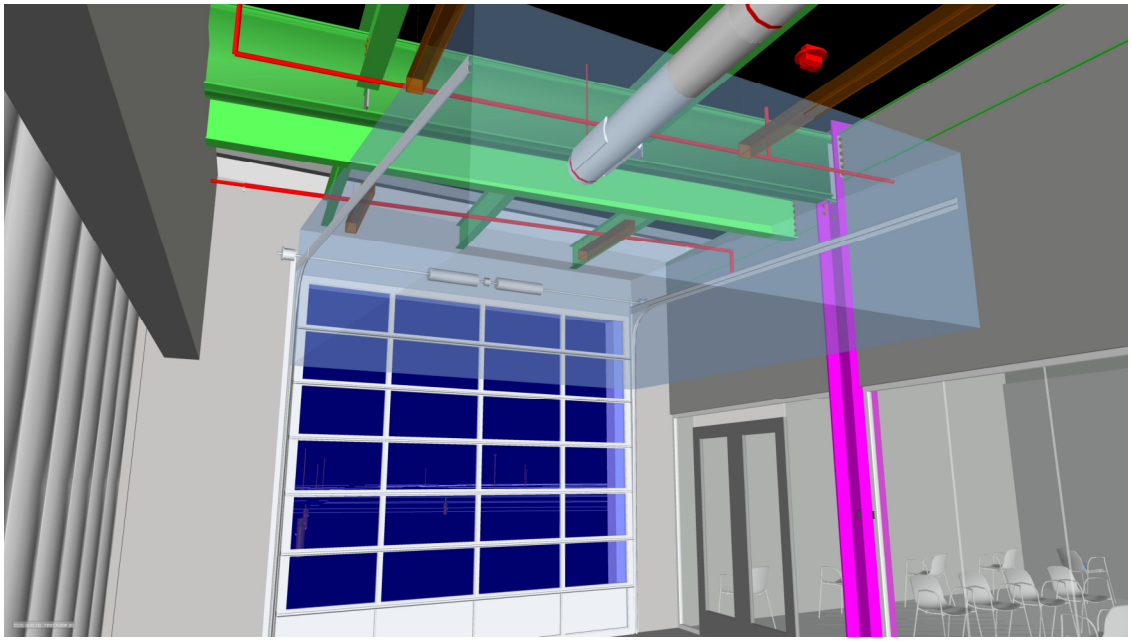
A Structural Horizontal member that spans the space or opening between two vertical supports (i.e., over a door or window).

- Models will likely show only the Structural walls not the Bond Beams. Without these components modeled, Subcontractors may penetrate the wall without notification (clash).

- Best practice to model this part of the wall darker than the rest of the wall.



Garage / Overhead Doors



A Structural Horizontal member that spans the space or opening between two vertical supports (i.e., over a door or window).

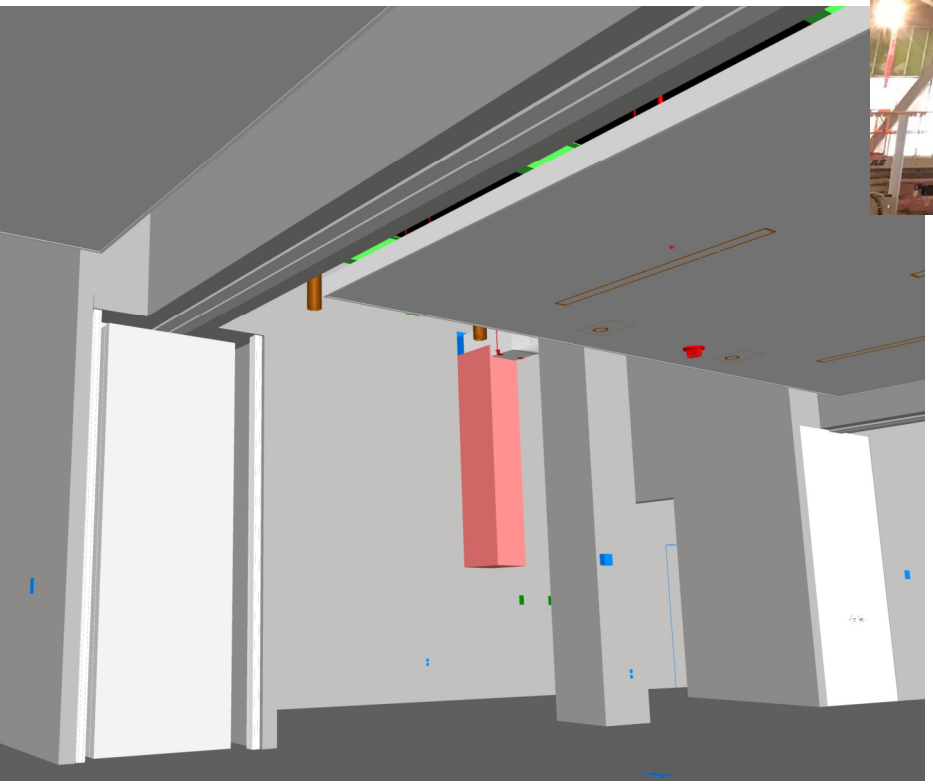
- Track and Door Modeled.
- Clearance zones should be modeled to represent when door is open and model in the garage door track supports

Cloud Ceilings

Suspended or “Floating” Ceilings:

- Drawings and Model will be in Construction Documents.
- Verify Sizing and Height Requirements from Drawings.
- How will ceilings be supported?
  - Aircraft Cable?
  - Unistrut?
- Allowed Subcontractors to coordinate avoiding support zones.
- Providing plan for installation by contractor long after coordination is finished

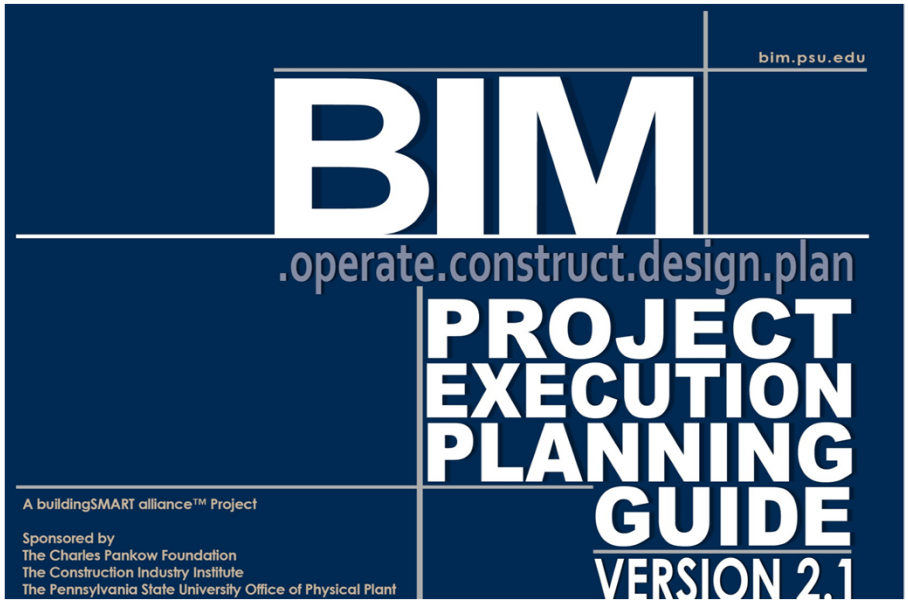
Operable Partitions



A Structural Horizontal member that spans the space or opening between two vertical supports (i.e., over a door or window)

- Architectural drawings and models typically reflects what is below the ceiling. BIM Coordination will require the support structure above.

- Detailed support modeling required if spacing is undefined.



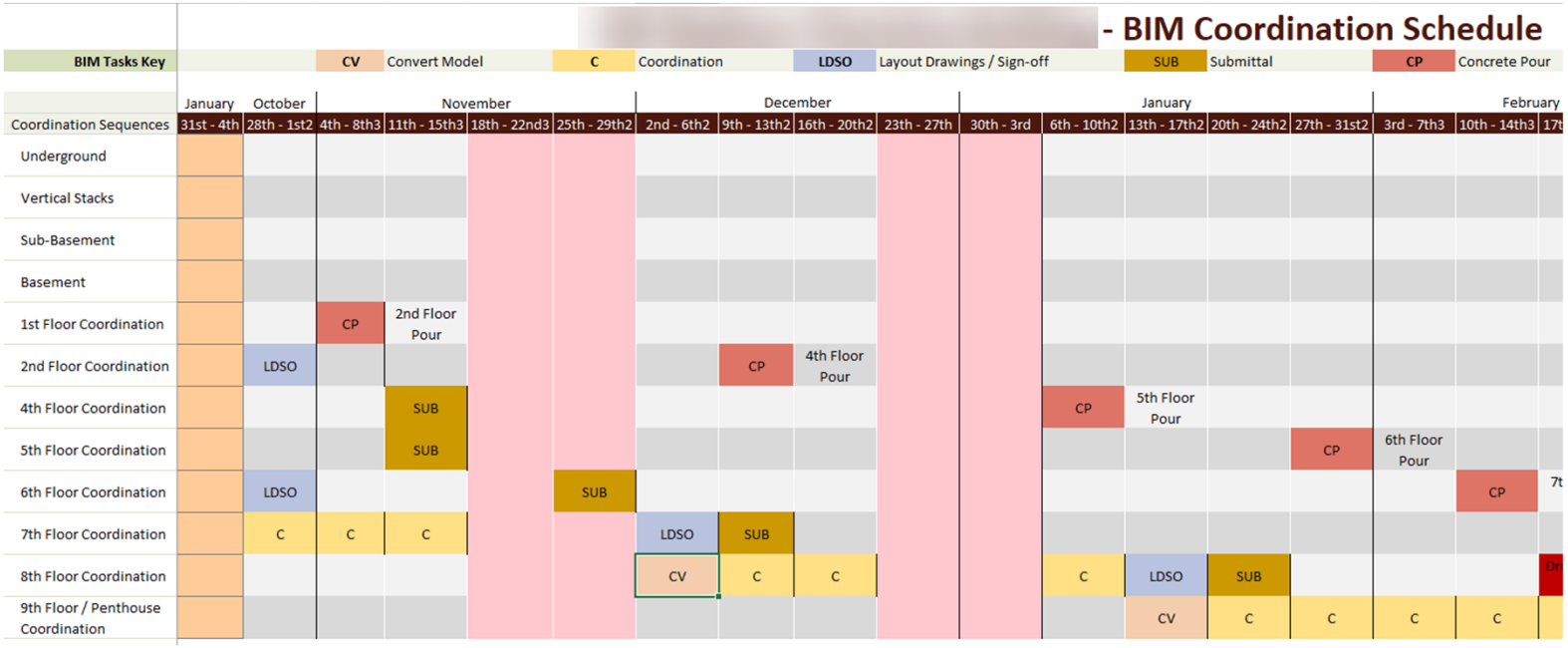
BIM Kick-off

- Meeting BIM Contacts
- Schedule
- Model Hosting / File Sharing
- BIM Coordination Process
- Work with project team members on Supplemental Modeling Elements
- Spatial “Sandwich” Diagrams

BIM Execution Plan

- Contact’s Information
- LOD
- Deliverables
- Pages and pages of documents
- Apply Supplemental Modeling within your Execution Plan.

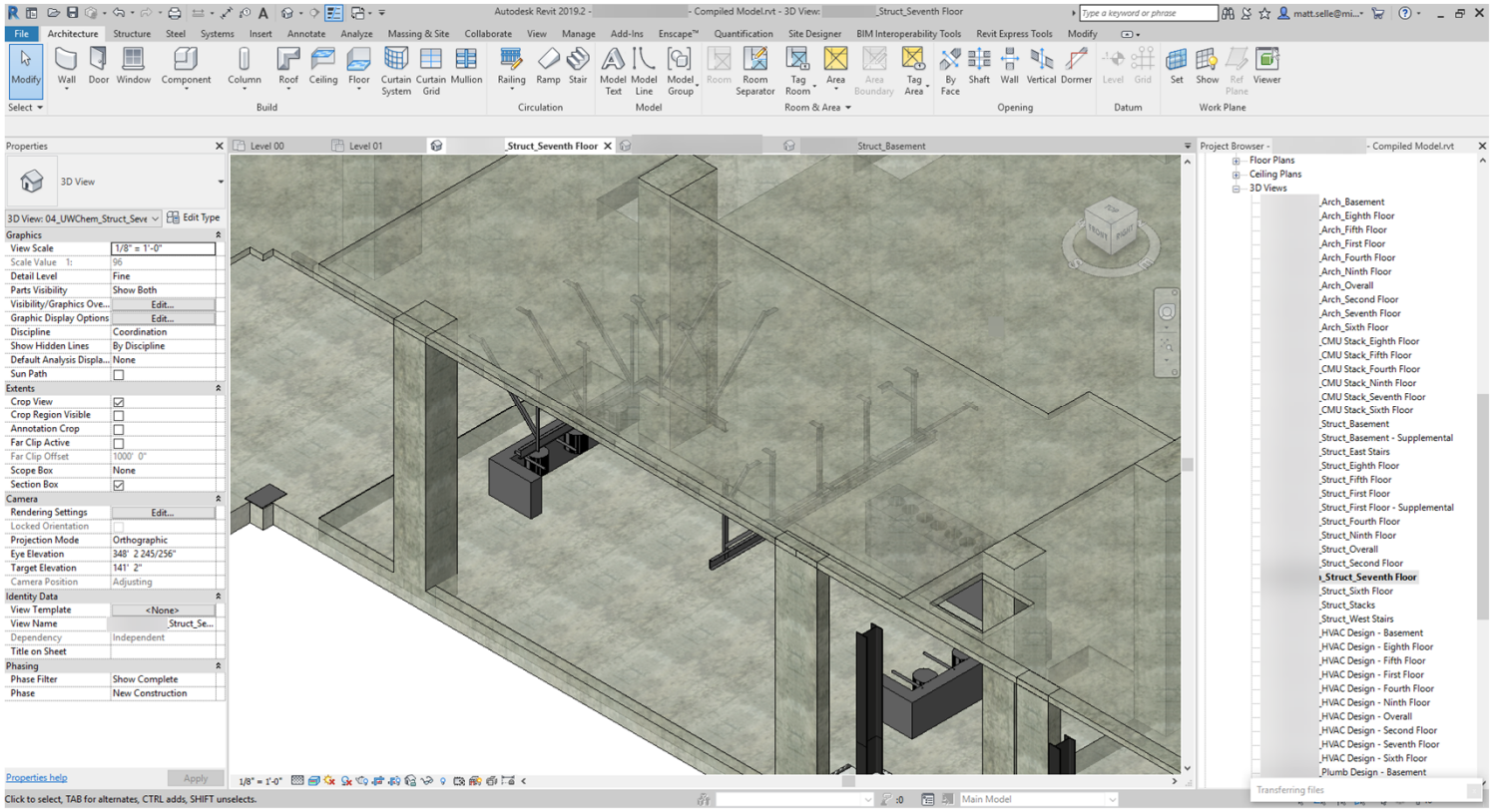
BIM Coordination Schedule



Understand your subcontractors process, allow for realistic expectations with built-in accountability.

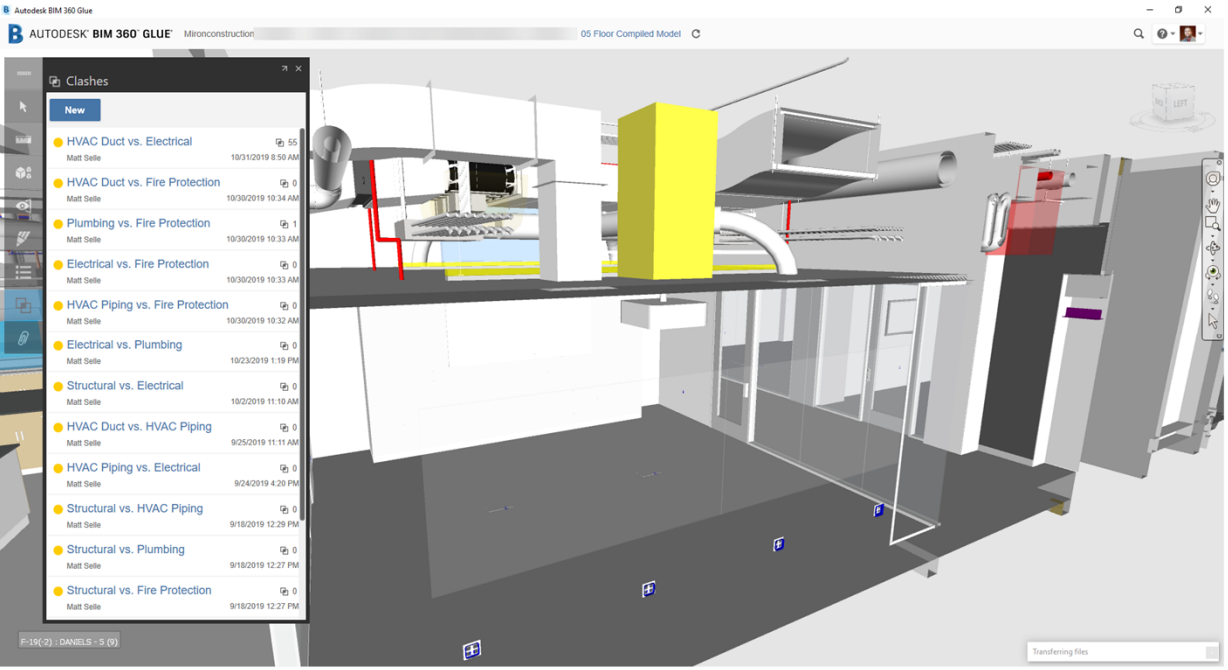
“Pull” plan scheduling instead of “Push”

Modeling Software (Revit, CAD)



- Identify the component(s) and review if the supplier/manufacturer has modeling capabilities
- Suppliers may have modeling content on their website(s)
- Model in content based on the information you have
- 3D views of supplemental modeling (Standalone Model vs. Federated Model)

BIM Coordination of Supplemental Modeling Elements



Customizable

- Own Clash Grouping
- Grouped with other Clashes (i.e., Structural)

Prioritizing Clashes

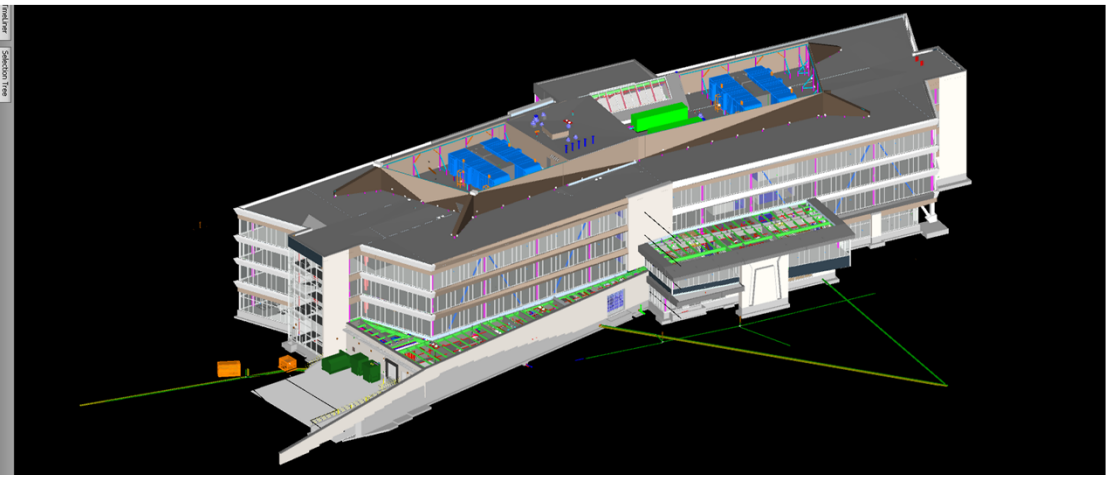
- MEPFP contractors will concentrate on their own clashes first (as well as Structure)
- Avoiding these Modeling Elements may be unobtainable

Collaboration

- Secondary Plans on installation in the event clashes remain after coordination is complete

BIM Coordination Sign-off

- Substantial completion of BIM Coordination
  - Pending changes to Contract Documents
- An agreement from all participating companies involved
  - Contractual / handshake agreement
- Final Navisworks model is saved as the final coordinated model
- Installation drawings required.



BIM Coordination Sign Off

Date:
Project:
Regarding: BIM Coordination Sign-Off <REVISED SUB-BASEMENT AND BASEMENT LEVELS>

Purpose:
The purpose of the BIM Coordination Sign-Off document is to ensure that the BIM coordination effort for the above named project does not negatively affect the project constructability, budget, and construction schedule.

Sign-off of BIM Coordination for the level(s) listed in the **"Document Deliverable(s)"** section will allow the BIM coordination model authors an appropriate amount of time to coordinate between systems and prepare systems for fabrication and installation.

By issuing this document, each BIM coordination model author and authorized decision maker, agrees that all conflicts have been resolved and architectural, structural, mechanical, plumbing, electrical, and fire protection systems have been fully coordinated. Each trades installation drawings shall act as the coordinated and complete documents. This ensures each BIM coordination model author and authorized decision maker is fully aware of the adjacent systems spatial arrangements, and that the appropriate steps have been taken to ensure clearance and system requirements are met. Any additional coordination required due design changes made by the architect, engineer, or owner after the date listed in the **"Document Deliverable(s)"** section will be managed by change order.

The installation drawings shall be submitted in PDF format. In addition to installation drawings, a current compiled coordination model will be retained in an un-editable NWD format and will be placed with the installation drawings. Components not installed where shown on the installation drawings or installed but not coordinated with the model will be relocated by, and at the expense of, the offending party. The offending party is also responsible for costs associated with other trades' work including: rework, re-coordinating, and schedule acceleration.

Post-Coordination

Typical Sequence would include:

- Releasing subcontractors for fabrication
- Spool / fabrication drawings
- Hanger / Total Station Layout placement (if not a part of BIM Coordination)
- Delivery of systems
- Sequence of system installation
- Installation of systems

Very likely BIM workloads for the project drop off and you're moving onto the next project.

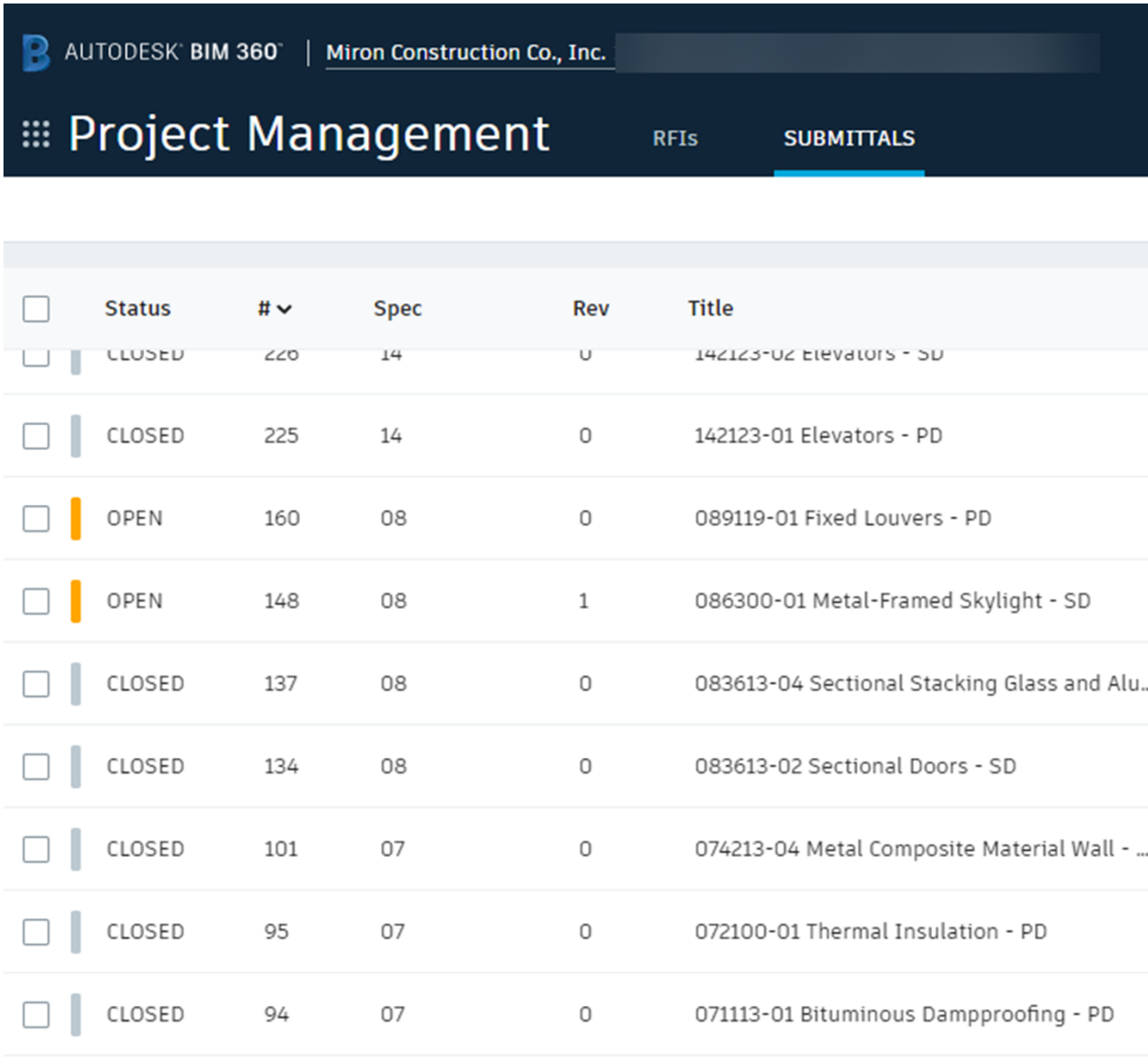
BIM Coordination Meeting Minutes easily accessible.

Field Use

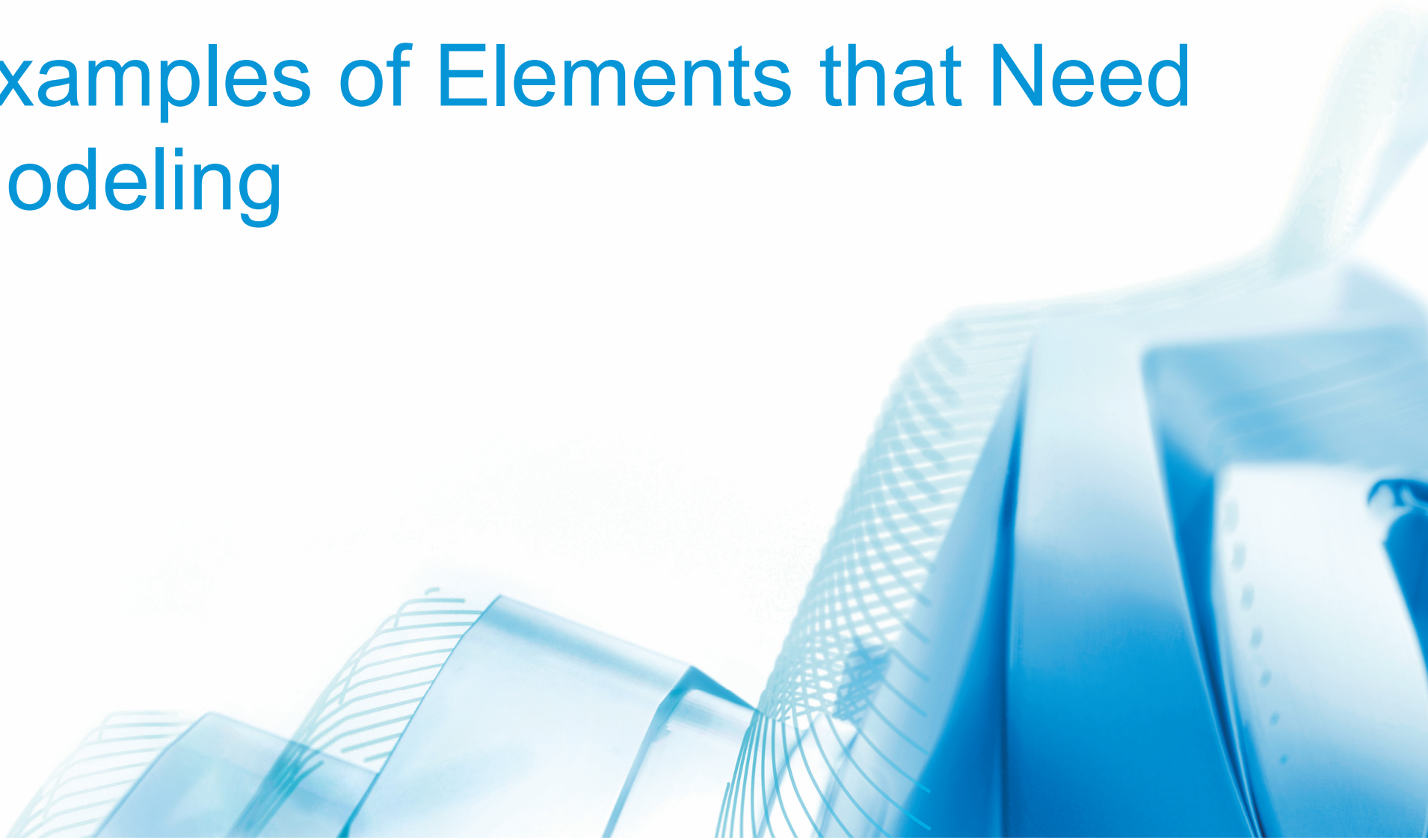
- Allows MEPFP's (Mechanical, Electrical, Plumbing, Fire Protection) to understand other scopes of work and their systems in the area work they're installing
- A central model-based hub allows for collaboration amongst tradespeople
- Holds accountability with project stakeholders for agreed upon layout.
- 75% of the on-site project team members rarely see the work put in coordination. (The last 100 feet)

Stay with your Project!

- Construction Changes
  - Documents
  - Sizing
  - Pricing
  - Rejected / Revised & Resubmit
  - Revisiting Modeling Efforts
- Onboarding Secondary Subcontractors
- Check-in with your Project Teams
  - Model Review
  - Meeting Minutes!



Examples of Elements that Need Modeling



Cross-Bracing, Kickers, Steel Supports

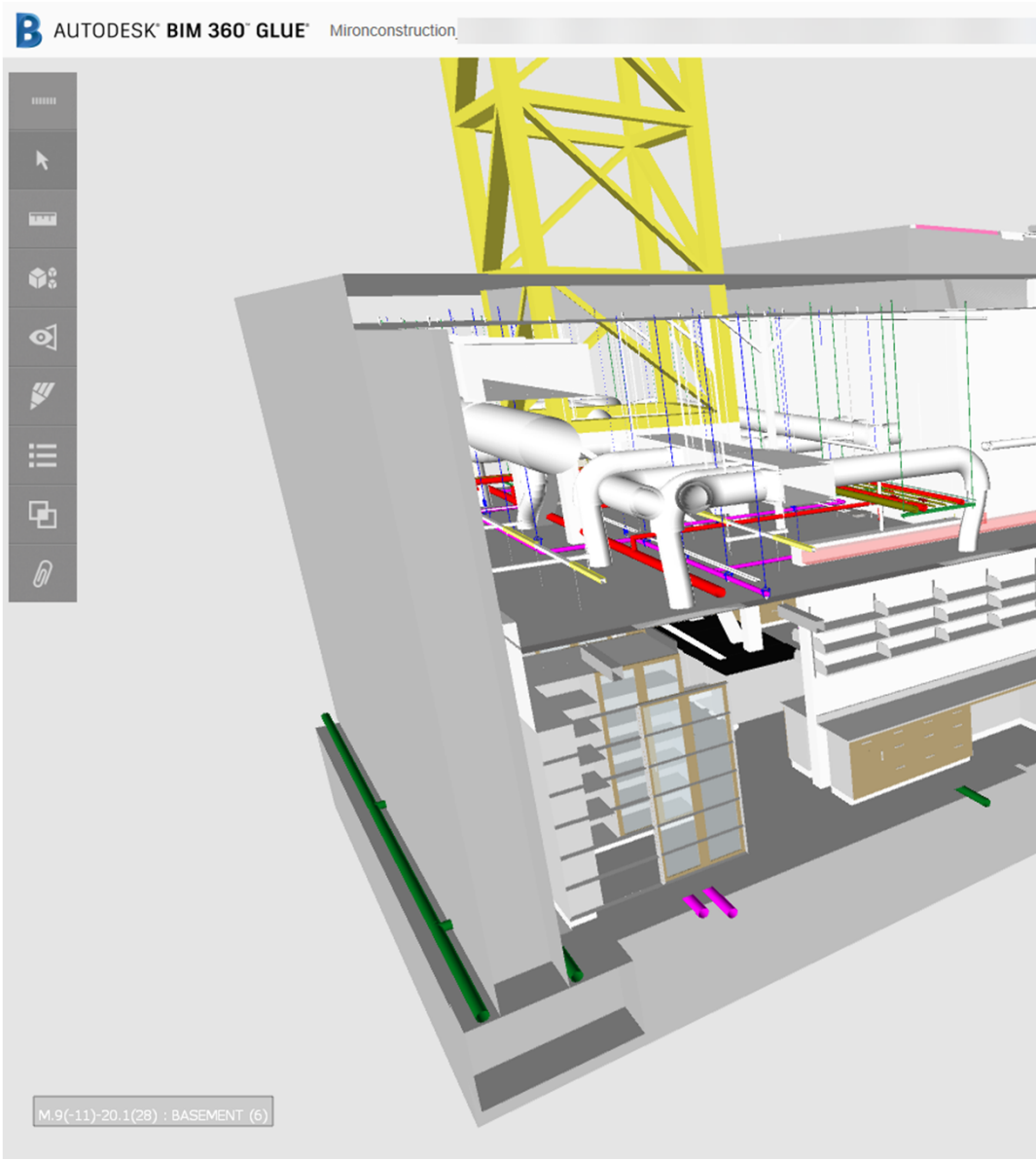
Kicker and cross-bracing is generally used to describe diagonal or vertical members connected between purlins, rafters, or joists with the intent of transferring load to points that might be supported by a wall below

- Depending on your region or experience level of the company, typically the Structural Fabricator Models in these elements.

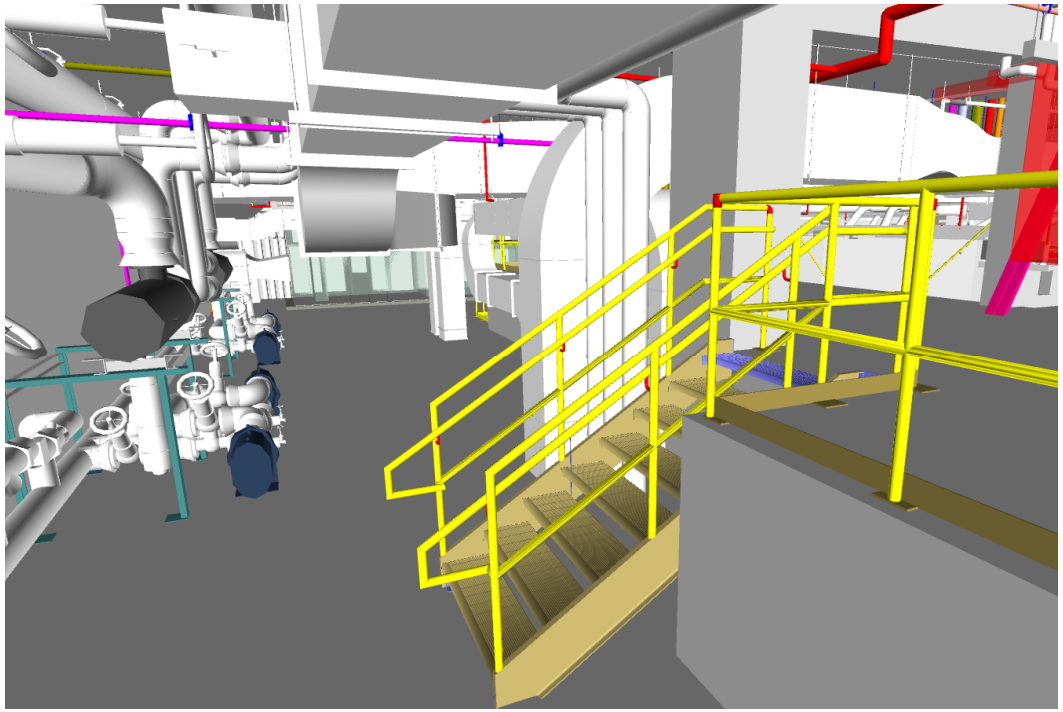
- Construction documents usually indicate these within a detail; not within the model or floor plans

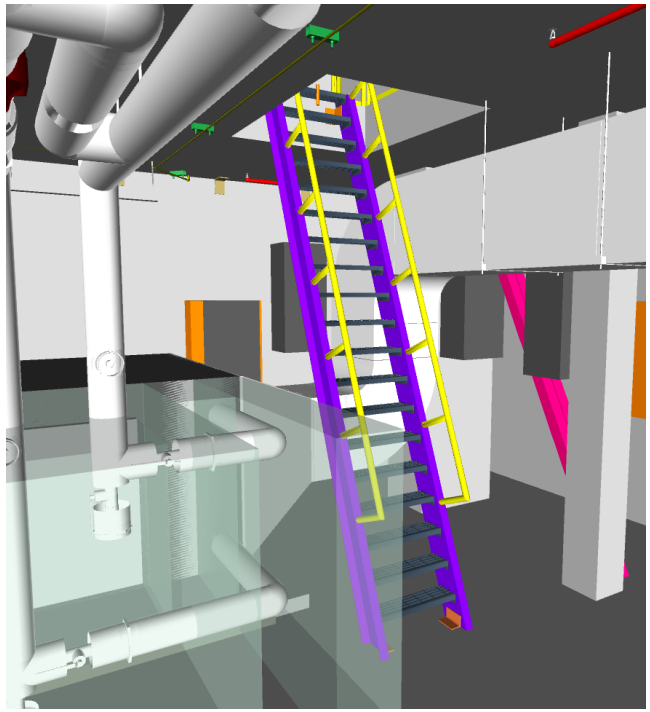
Tower Crane Coordination

- Tower Crane set inside the building perimeter
- Schedules call for MEPFP installation prior to dismantling of the Tower Crane
- Clash detection was set up for a 1’-0” tolerance to avoid damage/rework when disassembling the crane
  - Reduces risk of installation too close to the crane when potential movement of disassembling crane is removed
  - Allow work activities within schedule for finishing theses areas that are unable to install while the crane is in place



Ladders and Stairs



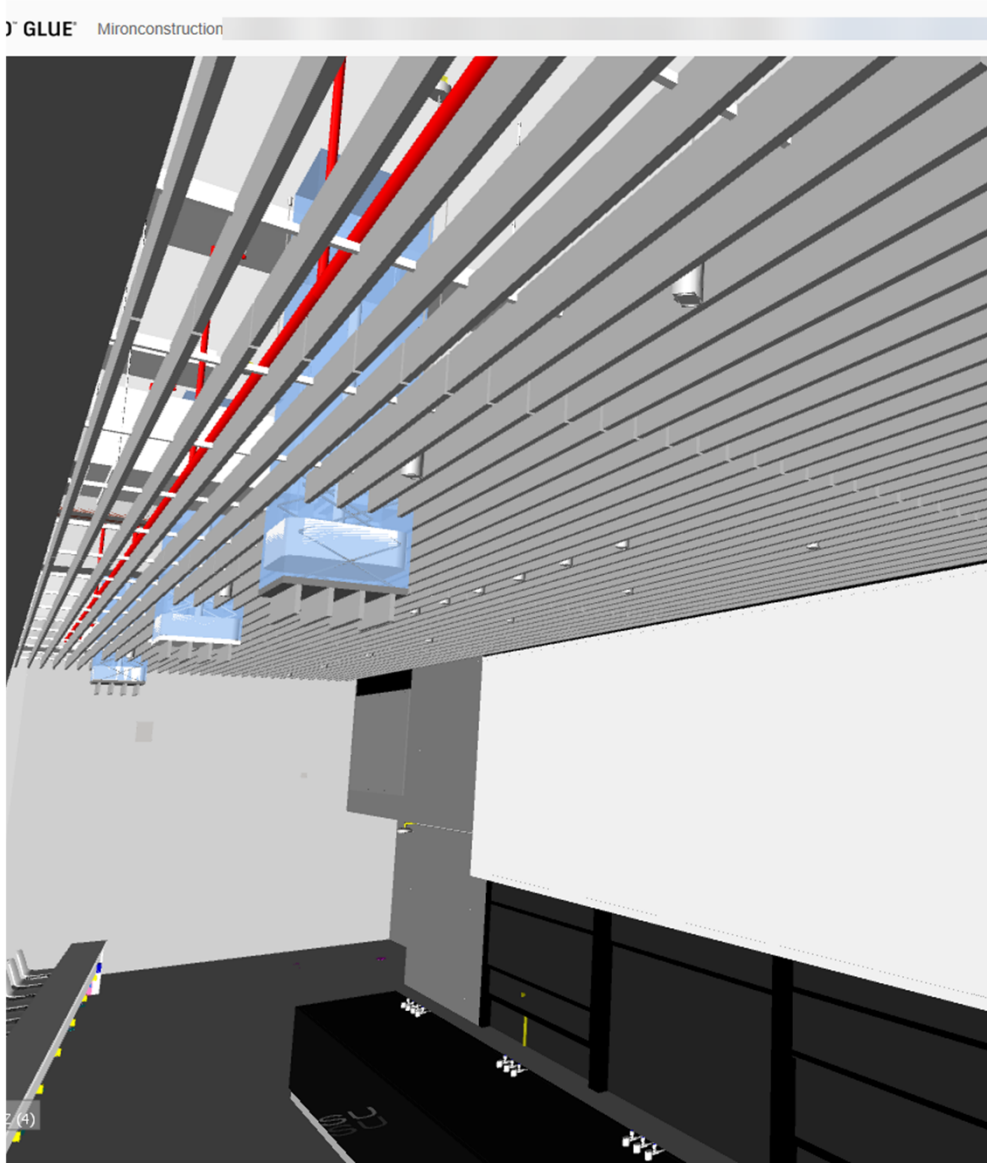


Provide “No Fly” zones around Ladders and Stairs (Landings) to allow for proper clearances.

Code Compliance sizing of zones is also recommended.

Owner-Provided Equipment

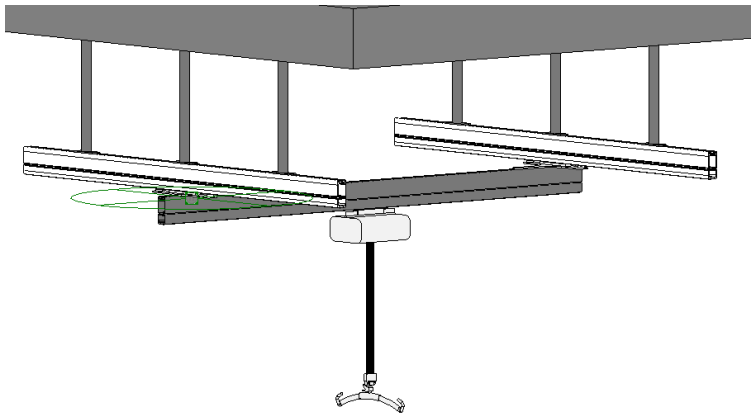
- These items can range from displaying on Construction Documents to on-site project team requests
  - Typically shown on Reflected Ceiling Plans and Details
  - Support Structure unknown
  - Based on the timeline of information available, a support structure “box” may be suitable.
  - Congested Coordination areas will require more detailed modeling efforts.



Typical Elements to Coordinate by Market Sector

Healthcare

- Patient Care
  - Patient Lifts
  - Cubical Tracks
  - Bariatric Lifts
  - Owner Equipment
  - Ambulance Garage Clearances



Retail / Commercial

- Signage Placement(s)
- Underground Electrical for Islands (paint booths, checkout lanes – typically not modeled due to size)
- Garage Clearances

Public Services

- Garage Clearances (Fire Stations)
- CMU Joints (HVAC Openings)

Industrial

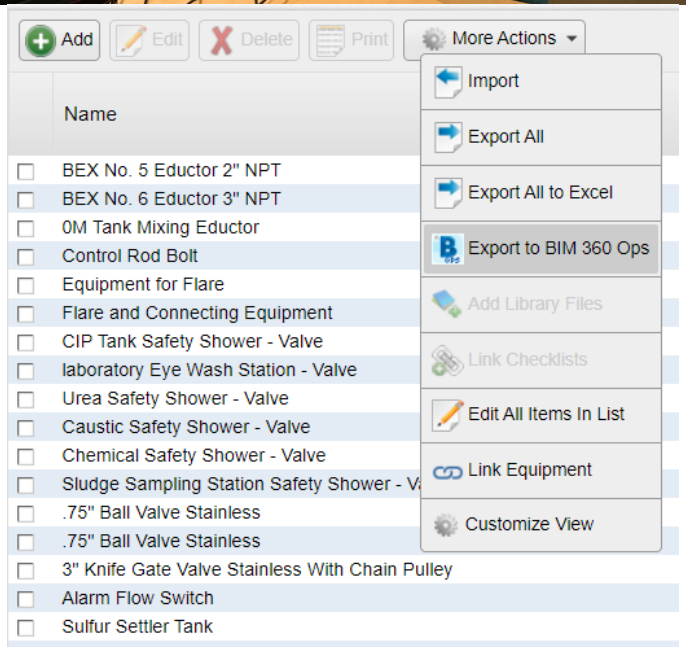
- Valve / Machine Clearances
- Ladders / Stairs
- Hoist Beams

Additional Benefits

- Specialty Contractors benefits
  - Planning
  - Schedule

- Proactive Approved Submittal Integration
  - Swap In/Out Information Modeling Content and Submittal Items are approved (after Coordination is complete).

- Owner Review and Turn-over
  - Facilities (Servicing and Maintenance)
  - A true as-built deliverable



Recap


Coordination Gotcha Items

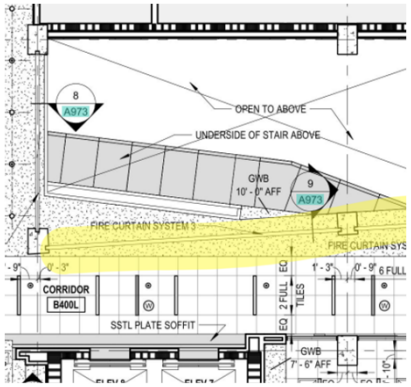
Friday, January 06, 2017 1:37 PM

- Read all general plan notes and look for items that will take up space above the ceiling
- Make ACT ceilings 4" tall to capture hangers and other items
- Contact structural steel/precast supplier at beginning of project to determine what their model deliverables will be.
- Model in lintels, bond beams, and grouted cores at bearing points in masonry bearing walls

- Overhead door clearances - including coiling and fire doors.
- Create opening plans for ductwork and large pipe penetrations through metal deck and roof - Get this information to the steel detailer ASAP.
- When dealing with large workstations with med gas, keep in mind the structural mounting required for hoods, gasses, etc...
- Make sure panel clearance zones extend to the structure
- Make sure light fixture clearances are at least 5" high. This will cover most fixtures. Can light clearances should be at least 8"
- Look for ladders and add clearance zone through rungs
- Find out what the steel supplier needs for openings (roof and sleeves)
- Movable partitions, if we have them get shop drawings
- Look for large medical equipment, lights or other equipment that may attach to structure. Run major electrical runs. Model in structural support if required. Blake has models that will cover most cases.
- Ceiling hung bathroom partitions
- Ensure that ceiling mounted equipment in gypsum board are all lined up down corridors!
- Steel Stud kickers to support curtain walls

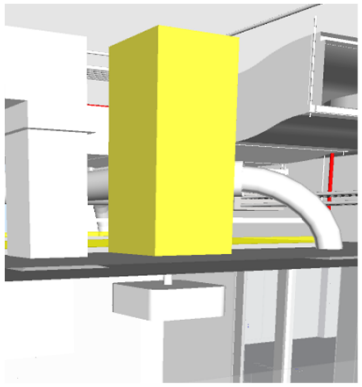
BUILD YOUR LIBRARY

Utilize resources, document circumstances, and apply supplemental modeling



IDENTIFY NEEDED MODELING EFFORTS

Review drawings, elevations, sections, details, verbiage



APPLY ELEMENTS TO BIM COORDINATION

Model in the gaps and notify your project team of what they need to coordinate

FOLLOW-UP & SUPPORT

Train and apply modeling efforts for downstream planning and installation

Special Thanks To:

- Brian Athey
- Kacie Hokanson
- Jay Mathes
- Taylor Olp
- Melissa Schulteis
- Laura Smith
- Blake Titus

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