Verify! Verify! Verify!
Virtual BIM Coordination for Construction

Katelyn A. Lewis
BIM Coordinator, CSTi LLC
About the speaker

Katelyn A. Lewis, BIM Coordinator

- Passion and love for Woodworking/Skills USA Alumni
- 505 BIM Users Group Member
- 12+ years experience with Autodesk software products
- 10 years in AEC Industry
- 8 years with Bridgers & Paxton Consulting Engineers
  - BIM Coordinator/Mechanical Systems Designer/process and workflow implementation/training
- 2 years with CSTi LLC
  - BIM Coordination optimizing efficiencies/process and workflow implementation/training
CSTi LLC.....
Consulting Survey Technology Integration

About Us...
We are a business based out of New Mexico. We offer a wide range of services for designers, contractors, and facility owners who don’t have time for surprises, we deliver a range of detail-oriented services that eliminate unknowns and chart a path forward. We bring top-of-the-line equipment to our clients and partners, including Trimble GPS & Robotics, Leica Scanning, Autocad Civil 3D, Cyclone, Revit and related technology. We are committed to providing certainty in an uncertain world.

Services:
• Construction Staking & Layout
• High Definition Laser Scanning
• GPR Ground & Structure Scanning/Subsurface Utility locating
• BIM Coordination
• BIM Execution
• 3D Modeling
• Scan to BIM Modeling Services
• Aerial (UAV/Drone) Mapping Facilities & Asset Management
• 4D & 5D Scheduling
• Thermal Imaging

DESIGN. BUILD. OWN. WITH CERTAINTY.

https://www.cstillc.com
Class Summary

This class shows how we utilize the data driven by virtual coordination for the construction process. We represent how software such as BIM 360 Glue is used to improve safety, costs, and the ability to learn new tools for all vested parties during the building process. The collaboration and communication between the AEC teams are improved when finding solutions to challenges before it is ever poured in concrete! We display how interfacing with critical trades like MEP, Fire Protection, and Structural Steel creates a seamless fabrication and installation process.
I AM A
BIM
COORDINATOR
I SOLVE
Problems
You DON’T know you have
IN WAYS you CAN’T
UNDERSTAND
Learning Objectives

- Understand how BIM Coordination is utilized before construction ever begins
- Preparing the project for virtual coordination
- Understand the process, workflow, and timeline needed to stay ahead of the construction schedule
- Understand how virtual coordination helps with cost and safety
Virtual BIM Coordination before Construction

- Understand project contract
- Preconstruction Involvement
- Know sub-contracting/detailing team
- What software will be used
Prepare the Project for Virtual Coordination

- Review contract documents
  - Civil/Site
  - Architectural
  - Structural
  - MEP
- Review construction schedule
  - Get an idea of timeline
- Locate sub-contractor list
  - Knowledge of BIM coordination
Prepare the Project for Virtual Coordination

GENERAL FLOOR PLAN NOTES

1. Finished floor elevation at level 1 of 3917'-0" = Project Zero
2. Provide continuous dampproofing and protection board assembly at below grade walls enclosing interior space and at walls of sallyport drive ramps, air intake, and exterior stairs, typical in accordance with specification section 07 1113 - extend across top of structural foundations to outside edge.
3. Refer to fireproofing and firestopping sheets for related requirements
4. Refer to Dimension Floor Plans, Finish Floor Plans, Equipment Floor Plans, Enlarged Floor plans, and Reflected Ceiling Plans for additional architectural plan requirements at each floor level.
5. Confirm locations of elevator sumps and compatibility of hoistway dimensions with elevator manufacturer prior to construction (coordinate with structural, plumbing, and electrical)
6. Where interior storefront glazing extends to ceiling, construct partition type M4D above head with kickers at 48" o.c. braced to structure.
7. Exposed concrete faces shall be constructed in accordance with architectural concrete specification section 03 3300
Prepare the Project for Virtual Coordination
## Prepare the Project for Virtual Coordination

### Specification Requirements

- MOBILIZATION: 345 days
- Site Fence/Trailer: 5 days
- **Milestone Notice to Proceed:** 0 days
- Site Removals/Rough Grades: 10 days
- Site Utilities: 30 days
- Debris 1-2: 22 days
- FOOTINGS/FOUNDATIONS: 87 days
- Pre-Augucast Earthwork: 6 days
- Drill Augucast - 18': 4 days
- Drill Augucast - 24": 5 days
- Post-Augucast Earthwork: 13 days
- F/R/P Footings: 22 days
- Underground MEP: 20 days
- F/R/P Slab on Grade: 8 days
- STRUCTURE: 70 days
  - Level 1: 26 days
  - Structural Steel Erection: 18 days
  - Detailing/Decking: 8 days
  - F/R/P Slab on Metal Deck: 10 days
  - Level 2: 29 days
  - Structural Steel Erection: 9 days
  - Detailing/Decking: 10 days
  - F/R/P Slab on Metal Deck: 10 days
  - Level 3 (Lantern): 5 days
  - Structural Steel Erection: 3 days
  - Detailing/Decking: 2 days
  - Penthouse: 15 days
  - Steel/Joists: 5 days
  - Detailing/Decking: 5 days
  - F/R/P Slab on Deck: 5 days
- EXTERIOR: 38 days
- South Side: 45 days
- Exterior Framing: 15 days

### Specification Review

#### 3.3 DUCTWORK INSULATION

**A. General:**

1. Insulate all ducts except those specified to be uninsulated. The following ductwork need not be field insulated:
   - Factory insulated ductwork and plenums.
   - Ducts with acoustic lining, provided the lining thickness matches or exceeds the required insulation thickness.
   - Exhaust ducts, except where noted.
   - Return air ducts, except where noted.

2. See Table 23.0701-1 for additional information.

3. Ensure that ductwork is leakage tested prior to applying insulation. Inspect ductwork and repair any deficiencies prior to applying insulation. Do not apply insulation over deficient ductwork or plenum construction.

4. Ensure that ductwork is clean and dry before applying insulation.

5. For ductwork with acoustic lining the drawings indicate the "clear inside duct dimension" required. Over-size ducts as required to provide the required air flow area.
BIM Coordinator
We Do
Precision
Guess Work
Based on Unreliable Data
Provided by Those of
Questionable Knowledge
Understand the Process, Workflow, and Timeline Needed to Stay Ahead of the Construction Schedule

- Create coordination Revit model
- Create BIM Schedule
- Establish BIM Participation Log
- Have BIM Kick-Off Meeting
- Begin coordinating models
- Prepare for Facility Management
Understand the Process, Workflow, and Timeline Needed to Stay Ahead of the Construction Schedule

**BIM Schedule – PROJECT NAME**

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Level 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underground</td>
<td>N/A</td>
</tr>
<tr>
<td>Phase 1</td>
<td>6/08/18</td>
</tr>
<tr>
<td>Phase 2</td>
<td>6/15/18</td>
</tr>
<tr>
<td>Phase 3</td>
<td>6/22/18</td>
</tr>
<tr>
<td>100% Coordinated</td>
<td>9/14/18</td>
</tr>
<tr>
<td>Submittal Drawings Due</td>
<td>9/28/18</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Model Sequencing</th>
<th>Order of Completion</th>
<th>Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>Architectural</td>
<td>P-1</td>
</tr>
<tr>
<td>2nd</td>
<td>Structural</td>
<td>P-1</td>
</tr>
<tr>
<td>3rd</td>
<td>Light Fixtures</td>
<td>P-1</td>
</tr>
<tr>
<td>4th</td>
<td>Main/Corridor Duct Work/Graded Pipes/Roof Drains</td>
<td>P-2</td>
</tr>
<tr>
<td>5th</td>
<td>Waste/GHSP/In-slab conduit/Ductwork/Fire Protection</td>
<td>P-2</td>
</tr>
<tr>
<td>6th</td>
<td>Domestic Water/Electrical Panels</td>
<td>P-2</td>
</tr>
<tr>
<td>7th</td>
<td>Branch Lines – all trades to 0'-1/2” pipe conduit to 0'-1”</td>
<td>P-3</td>
</tr>
<tr>
<td>8th</td>
<td>Plumbing Fixtures/ Switches/ Devices</td>
<td>P-3</td>
</tr>
<tr>
<td>9th</td>
<td>Owner Furnished Items that require coordination</td>
<td>P-3</td>
</tr>
</tbody>
</table>

**Schedule a BIM Kick-Off Meeting with the Team**

**Project Participant Log**

The Project Participant Log will be filled out before the BIM Coordination Kick-off meeting. This log will be updated and e-mailed to each participant for their use and accessible to everyone involved in the BIM coordination process. This log will also be used in assessing any fines due to missed model update requirements and unexcused coordination meeting absences.
Understand the Process, Workflow, and Timeline Needed to Stay Ahead of the Construction Schedule

BEGIN COORDINATING MODELS

• Provide any training necessary
• Merged models in BIM 360 Glue
• Create clash reports necessary
• Create markups
• Have weekly/bi-weekly meetings
• Field use drawings created for fabrication
• Subs/detailers submit drawings to BIM Coordinator
• Perform on-site verification
CLASH REPORTS

MARKUPS

COORDINATION MEETINGS

Project Name: CSTi17055
Project Percentage Completion: 70%

Coordinator’s Name: KATELYN LEWIS

Issues to be completed and modeled entities uploaded to GLUE by 8/2/18 10am (MST):

<table>
<thead>
<tr>
<th>No.</th>
<th>Responsible Party</th>
<th>To Be 100% Coordinated in Area 1A</th>
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<tbody>
<tr>
<td>01</td>
<td></td>
<td>ALL TRADES</td>
</tr>
<tr>
<td>02</td>
<td></td>
<td>Branch lines must be added and worked around other trades to the best of their ability.</td>
</tr>
<tr>
<td>03</td>
<td></td>
<td>All Trade</td>
</tr>
<tr>
<td>04</td>
<td></td>
<td>rotate lights in med vac room to allow for other trades. conduit re-route from process level 1.</td>
</tr>
<tr>
<td>05</td>
<td></td>
<td>CSTI</td>
</tr>
<tr>
<td>06</td>
<td></td>
<td>All Trade</td>
</tr>
<tr>
<td>07</td>
<td></td>
<td>All Trade</td>
</tr>
<tr>
<td>08</td>
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<td>CSTI</td>
</tr>
<tr>
<td>09</td>
<td></td>
<td>All Trade</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>All Trade</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>All Trade</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>All Trade</td>
</tr>
</tbody>
</table>

PLEASE ADJUST ACCORDINGLY
BEING A BIM COORDINATOR IS EASY. IT'S LIKE RIDING A BIKE EXCEPT THE BIKE IS ON FIRE YOU'RE ON FIRE EVERYTHING IS ON FIRE AND YOU'RE IN HELL
• 100% coordinated, field use drawings created for fabrication and installation.

• Sub-contractors/detailers will submit drawings to BIM Coordinator.
Perform
On-site verification

Field crews must install per coordinated “field use drawings” that have been approved. This will ensure that every trade has a location within designated areas for install with minor to no issues.
MULTI TASKING
PROBLEM SOLVING
REQUIRES COFFEE
WILL TRAVEL

Bim Coordinator®

WARNING: Sarcasm inside

Contents may vary in color

100% ORGANIC

CAUTION

For adult language

Long hours may cause
binge drinking

Teespring.com
Understand the Process, Workflow, and Timeline Needed to Stay Ahead of the Construction Schedule

PREPARE FOR FACILITY MANAGEMENT

- Appropriate tracking is established
  - Pushed through different formats
- Compare models and verify data
  - Parameters
  - Equipment
Understand how virtual coordination helps with cost and safety

- No definite way to calculate “actual” cost savings
- BIM coordination process eliminates unknown
  - Chart a path forward
- Prefabrication
- Field crew hours decrease
- Extra unnecessary materials won’t clutter jobsite.
- Problems resolved before any damage is done
Understand how virtual coordination helps with cost and safety

The ductwork reconfiguration proposed in RFI 058 is not feasible because of acoustical restrictions preventing the placement of chase openings above the courtroom. In lieu of the proposed reconfiguration, please proceed as follows:

1) At gridline intersection E/3 on levels 2, 3, 4, 5, and roof, the embed plates referenced in the RFI shall be installed such that the bottom edge of each plate is ½” below the bottom of the beams they support on gridline E. The supply and return penetrations adjacent to these plates shall be located as originally configured in the mechanical drawings but may be adjusted vertically, as required, to pass underneath the plates. It is acceptable for the embed plates to span between concrete lifts at the floor levels.

2) At gridline intersection E/2 on level 2, adjust the duct and fire smoke damper aspect ratio (keeping the free area the same) of the 76”x36” return shown on sheet MH-102 to allow the chase penetration to occur beside the embed plate. A more square configuration will work.

3) At gridline intersection E/2 on the roof level, field cut the North/South leg of the corner embed plate to reduce its horizontal length to 10” (i.e. remove 2’-8” of horizontal length). It is intended that this modification will allow the 84”x48” return duct shown on sheet MH-105 to penetrate the concrete wall on gridline 2 beside the plate.

4) At each mechanical penetration of the concrete walls, use concrete beam type 3 from the concrete beam schedule on sheet S2.0 (and other plan sheets). It is acceptable that the concrete beams and the steel embeds overlap where required.
Understand how virtual coordination helps with cost and safety
Understand how virtual coordination helps with cost and safety

CSTi BIM Remediation

Per original contract the existing was to be remodeled. After 3D Scandone by the CSTi team for verification of design, a 10 in sag in the roof structure was realized – this caused further investigation and the determination to demo and replace the Gym in its entirety. Upon demolition commencement, the entire structure collapsed with very little pressure exhibiting structural fatigue.

**Conflict:** Life safety requirements were not to code.
**Solution:** BIM verification determined missing elements and insufficient fire stopping that otherwise would not have been found until fire marshal inspection.

**Conflict:** 3 more ft in width and 1 1/2 more depth was required for all duct in main corridor.
**Solution:** Duct work was split into 3 separate systems running around interior concourses. Penetrations through floors and roof were modified to allow for new routing.

**Conflict:** Kitchen hood exhaust and air handler units did not fit per contract design.
**Solution:** Kitchen hood was replaced with an alternate manufacturer and 2 roof top units were used rather than 1.

**Conflict:** No accommodation for Fire protection.
**Solution:** Fire Protection mains had to be rerouted around concourses and over classrooms to avoid corridor congestion.

**Conflict:** Per contract design all underground plumbing water main fire main and electrical main were running through footings were designed at elevations that would penetrate the footings of the foundation.
**Solution:** All inverts and routing of these systems were modified to alleviate the potential cost impact of increasing the depth of footings and foundations.

**Additional materials and schedule for foundation:**
- $37,000.00 – 2 months
- Ductwork rerouting: $147,000.00 – 1.5 months
- Penetration relocation: $32,000.00 – 3 weeks
- Fire Protection routing: $51,000.00 – 4 weeks
As BIM Coordinators, we are here to help the process of construction and mitigate risk. We are not here to replace the respected jobs it takes to design and construct a successful building. BIM Coordinators are here to help solve challenges and increase communication between all.

Remember,
Keep moving forward and be that magic behind the curtain!
QUESTIONS???

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