

CS226019

Verify! Verify! Verify! Virtual BIM Coordination for Construction

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Learning Objectives

- Understand how BIM Coordination is utilized before construction ever begins
- Preparing your 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

Description

Ever wonder what a BIM Coordinator does during construction? What is the purpose of a BIM Coordinator? How do we help the life cycle of a building before it is built? Virtual BIM coordination plays a huge role in improving construction and collaboration. This presentation will explore the process and workflow of a BIM Coordinator before, during, and after construction. Our team's established methods not only help construction teams with issues before they ever happen on the jobsite, but for everyone involved with the life of the project. Learn how to utilize BIM coordination to its fullest while we explain the processes used with BIM 360 Glue, Revit, AutoCAD, Dynamo, and more. We will show how these processes and workflows will reduce labor hours and material costs, resulting in increased profitability and minimizing exposure to safety hazards common in our industry.



Speaker

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BIM Coordinator, CSTi

Having an early love for woodworking, I joined Skills USA. I competed multiple times in cabinetmaking, winning state and moving on to compete at the National level. I am now a Skills USA Alumni and competition judge for the organization. I have been in the Architectural/Engineering/Construction (AEC) Industry for ten years. After graduating with honors from Central New Mexico Community College, I became a Mechanical Designer learning valuable tools to help develop my career. I am also a member of the 505 BIM Users Group in New Mexico. Through this experience, I was hired at HB Construction and made the transition to CSTi LLC. I specialize in virtually coordinating major commercial projects. I help with BIM implementation and process workflows. I work directly with the AEC teams to help solve project system challenges before they ever happen on the jobsite. Additionally, I provide training courses for the software utilized on my projects. Some of the software I use includes: Revit, AutoCAD, BIM 360 Glue, Dynamo, Navisworks, Bluebeam, and Procore. I am continuing to expand my knowledge in Architectural, Structural, MEP, Fire Protection, and am looking forward to new and interesting demands in the construction industry!

Being a BIM Coordinator!

There are many different variations of a BIM Coordinator in our industry. At CSTi, a BIM Coordinator virtually coordinates architectural, structural, mechanical, plumbing, and fire protection systems within a building. This is done through Revit, AutoCAD, and BIM 360 Glue. First, we need to verify that all information stated within the Contract Documents is modeled correctly. We then work directly with subcontractors/detailers to coordinate all these systems in a timely fashion. Together we solve problems before they happen on the jobsite. Once the virtual coordination is complete, field use drawings are created and approved for fabrication. During the actual install of the systems, the BIM Coordinator will arrive to the jobsite and perform on-site verification to ensure that all systems are installed per the coordinated field use drawings. We will then prepare our coordinated model for facility management.

This is quite a bit of information. So, let's break it down a little bit and explain our process!

How virtual BIM Coordination is utilized before construction starts

- Understand the project contract
- Preconstruction involvement
- Know the sub-contractor/detailing team
- What software will be used

Note: *It is very important to understand what type of contract the project will be under. Know the differences between contract types and prepare accordingly. Common contracts include:*

- CMAR-Construction Management at Risk
- Design Build
- Design Bid Build
- Hard Bid
- IPD-Integrated Project Delivery

Being aware of the contract type will help determine what kind of direction will need to be provided to the detailing teams during coordination.

Example:

- Design Build - Coordination will take place during the design phase created by the AE team members.
 - There is an open line of communication
- Design Bid Build – Coordination takes place after contract documents are created and questions (RFIs) are produced and directed back to the AE team for review.
 - Potential change orders are created

Note: *90% of what the BIM Coordinator will be involved in, is during the Preconstruction process of the project. The BIM Coordinator is so far ahead of the actual construction, they find issues sometimes months before the install.*

Know what type of software will be used by the detailers including:

- Revit
- AutoCAD
- AutoCAD MEP Fab
- Autosprink
- Navisworks
- Other non-Autodesk Fabrication software

Determining the software will prepare the BIM Coordinator on how the setup will be done in the coordination models within BIM 360 Glue.

Note: *It is always preferable for the detailers to use Revit where possible. If the models are prepared for facility management, they will need to be populated with smart equipment elements that can later be input into 360 Field.*

How to prepare the project for virtual coordination

- Reviewing the contract documents
- Review the construction schedule
- Locate the sub-contractor list

As BIM Coordinators, we must know every detail about the project. We start with the dirt! Yes, the dirt. We evaluate and verify the entire building from ground up within the contract documents, specifications, and submittals that will directly affect the coordination with the MEP & FP systems.

CIVIL/SITE:

Here at CSTi, we communicate with our survey team to locate the building.

We:

- Verify the correct gridline location (normally verify the correct gridlines with structural first).
- Verify the correct elevation depths of foundations, auger cast piles, grade beams, etc. and their locations.

This information is important to get the proper building staking and layout.

We will often help our survey team verify what is in the contract documents versus what is modeled.

Note: *If discrepancies are noticed between Civil, Architectural or Structural plans during the review and verification, notify the general contracting team. They will need to be aware of the situation. That will allow them to properly document the information found for record.*

ARCHITECTURAL:

- Wall types
 - Will kickers be needed
 - Fire rated wall locations
 - Chase locations
- Ceilings
 - Different types
 - Sound attenuation
 - Will kickers for soffits be needed?
- TRUE dimensions
 - Verify the dimensions shown are real and not “text” for visual purposes.
 - The model must have the correct content to do proper virtual coordination.
- Details
 - Review and verify within the contract documents.

STRUCTURAL:

- Anything underground
 - Foundations, auger cast piles, grade beams, etc.
- Steel beams and columns
 - Verify the steel fabricator submittal compared to the contract documents and inform the project engineer of any discrepancies found.
 - Receive an approved steel model and incorporate that information into the coordination model for all trades to coordinate with.
- Joists
 - Verify the steel joist fabricator submittal compared to the contract documents and inform the project engineer of any discrepancies found.
 - Ask for the joist profiles and modify to the appropriate joist webbing for all trades to coordinate with.
 - Modeling the correct bridging locations.
 - Verify that all trades avoid these areas.
- Details
 - Review and verify within the contract documents.

MEP (Mechanical, Electrical, and Plumbing) and Fire Protection:

- Verify underground
 - Equipment
 - Electrical conduit
 - Piping
 - Sloped piping
- Ceiling layouts
 - Lay-in/GYP
 - Support systems
 - Will there be any sound attenuation?
 - Verify if this information is modeled correctly.
 - This could possibly affect the coordination between all trades within the plenum spaces.
 - Diffusers
 - Verify elevations
 - Lighting
 - Verify elevations
- System Types
 - Verify if there is any special equipment and the support systems attached to structure needed.
- Details
 - Review and verify within the contract documents.
- Hanger requirements
- Insulation requirements

Note: We will often overlay the contract document PDF's within Bluebeam to verify:

- *Gridlines*
- *Wall openings*
- *Stairways*
- *Elevator shafts*
- *Compare submittals*

After we verify and perform a thorough sweep of the contract documents, we will locate a sub-contractor list from the general contractor's Project Manager.

Once the contact list (BIM Participation Log) has been created, we will initiate the conversation with each sub-contractor involved with:

- Steel
- Mechanical
- Plumbing
- Electrical/Telecommunications
- Fire Protection

It is important to verify the level of involvement and their knowledge in:

- Experience with BIM coordination on a previous project
- Revit
- AutoCAD
- AutoCAD MEP Fab
- AutoSprink
- BIM 360 Glue
- Navisworks
- Bluebeam
- Procore

Knowing these things will determine how the project will be run throughout the coordination process.

Note: *Will the sub-contractor be directing the detailing and coordination out to a third party?*

Once the scope of work has been determined, and the sub-contractors/detailers have been established, you can begin to build your 3D Coordination model and create the BIM Schedule.

Understand the process, workflow, and timeline needed to stay ahead of the construction schedule

- Create the coordination Revit model
- Create the BIM Schedule
- Establish the BIM Participation Log
- Have the BIM Kick-off Meeting
- Begin coordinating the models
- Prepare for Facility Management

Create the coordination Revit model

There are a few things to remember when building the model in Revit that will be useful during coordination with other trades. Below is our process:

- Link in the architectural and structural model.
 - Verify the models come in the correct location.
 - We usually locate the models in real world coordinates for survey and Scan to BIM processes.
- Create views to be uploaded to BIM 360 Glue.
 - Create the project within Glue to have a location to upload.
 - Proper folder structure
 - Separate each view per trade
 - Example: one view for Architectural items, one view for structural (foundations, floors, walls) items, one view for steel (beams, columns, joists) items, etc.
 - Upload views to Glue.
- Model fireproofing clearances to be around the steel beams (only if there is fireproofing on the project).
 - Verifying and modeling a physical entity for the trades to see will help keep them away from the fireproofing during coordination (we use Dynamo to help with this process).
- Model ceiling grids
 - This will show the grid layout in Glue for coordination of diffusers and lighting layouts (we use Dynamo to help with this process).
- Model room tag text
 - This will show the room tags in Glue for coordination (we use Dynamo to help with this process).
- Model soffit and wall kickers
 - This will show kickers in locations for other trades to be aware and avoid.
- Model king studs
 - This will show the king stud locations in framed walls for other trades to be aware and avoid (we use Dynamo to help with this process).

Note: It is VERY important to verify and keep up to date on all:

- Addendum
- ASI
- RFI
- MCR

The Revit models need to reflect any changes that will directly affect the MEP, and FP systems during coordination.

- Do your best to receive updated models from the design teams, but in most cases, they aren't required to provide that updated information to you. You may need to update the models yourself.
- Most often, models will need adjustments to be "constructible".

Create the BIM Schedule

A BIM Schedule is created for all sub-contractors/detailers to follow during the coordination process. This schedule will directly relate with the construction schedule.

Creating a six to eight week lead time for Field Use Drawings to be "approved for fabrication" is crucial. This means the BIM Coordinator will need to be 100% coordinated anywhere from seven to nine weeks ahead of the actual install date on the construction schedule.

- This is key to be ahead of the construction.

Note: The possibility of the dates shifting in the construction schedule is likely due to unforeseen circumstances and delays. Be aware of that and be in constant communication with the general contracting team. They must provide current construction schedules and look-aheads that will direct the coordination team properly during the coordination process if modifying the BIM Schedule is necessary.

Create the BIM Participation Log

The BIM Participation Log will be created to keep track of all contact information between all sub-contractors and detailers on the project. This will be distributed at the BIM Kick-Off Meeting for everyone to have in case there is coordination that needs to be done outside of the scheduled coordination meetings.

Note: It is key to have the detailers coordinate with each other not only in the meetings hosted by the BIM Coordinator, as well as outside of the meetings. Doing this will ensure they are taking initiative with their information that needs coordination.

Have the BIM Kick-Off Meeting

A BIM Kick-Off Meeting must be held before any coordination is done!

All participants plus their managers must attend the meeting to discuss the guidelines, instructions, and the BIM Attachment contract.

During the meeting, it is important to provide upload instructions and to have consistent file naming, folder structures, etc.

Note: *Having the general contracting team attend is necessary. Everyone will need to be on the same page. The GC needs to be aware of the kind of support to provide for the BIM Coordinator.*

Begin coordinating the models

Once the above processes have taken place, coordination can now begin.

Everyone's workflow will be a little different depending on the kind of efficiencies that works best for the individual. Below is a great practice for the BIM coordination process:

- Provide any training necessary to the coordination team.
 - It will be often that at least one team member will need some training in one of the software types being used
- Open the combined coordination model in BIM 360 Glue.
- Create clash reports necessary.
- Create markups for the detailers to address.
- Have weekly/bi-weekly meetings to discuss issues within the models.
 - Every detailer is required to attend along with the person who can “approve” modifications to take place during coordination.
 - Create weekly BIM Reports for documentation and record
 - Meetings are recorded for documentation
- Be available to walk through the models with the GC team if questions or issues arise and need to be verified in the model versus contract documents.
 - Training the GC team in BIM 360 Glue may be needed to utilize the software when on the jobsite from:
 - Desktop
 - I-pad
 - Data-Vault
- Once the team is 100% coordinated, field use drawings will be created for fabrication.
 - Usually one week is enough time for the detailers to create their drawings
- The detailers will submit their drawings to the BIM Coordinator.
 - Approve for clarity and content
 - Send to the general contracting team (project engineer) to be submitted to the AE (Architectural/Engineering) team to be approved for fabrication

- Perform on-site verification
 - Once install of the MEP & FP has started, the BIM Coordinator will do verification on-site to make sure the field crew is installing per the “field use drawings” that have been approved.
 - Utilize different formats.
 - I-pad verification from model to onsite actual install
 - Scan to BIM verification
 - Other platforms that are available:
 - Virtual glasses
 - Smart helmets

Note: This is ensuring that every trade has a location within the designated areas for install with minor to no issues.

Note: Everyone needs to be aware to avoid issues on the jobsite, it is important to verify all field crews are following the submitted and approved field use drawings to mitigate clashes and issues that could affect timelines and install. If there happens to be an issue that is unforeseen, a conversation with the detailers is necessary to make sure what is modified in the field, won't cause a problem further down the system lines. The detailers can verify this very quickly and update their models appropriately to keep things up to date and moving along seamlessly.

Prepare for Facility Management

Once coordination is complete, the models will be prepared and setup for facilities and asset management.

- The appropriate tracking is established and pushed through different formats
 - Revit
 - BIM 360 Glue
 - BIM 360 Field
 - Building Ops
- Compare models and verify the data and parameters are placed into the necessary equipment

Note: It would be ideal to have the Architects and Engineers have the appropriate modeled information, including parameters already created and placed into their 3D digital information within the models.

- This is rare, but there are some that will provide this information.

Understand how virtual coordination helps with cost and safety

Now that we have gone through the process and workflow of virtual coordination, let's take a minute to explain how all that work performed coordinating ahead of the construction, helps with the cost and safety throughout the project life!

There is no definite way to calculate "actual" cost savings from the coordination process because the potential problems were resolved before any damage was done. There are two major factors in construction, cost and time. In all reality, time is the most important part of the project. But, there are things that we can assume and consider.

If the project is approached with the BIM path:

- Mitigate risk
- Install of the MEP and FP systems timeline has been decreased
- The ability to pre-fab more in-house and not fabricate on the jobsite
- Less material is used
- Verification is performed before, during, and after construction
- Punchlist is decreased
- Less field crew hours
- The ability to solve an issue with other trades before install is performed
- Interface with critical trades like MEP, Fire Protection, and Structural Steel helps create a seamless fabrication and installation process

If the project is approached without the BIM path:

- A clash is detected during install of the MEP and FP systems.
 - Install comes to a stop
 - A solution must be found via RFI/or change in direction
 - field crew hours have now increased
 - Clash was pre-fabricated and now needs to be shipped back to the shop for alterations
 - fuel costs to travel back and forth
- Wait time for questions on the design to come back from the AE team members
- Construction schedule timeline has been increased due to coordination issues and problems onsite

These are only a few examples of how going down particular paths could help or hinder the efforts as a BIM Coordinator.

Conclusion

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 the 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 we interface with critical trades like MEP, Fire Protection, and Structural Steel to create a seamless fabrication and installation process.

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!!