

CS124572

BIM 360 Experiences: Bilateral Benefits When Academia Meets AECO Industry Reality

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Learning Objectives

- Summarize each of the presented BIM360 applications as well as potential use cases for each
- Determine which BIM360 services are suitable for the development of an exercise which meets their needs
- Design an effective exercise that partners academia and industry through BIM360
- To carry out a collaborative exercise between industry and academia with knowledge of general best practices and lessons learned

Course Description

The BIM 360 products provide project teams with a range of options for project collaboration that differ from the traditional ways of conducting business and can intimidate new users. This class will focus on the **development and advantages of a collaborative learning exercise** between industry partners and academic institutions, with the goal of exposing students to **real-world collaborative experiences** they will face as they begin their careers in the architecture, engineering, construction, and owner-operated (AECO) industry. Learn how industry partners have the opportunity to push the boundaries of their BIM 360 utilization in a no-risk environment, while affording new employees valuable experience. Academics Nathan Blinn and Dr. Raymond Issa—with David Epps, director of construction technology for Winter Construction—will share their experiences with BIM 360 software, while providing a **customizable blueprint** for the development of your own BIM 360 learning exercise, complete with lessons learned and learning objectives.

Speaker's Bio

Nathan Blinn:

Nathan Blinn is a PhD Candidate at the University of Florida M.E. Rinker, Sr. School of Construction Management, with industry working experience as a virtual construction engineer, and as a technology consultant. After obtaining his bachelor's degree from Roger Williams University, where he was first exposed to the world of VDC technology, and his master's degree from the University of Florida, he has followed a passion for virtual construction technologies and their effective integration into the AECO industry during his doctoral studies. He has



published work in the fields of augmented reality, unmanned aircraft systems, reality capture technology, and the impact of various technologies on pedagogical techniques and the education of future AECO professionals. Furthermore, as a researcher in the Center for Advanced Construction Information Modelling at UF, he aided in the development of the course “Reality Computing for Design and Construction” through the Autodesk Design Academy.

David Epps:

As Director of Construction Technology, David oversees the implementation, management and innovation of technology that provides value to the Construction process. This includes Building Information Modeling and Virtual Design and Construction, but also extends into other exciting and overlapping areas like Drones / UAVs, Laser Scanning, Virtual Reality, and Construction Simulation. His focus also includes project pursuit and marketing support, project setup, BIM Execution Planning, company and industry training, project standardization and consistency, recruitment, and managing the day-to-day workload and support needs across the company.

He is responsible for the evaluation, purchasing, and management of new software and hardware that is released to the industry and collaborating with leading software and hardware providers to push the technology toward adding higher value on Construction projects. He is a member of the BIMForum Leadership Group and a frequent presenter at numerous industry conferences and events in the hopes that educating and working with the most innovative members of the Design and Construction industry will lead to a more collaborative and efficient Construction process for everyone involved.

Ultimately, his main role is ensuring that BIM and related technologies are consistently leveraged through Project Concept/Design Support, Project Pursuit, Preconstruction, Operations, and Facilities Management/ Owner Handover.

Experiential Learning Exercises

On teachers “They give the pupils something to do, not something to learn; and the doing is of such a nature as to demand thinking, or the intentional noting of connections; learning naturally results”
– John Dewey

Learning is an often debated concept in which many schools of thought exist. However, in construction and the Architecture, Design and Construction (AEC) industry as a whole the belief in experience as the most valuable asset of an individual is quite pervasive. Due to this, it stands to reason that the ability to gain hands on experience can be invaluable to industry professionals, both aspiring and existing, as they work to adapt to the emerging technological workflows which are driving the future. The ability to provide experiential learning to students and industry professionals helps provide a solid foundation that moves beyond conceptual learning and can be built upon as further experience is gained.

This exercise was designed to provide students with meaningful experience using a range of connected BIM technologies, while simultaneously affording the industry partner the opportunity to train new employees or test new workflows in a no-risk environment. The bilateral benefits made possible through this exercise can continue to evolve and grow as the academic and industry partnership evolves and the individual needs change. Whether the person participating in this exercise has never experienced connected BIM enabled coordination or simply wants to expand their understanding and experience to new areas, the focus on experiential learning creates meaningful experiences which encourage further thought and skill development.

Benefit of Collaborative Learning Exercises:

The benefits of an interactive, synchronous BIM based coordination activity cannot be overstated. Students gain a firsthand understanding of the complex process while developing a respect for the roles of each member of a project team. The ability to assume the role of a specific team member and see the problem from a new perspective, with a tangible goal in mind, forces the students to think critically and apply their knowledge of the BIM processes in a real-world scenario. The ability to utilize the technology, concepts and intangible skills, such as communication and negotiation, which will be crucial in their careers is a great asset to their education. Furthermore, it affords them the opportunity to make mistakes in a low-risk environment where instructors and peers can offer insight and guidance toward success. Overall, the ability to work synchronously in a connected BIM environment provides benefits which break down the traditional asynchronous stereotypes placed upon learning while enriching the students overall learning experience.

BIM 360: What's Out There?

There are a number of products as part of the BIM 360 suite from Autodesk and each provides a unique toolset to project teams. The products selected for use in this exercise afford the academic and industry partners the opportunity to work with a range of toolsets which enable project coordination and provide a realistic cross-section of what is being implemented across the AEC industry. The selected products provide a foundation for students to build upon and a test bed of products for industry partners to work with as the bounds and capabilities of connected BIM are explored.

Products Used in this Course



Autodesk Revit:

Revit is used as the primary modelling and model management environment for the exercise and is the primary modeling tool taught and used throughout the industry. In relation to this exercise, it will be used in combination with other services to act as the primary model interface between the student, industry and academic teams.



Autodesk BIM 360 Team:

BIM 360 Team hosts project models in a cloud environment, providing access to all project team members for project management. Real-time design review and coordination are made possible through native markup and notation tools in the online BIM 360 Team environment and can be shared with the project team for effective project review. Furthermore, projects in BIM 360 Team can be accessed directly in the Revit environment enhancing real-time collaborative workflows enabled by the cloud. BIM 360 Team puts connected BIM workflows at the fingertips of the entire project team. During this exercise BIM 360 Team will be used to host the live project models for each of the disciplines. Additionally it will enable all participants to experience or test workflows and experience the permission settings for collaborative modeling practices.





Collaboration for Revit:

This plug-in for Revit provides the ability to work collaboratively in a live modeling environment via cloud connectivity. Project team members can access the model from any Revit any Revit environment they are logged into that has internet access to their BIM 360 Team environment. Additionally, Collaboration provides a communicator tool for the project project team to use natively within the Revit environment. Most importantly it saves archives and “checks out” model elements so that individuals do not duplicate efforts or inadvertently change something that another team member is managing.



Autodesk BIM 360 Docs:

Construction document management can be centralized in the BIM 360 Docs cloud based environment. This provides access to the most up to date drawings, specifications, and other project documentation. In this exercise BIM 360 Docs is used to host the drawing sets for the selected project. The drawing sets can be managed, notated and updated for the entire project team. As a potential solution for project teams seeking more streamlined document management in the field, exposure to this solution for students and the ability to test its capabilities for professionals is of great benefit.



Autodesk BIM 360 Glue:

Cloud-based interdisciplinary design reviews are made possible through the use of BIM 360 Glue. Project teams can conduct coordination and clash detection exercises, with each project stakeholder having the ability to manage their individual content contributions and visualize the coordination or clash reports. Models can be pushed to BIM 360 Glue directly from Revit with version control as updates are made. Furthermore, BIM 360 Glue allows project members to navigate 3D models, measure, annotate, and collaborate with every building system, thus encouraging collaborative problem solving throughout the design and coordination process. In this exercise glue will be used as the coordination and clash detection environment. Students will push updated models into the assigned Glue projects and have the ability to review the developed clash reports live. Additionally, the industry partner will have the opportunity to test BIM 360 Glue workflows as well as processes for integrated operation with Navisworks Manage.



Autodesk Navisworks Manage:

The ability to view, review, simulate, coordinate, and access model information is made possible through the use of Navisworks Manage. Navisworks Manage provides the ability to conduct clash detection, model review, and a number of integrated activities including the inclusion of schedule, cost and project information. For the purpose of this exercise Navisworks Manage will be used as an alternative workflow for model review and QA/QC activities, as well as for coordination in combination with BIM 360 Glue.

The Integration of Connected BIM in Higher education

Each individual pairing of academic and industry partners will have a different set of goals, anticipated outcomes, and time availability to complete a collaborative exercise. Due to this, it is important to note that all recommendations and processes discussed here can be customized to fit the needs of the parties involved. Proper planning can make a variety of exercise iterations possible, which can be additionally scaled to the skill level and content available from everyone involved. The exercise as outlined here is based on an upper division course taught as part of the construction management curriculum at a major University.

The course this exercise was first implemented in had the following criteria:



Weeks



Hours / week
in-class
contact time

The course meets weekly for a single 3 hour time block. It is a semester long course which typically runs a total of 15 weeks. It is an upper division course focused on the utilization and management of BIM and VDC technologies. Students are expected to have a basic understanding of construction practices and basic computer/technological proficiency. The software platforms primarily covered in the course include:

- Autodesk Revit
- Autodesk Navisworks
- BIM 360 Glue
- BIM 360 Docs
- BIM 360 Team
- Collaboration for Revit

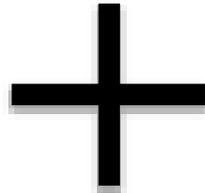
During the course students complete seven classwork assignments, based on standard plans designed specifically for the course, as well as one semester long group project developing an as-built model of local buildings near the University. The primary focus for the individual assignments is on best practices, theory, and BIM execution, while the group project focusses on team collaboration and BIM workflows over the life of a project. Essentially, the core components of skill building and concept application drive the two sets of activities which make up the backbone of the course. The collaborative exercise bridges the gap between skill building and application related to connected BIM services and processes.

Common project



(7) Individual
Class
Assignments

Skills building



Team project



As-built model of
local school
buildings

Application of
concepts

PRIMARY PILLARS OF CONSTRUCTION TECHNOLOGY COURSE WHICH FIRST IMPLEMENTED THIS COLLABORATIVE COORDINATION EXERCISE

BCN 6785

Classwork: *(Level 300 BIM development)*

- Focus on building fundamental skills (best case project environment)
- Sample building designed and coordinated using Revit
- 3D model developed and used to derive 2D content for students

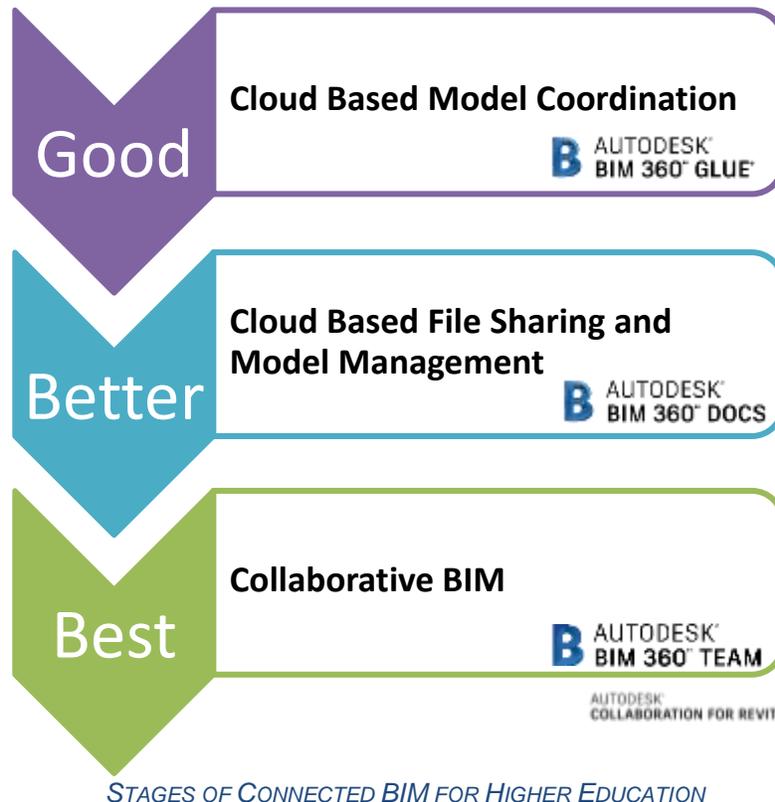
Group Project: *(Level 300 BIM development)*

- Focus on collaborative BIM process and the application of fundamental skills in a real world project
- Teams assembled of diverse experience and education backgrounds
- Reinforce the skills gained and provide real world complexity

PROJECT DETAILS WHICH SURROUND THE COLLABORATIVE EXERCISE AS PART OF THE COURSE

The course begins with instruction and utilization of desktop applications, where students are encouraged to work in the computer lab as well as on personal computers. The primary focus in the early stages is on modeling best practices, information management, model management, and the development of foundational BIM skills. These skills are then built upon toward the goal of achieving literacy in connected BIM processes, which most effectively prepare students for their eventual career in the AEC industry. The move from desktop stand-

alone application to connected BIM occurs in stages, each leveraging a different piece of technology. While not all course may have the time or ability to achieve full implementation the stages of integration can be described in a good, better, best manner.

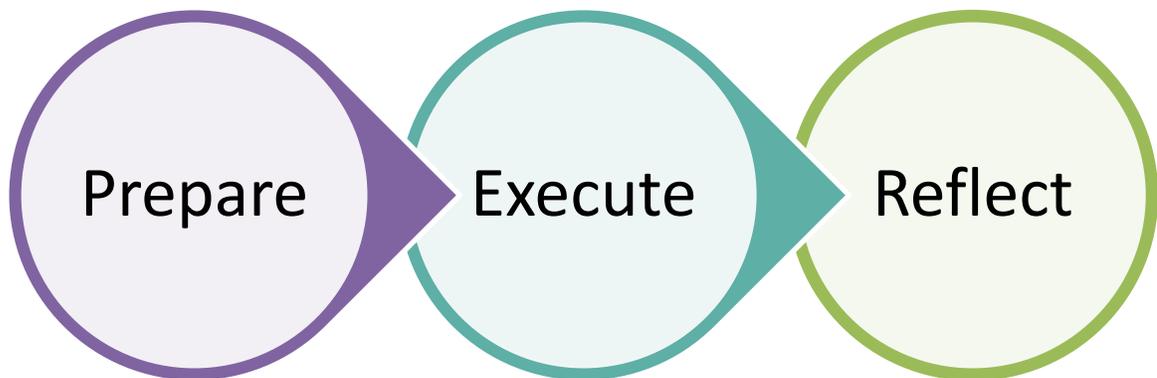


At the early stages the use of models to coordinate and update designs is something which can easily be added to the fundamental BIM skills developed by the students. Next would be getting the students to leverage document and model management technology, such as BIM 360 Docs throughout the course of their assignments. Finally, and the best case scenario, would be for the students to achieve collaborative BIM literacy through the use of collaborative modeling practices, coupled with integrated document/model management, and coordination capabilities.

The most effective way to achieve connected BIM literacy is through the use of hands-on activities and exercises which afford the students the opportunity to put their technical skills to use and experience the workflows first hand. In that spirit, it is difficult to achieve meaningful examples of connected BIM utilization, with any cloud based platform intended for disparate project teams, in a classroom setting. The development and execution of collaborative exercises with industry partners can be an impactful way to demonstrate the power of connected BIM while working through an engaging and meaningful learning experience for everyone involved.

A Roadmap for Collaborative Coordination Exercises

The instruction of collaborative coordination and other Connected BIM processes is an important part of preparing future professionals and companies for the future of the AEC industry. As such, there is great opportunity for bilaterally beneficial experiences between academic and industry partners. Such exercises provide students with meaningful and founded experience in true-to-life scenarios and the industry partners have the opportunity to push the bounds of their current processes in a no-risk environment. However, such exercises are only as impactful as their planning allows and certain considerations should be made in order to achieve the highest levels of success.



Exercise Development Considerations:

- Clear learning objectives for all participants
- Concise goals and expectations for each stage of the exercise
- Meaningful content designed to achieve the learning objectives
- Adequate time provided for each stage
- Feedback loops for continued improvement and development

Learning Objectives for Students:

By the end of the exercise students will be able to:

- List the BIM360 applications and their associated uses for a construction project (Remember-Factual).
- Identify appropriate use cases and implementation strategies for each of the presented BIM360 products (Remember-Metacognitive).
- Select the most appropriate set of BIM360 tools for a given project and specific situation (Analyze-Factual).
- Create and execute project tasks in each of the presented BIM360 applications (Create-Metaphysical).

Learning Objectives for Industry Team:

By the end of the exercise industry partners will be able to:

- Carry out BIM360 exercises with the goal of testing alternative or novel utilization workflows for each application (Apply-Procedural).
- Detect strategies for improving their current BIM360 workflows (Remember-Metacognitive).
- Deconstruct one's own habits and procedures, both good and bad, in the BIM360 environment (Analyze-Metacognitive).
- Design a more efficient workflow strategy for the BIM360 applications being utilized (Create-Procedural).

Methodology:

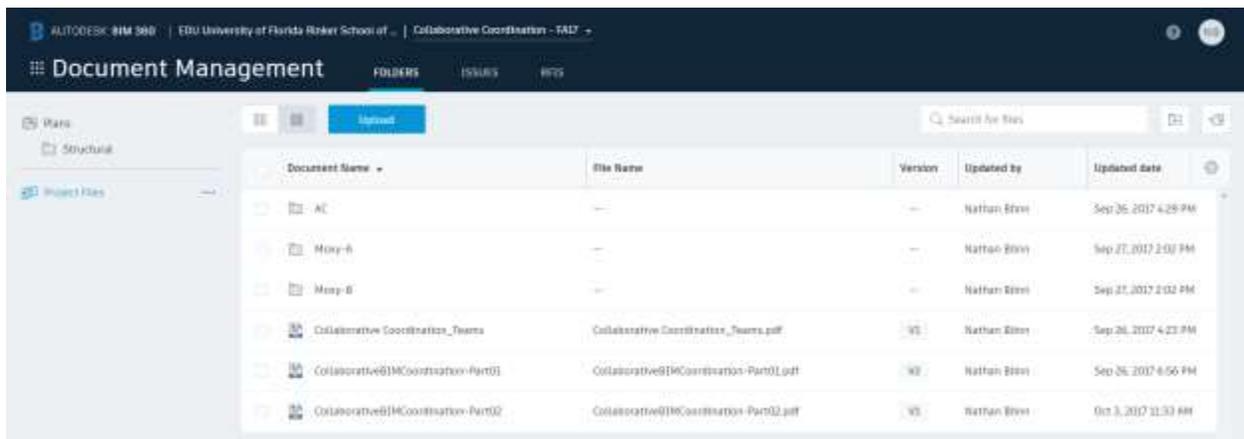
The recommended developmental methodology consists of planning activities broken into four stages. The first of which is the initial goal discovery stage and the remaining three are the development of details for the exercise itself. Each stage is outlined below with a series of recommended goals and process milestones to act as a foundation for the development of your individual exercise.

Pre-Stage: Development

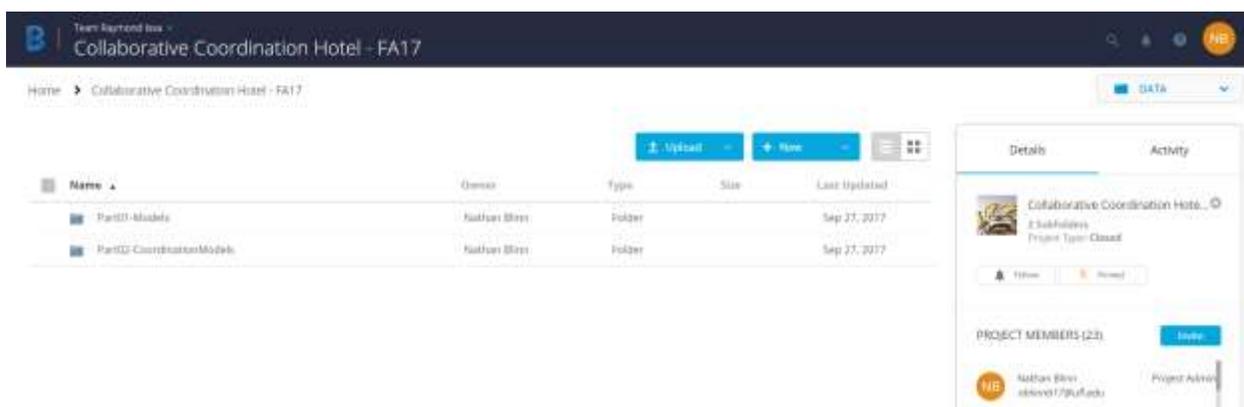
Set a goal for the completion of each portion of the pre-stage. It is recommended that pre-stage activities are completed prior to the start of the semester in which you hope to integrate this collaborative exercise. The following are the goals that will start the exercise planning off on the right path.

- Compile documentation for existing building project to be utilized for the exercise.
- Determine if the entire building is to be used or if a specific portion should be the focus.
- Determine anticipated number of groups and how the selected building will be divided among them.
- Determine which building elements will be grouped and assigned to student teams for review
 - We focused on architectural and structural components
 - Specifically, interior partitions, ceilings/soffits, and structural beams/columns
 - These were selected as they are some of the primary components involved in clashes with MEP systems during coordination.
 - Students had not yet achieved MEP modeling proficiency in the course we included the exercise in and as such had them focus on the elements they were comfortable with and the industry partner managed the MEP models
- Cleanse the model to reduce extraneous detail elements and reduce overall model complexity.
 - Allow for a focus on the selected building elements
 - Ensure MEP models are prepared for insertion into the student models

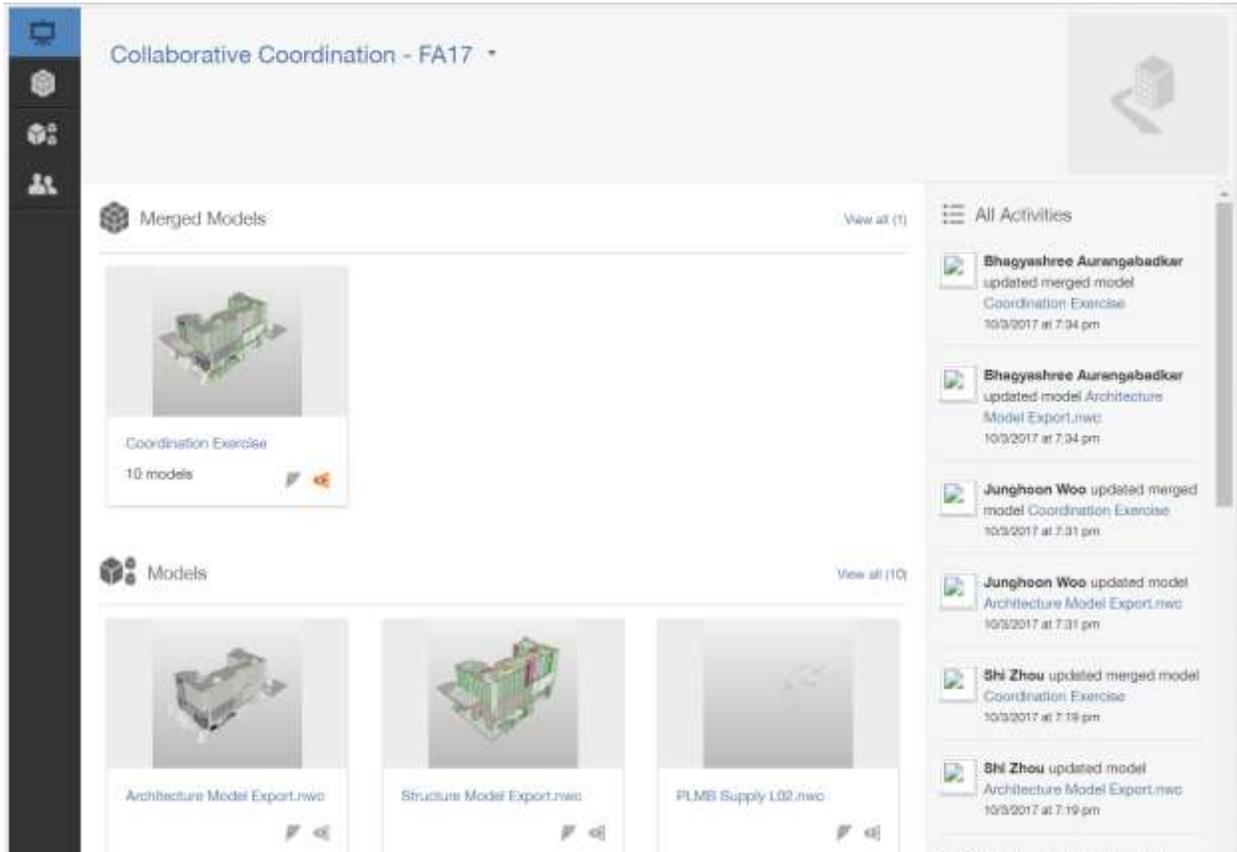
- Edit project models to introduce errors which will cause coordination issues and should be found during the student team QA/QC exercise in stage 01.
- Between 20-30 changes per team of six is appropriate
- Divide the changes among the disciplines assigned to the teams evenly based on number of students assigned to each discipline
- Be sure to log changes, sample log provided as a supplement to this course
- Develop exercise specific prompts and written materials.
- Sample provided as supplemental materials to this course
- Prepare BIM 360 projects in; Glue, Team, and Docs
- It is best to create one project for the exercise and then apply permissions so that individual teams only have access to their team specific folder



BIM 360 DOCS SETUP FOR COLLABORATIVE COORDINATION EXERCISE



BIM 360 TEAM SETUP FOR COLLABORATIVE COORDINATION EXERCISE



BIM 360 GLUE SETUP FOR COLLABORATIVE COORDINATION EXERCISE

Stage 1: Coordination Kickoff & Modelling Meeting

The initial part of the live exercises is the change for everyone to understand the expectations for the exercise, establish roles and collectively plan for the next stage. This stage can be accomplished in approximately 1 hour.

- Expose students to the exercise which will take place the following week
- Create project teams, assign roles each team member is expected to fulfill
 - Ensure teams have evenly distributed talent, experience, and backgrounds among the students
- Have industry team in for the kickoff meeting to set project expectations and run the BIM “kickoff meeting”.
 - The industry partner should be in attendance virtually using some form of video conferencing system.
 - Having the industry partner virtual is not only the most efficient use of their time (e.g. no travel) but it is a true-to life experience as coordination often occurs virtually.
 - Virtual presence of industry team also allows for greater demonstration of the connected BIM technology in the BIM 360 suite of products
- Review models collectively to ensure an understanding of what roles everyone is playing and what building aspects they should be focusing on.

- Assign QA/QC homework to the student teams which should be made due at least 24 hours prior to the commencement of Stage 02.

Stage 2: Coordination Meeting

The second stage of the exercise is where the majority of the work and learning takes place. In this stage all the “project stakeholders’ will take part in a coordination meeting while making live changes to the models. Stage 02 requires 2-3 hours to be effectively executed, 3 highly preferred.

- Conduct coordination exercise, run by the industry partner, over the entire 3 hour class period.
- Use live video streaming and BIM 360 collaboration tools.
 - This ideally requires all students to be situated in a computer lab or at least on capable laptops with stable internet connection so that everyone can be simultaneously logged into the model and coordination environments.
- Coordinate, update models, review, repeat
 - Define the schedule for this based on the number of teams and complexity of the project selected
- Part way through coordination, industry team should upload an “updated” model for whichever discipline they are in charge
 - This model should be largely different, due to greater detail generally, than the original model, thus simulating what takes place as subcontractors and designers refine their models during coordination
- Assign debrief homework due for Stage 03 of this exercise
 - Debrief can be completed via an online survey which empowers students to share their experience openly and honestly
 - Valuable feedback for the improvement of the exercise can be gained

| Collaborative Coordination Timeline (3 hour) **Sample** | | | | |
|--|---------------------------|-----------------------------|---------------------|---------------------|
| Time | Coordination Focus | Group A | Group B | Group C |
| 5:00 | All | Exercise and Model Overview | | |
| 5:10 | | | | |
| 5:20 | Group A Area | Coordination Review | Internal Review | Internal Review |
| 5:30 | | | | |
| 5:40 | Group B Area | Internal Review | Coordination Review | |
| 5:50 | | | | |
| 6:00 | Group C Area | Internal Review | Internal Review | Coordination Review |
| 6:10 | | | | |
| 6:20 | All | | | |

| | | | | |
|------|----------------|---|---------------------|---------------------|
| 6:30 | | Model Change Review and Common Issue Discussion | | |
| 6:40 | Upload to Glue | | | |
| 6:50 | Group A Area | Coordination Review | Internal Review | Internal Review |
| 7:00 | Group B Area | Internal Review | Coordination Review | |
| 7:10 | Group C Area | | Internal Review | Coordination Review |
| 7:20 | All | Model Change Review and Iterative Review Discussion | | |
| 7:30 | | | | |
| 7:40 | Upload to Glue | | | |
| 7:50 | All | Final Review of Model Change and Coordination Processes | | |
| 8:00 | | | | |

SAMPLE STAGE 02 SCHEDULE FOR THE COLLABORATIVE COORDINATION EXERCISE

Phase 3: Final Coordination Review and Debrief

The final stage of the exercise is designed to provide an opportunity for reflection and continued instruction related to coordination practices.

- Review final coordination report and the changes which took place over the course of Stage 02.
- Facilitate discussion for next steps and possible solutions to identified problems should coordination continue.
- Discuss the exercise as a whole
 - What were some lessons learned, from all participant groups, students, faculty and industry professionals
- Industry partner can provide further industry insight into the coordination process and lessons learned during live coordination processes.
- This is your chance to drive home the capabilities of connected BIM and how coordination processes are just one example of how the BIM 360 suite can improve project experiences.

Exercise Content Narrative:

Develop an exercise narrative to be shared with everyone involved in the exercise. This will allow for a basis of understanding and set the tone for the exercise as a whole. It should be developed during the pre-stage to outline the selected project and specifics for which building systems are being developed. The narrative for the exercise conducted by the course instructors is found below for your review and to be used as a template.

Sample Content Narrative

This exercise will focus on the two lobbies of the selected hotel project. The lobbies are designated as Moxy and AC. Each lobby has a different design style but is roughly the same size and complexity. The focus will be on the modelling and coordination of these spaces. In order to accomplish this the class will be broken into three teams with each team member focusing on a specific area or component of the lobby space design. The goal will be for the students to conduct basic architectural and structural model QA/QC exercises, followed by a simulated coordination exercise and concluding in a project debriefing session. As part of the exercise the industry partner will provide an initial set of MEP models to coordinate with, followed by an updated set prior to the final meeting which reflect a greater level of detail. This simulates the real world changes which occur on a job every day. The materials needed for the exercise are as follows:

- Architectural and Structural Models (In BIM 360 Team)
 - It will be cleaned to reduce overall size and focus on the specified building elements of interest
 - All necessary building component families and types will be included
- The lobby spaces of the building will be the focus of the groups and will be the only areas for QA/QC review
- MEP models (arch vision/ preliminary design)
 - To be provided by Industry Partner
- MEP models (final design)
 - To be provided by Industry Partner
- Lobby drawings set with selected information redacted to facilitate the need for RFI submission (In BIM 360 Docs)

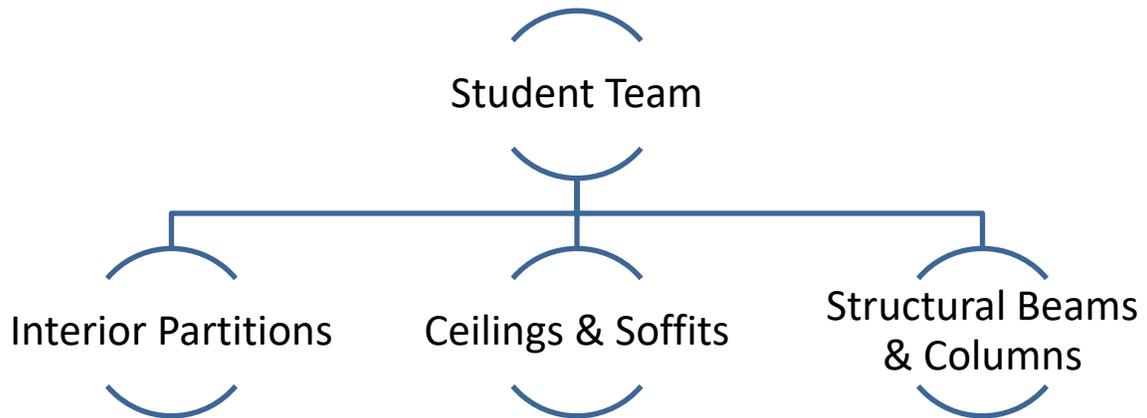
In this assignment the class will be broken into three teams of six and expected to conduct BIM based QA/QC and coordination activities for a specified portion of a building. Based on class size each building portion may be used more than once, which will provide the opportunity for comparative review of the group's performance. A base bid design drawing set will be provided to each team member, in BIM 360 Docs, and they will be expected to complete a QA/QC check of the appropriate portion of the model prior to the first building coordination meeting in Stage 02. Using the Autodesk BIM360 software suite, each group member will upload their individual work to the group project and review the others work in BIM 260 Team. The group will then hold a coordination meeting to review the models and make the appropriate adjustments, with the industry partners acting as the MEP subcontractors and the instructor acting as the owner. Coordination will take place in BIM 360 Glue and Navisworks. Following the first round of coordination corrections will be made, then a second round of coordination will take place to discuss the changes and make any final arrangements prior to submission. This process will be conducted live and all changes will be expected to be discussed and made during the exercise. Following the coordination portion of the exercise, a debriefing survey will be filled out by everyone and a debriefing session will be convened to facilitate discussion.

Exercise Team Breakdowns

The specific breakdown of the teams and groups for your exercise will vary greatly depending on the makeup of the course and industry partner relationship that exists. Below is the recommended breakdown of team roles as executed during the integration of this exercise into an upper level construction management course.

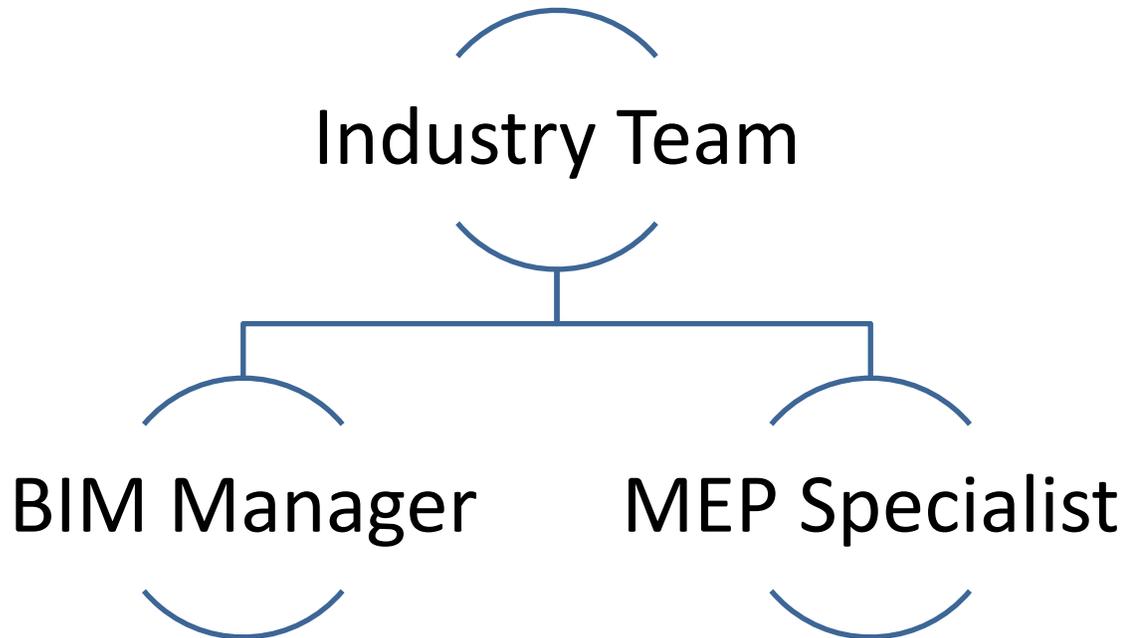
Student Teams:

Student teams should be developed by the instructor to ensure the even distribution of talent, experience, and backgrounds. It was found that teams of six worked effectively to allow pairs of student to work on each construction discipline. For the purposes of our exercise we decided to have each team focus on the following 3 categories, with two students per category:



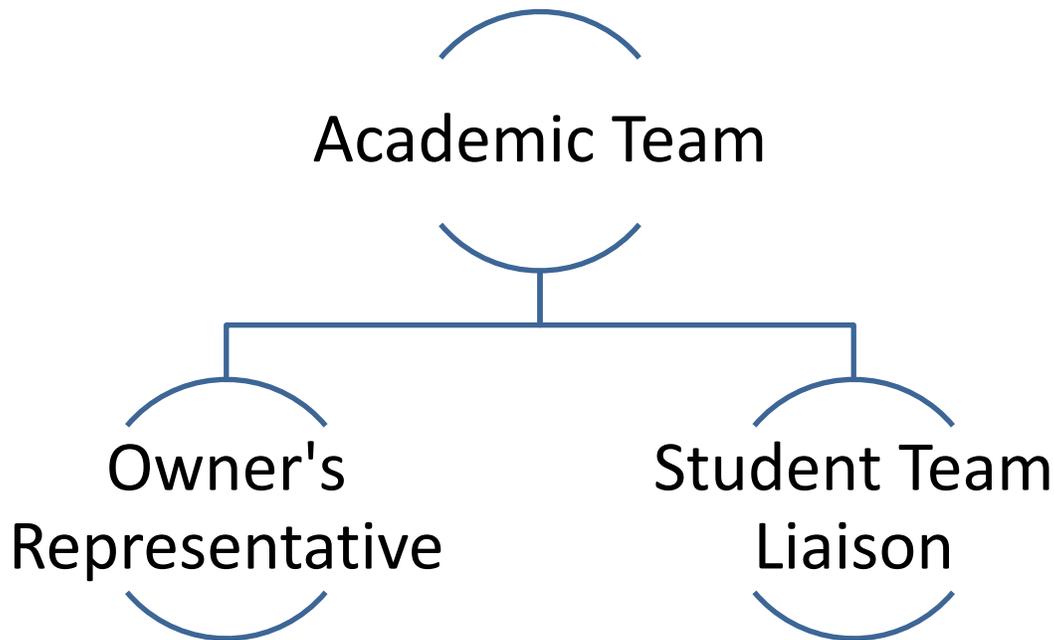
Industry Team:

The role of the industry team will be largely to facilitate project coordination and to act as the BIM/VDC manager. They will run the coordination meeting and provide additional content depending on what building systems are selected as the focus. In the case of the exercise conducted and reviewed in this class, the industry team provided the MEP models and managed those so that the students could focus on the architectural and structural models as part of the overall coordination process



Academic Team:

The academic partner, e.g. instructor and/or graduate TAs, will act as the owner's representative during the exercise. Information regarding the contract type and obligations of each group member should be made available via BIM 360 Docs for the teams to review and reference. Furthermore, acting as the owner, the instructor will provide models for additional disciplines, as well as any change orders which will need to be captured. Finally, the academic team should act as the liaison between the student teams and industry partner to get answers to questions and to facilitate the work that is being completed. Aside from their role in the exercise the academic team should facilitate the development and execution of the plan for the successful completion of the exercise.



Collaborative Exercise Stage Outlines and Resources

The development of documentation for a collaborative exercise such as this can be daunting, to alleviate that barrier sample documents have been provided for you as supplemental resources for this course. The provided documents provide a framework, based on the way the course instructors executed this exercise, and are written to provide a chance for customization and adaptation to your specific needs. Additionally, sample of these documents have been included in Appendix I – Appendix III in this document. The available documents include:

- BIM360CollaborativeExercise-Stage01-Sample
- BIM360CollaborativeExercise-Stage02-Sample
- BIM360CollaborativeExercise-Stage03-Sample
- BIM360CollaborativeExercise-ModelChangeLog-Sample.xls

The provided “Stage” documents can be updated and used as the assignment files for distribution to the students. They should also act as your guide as you modify this exercise to meet your needs. Adjust the objectives and outcomes which will subsequently help ensure you are completing the exercise towards your goals. Develop this in partnership between the industry and academic groups to ensure that the mutual benefits which are possible are taking place. Finally and most importantly, ensure that everyone is able to have fun and step out of their technological comfort zones. Using the BIM 360 suite can be daunting but once they dive in it can be a rewarding experience which lays a foundation for a future of success leveraging connected BIM technology

Lessons Learned and Points for Consideration

The execution of a collaborative coordination exercise does not come without road bumps and growing pains, especially in its first iteration for a given pair of academic and industry partners. The being said, everything is a learning experience and can lead to a better exercise when taken into consideration. Here are some the lessons learned that were experienced in the first iteration of our teams exercise which may be of interest to you.

- Plan early and often
 - This seems like a no-brainer but it is important to stay in communication and develop a detailed schedule for content and exercise development between the academic and industry partners
 - Everyone is busy and effective planning can ensure that the exercise does not fail due to unforeseen complications
- Allow for plenty of time for the exercise stages
 - Each stage is different but the key is to ensure that enough time is allotted
 - Stage 02 specifically requires a longer period of time, three hours is preferred but no less than two should be attempted as it stifles the ability to adequately navigate the coordination process.
- Test any and all video conferencing equipment days before the exercise
 - The last meeting between the academic and industry partners should be held using the actual video conferencing and presentation equipment which will be used, this allows for troubleshooting and plenty of time for adjustments
- Pick a reasonable project scope for each student team
 - The purpose of the exercise is to expose students to the coordination process not for them to prove they know how to model
 - Consider specific and small scope, e.g. single building element classifications, for each subset within the teams
 - This allows for a focus on the process and experience overall
- Use real project models
 - If possible the industry partner supplying a real-world model set, which they have or are coordinating, is hugely beneficial
 - The industry partner has in-depth knowledge of the project and can share lessons learned and real experiences which ground the exercise in reality
 - It is important to get students into working projects models so that they gain an appreciation for the complexity
 - The industry team has the opportunity to test work flows and work with a model that they know is true to what they experience in their day to day operations
- Group students based on backgrounds
 - Not all students have the same levels of experience and expertise
 - Student groups should be selected by the instructor to ensure an even distribution of talent and experience, which leads to a better outcome

Resources:**Publications of Interest:**

Dewey, John. Democracy and education. Courier Corporation, 2004.

Webinars:

BIM 360: Construction Management Webinar Series

<https://academy.autodesk.com/inspiration/webinars/construction-management-bim-360>

Connected BIM Webinar Series

<https://www.autodesk.com/campaigns/connected-bim-webinar-series#>

Information Courses and Tutorials:

BIM 360 Docs

<https://info.bim360.autodesk.com/bim-360-docs>

<https://knowledge.autodesk.com/support/bim-360-docs?sort=score>

BIM 360 Glue

<https://info.bim360.autodesk.com/bim-360-glue>

<https://knowledge.autodesk.com/support/bim-360-glue/getting-started?sort=score>

BIM 360 Team

<https://info.bim360.autodesk.com/bim-360-team>

<https://knowledge.autodesk.com/support/bim-360-team/getting-started?sort=score>

Collaboration for Revit

<https://www.autodesk.com/products/collaboration-for-revit/overview>

<https://knowledge.autodesk.com/support/collaboration-for-revit?sort=score>

Appendix I

Sample documentation for the Stage 01 Assignment sheet template, ready for customization, can be found as part of the supplemental resources for this class. A copy for review and reference is included here.

Collaborative Coordination Exercise: Leveraging Connected BIM

Insert Academic Institution* – *Insert Industry Partner

Stage 01: Coordination Kickoff Meeting

Overall Exercise Summary:

This collaborative BIM coordination exercise is designed to expose you to real-world BIM processes through a partnership with industry professionals. The exercise will be conducted using the BIM 360 suite of products, which provide project teams with a range of options for project collaboration that differ from the traditional ways of conducting business. Three parts will be conducted to provide a holistic experience, with multiple opportunities for reflection and skill development. Gaining exposure to **real-world collaborative BIM coordination experiences**, will prepare you for situations which will be faced as you begin your career in the architecture, engineering, construction, and owner-operated (AECO) industry.

Learning Objectives:

By the end of Stage 01 of the exercise you will be able to:

- List the BIM360 applications and their associated uses for a construction project.
- Identify appropriate use cases and implementation strategies for each of the presented BIM360 products.
- Conduct QA/QC activities using live models for architectural and structural components

Exercise Stage 01 Goals:

The overall goal of this Stage of the exercise is to lay the foundation for the coordination activities in the remainder of the exercise and kickoff the coordination process. Project teams will be formed and roles established so that every team member has a stake in the project. Furthermore, you will be introduced the BIM 360 environment in which you will be working, including: BIM 360 Docs, Glue, Team, and Collaboration for Revit. Industry partners will conduct a project kickoff meeting and start the coordination process through the setting of expectations as would occur in a true project kickoff meeting. Additionally, project teams will have the opportunity to preliminarily plan their “internal” coordination efforts and outline that plan for the “Owners representative” for review and approval. Finally, teams will be expected to conduct QA/QC model checks for the specified disciplines prior to Stage 02 of this exercise.

The BIM Coordination Kickoff Meeting

The kickoff meeting is a crucial component of preparing for a successful coordination process. Project stakeholders have the opportunity to outline expectations, set roles, and define the needs of the project. Ideally all of the individual team members who will participate in the coordination of the project will take part in this meeting. However, exceptions do occur when sub-contractors have not been selected prior to the time of kickoff. In Part 01 the project manager will run the coordination meeting and outline the roles of each individual team. For the purposes of this exercise it is understood that the MEP sub-contractors have not yet been selected but will be brought in at a later date. Also, the owner has a tight deadline set for the project and getting a jump-start on coordination is the only path forward.

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Be prepared to discuss the project with your team and to set internal goals which will enable you to meet the project manager and owner deadlines. This is your chance to ask questions in preparation for your QA/QC work prior to the first coordination meeting. Ensure you understand what is expected of you and let the project begin.

Level of Development (LOD) and QA/QC Details:

LOD 300

- Model elements will be of a specific system with appropriate size, shape and location within the model.
- This will enable appropriate coordination, based on reliable spatial information, to take place during the subsequent meetings

Model QA/QC

The focus of this exercise will be primarily on the architectural partitions and ceilings, as well as the structural components in the lobby. Each team will be responsible for verifying the provided models for their given building/building sector. During this check teams should be looking for and fixing errors related to:

- » Building component placement for assigned discipline
- » Material Properties
- » Component styles or types which impact shape
- » Component sizing
- » Overall accuracy related to specified design

Project Team Roles:

Owner's Representatives (*Academic Instructors*)

- » Project Owner/Design Team Representative (1 Per Team if possible)
 - The owner's representatives act as the voice of the owner and design team throughout the coordination process. They also coordinate and distribute the necessary data sets for the completion of the exercise.

Student Teams (6 members each)

(Instructor Note: As many teams as necessary, Adjust the team names and include details related to your class specifics here)

- » Partitions QA/QC (2)
 - These individuals focus on the interior partitions of the given building or building sector assigned to their team. The performance of QA/QC checks on the partitions should be conducted and the models prepared for coordination.
- » Ceilings QA/QC (2)
 - These individuals focus on the ceilings and soffits of the given building or building sector assigned to their team. The performance of QA/QC checks on the ceilings and soffits should be conducted and the models prepared for coordination.
- » Structure QA/QC (2)

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- These individuals focus on the major structural components of the building, e.g. beams and columns of the given building or building sector assigned to their team. The performance of QA/QC checks on the structural elements should be conducted and the models prepared for coordination.

Construction/VDC Manager (Industry Partner)

- » Project Manager (1)
 - Acts as the project facilitator, running the coordination meeting, setting expectations, and working between the Student teams and owner's representatives throughout the exercise.
- » VDC Manager/ Specialist (1)
 - Conducts the model coordination and review exercises acting as the head BIM manager for the exercise. This person prepares the coordination reports and works with the student teams throughout the exercise.

Homework:

Due 24 hours prior to the start of Stage 02 of this exercise

- » Student teams are to complete QA/QC checks of their specified building components.
- » Any errors are to be adjusted and logged appropriately
- » All modeling work is to be completed using the live exercise model hosted in BIM360 Team, accessed through Collaboration for Revit
- » All work is to be completed 24 hours prior to the announced start of Stage 02

Appendix II

Sample documentation for the Stage 02 Assignment sheet template, ready for customization, can be found as part of the supplemental resources for this class. A copy for review and reference is included here.

Collaborative Coordination Exercise: Leveraging Connected BIM

Insert Academic Institution* – *Insert Industry Partner

Stage 02: Project Coordination

Overall Exercise Summary:

This collaborative BIM coordination exercise is designed to expose you to real-world BIM processes through a partnership with industry professionals. The exercise will be conducted using the BIM 360 suite of products, which provide project teams with a range of options for project collaboration that differ from the traditional ways of conducting business. Three parts will be conducted to provide a holistic experience, with multiple opportunities for reflection and skill development. Gaining exposure to **real-world collaborative BIM coordination experiences**, will prepare you for situations which will be faced as you begin your career in the architecture, engineering, construction, and owner-operated (AECO) industry.

Learning Objectives:

By the end of Stage 02 of the exercise you will be able to:

- Create and execute project tasks in each of the presented BIM360 applications.
- Complete coordination reviews and exercises in BIM 360 Glue
- Utilize Collaboration for Revit to simultaneously model and review projects with team members.
- Understand how a coordination meeting is run and the basic roles of the various project stakeholders for a standard project.

Exercise Part 02 Goals:

During Stage 02 of this exercise project teams will be expected to participate in a 2-3-hour BIM coordination meeting. All project stakeholders must be present and logged into the live model through Collaboration for Revit, hosted on BIM 360 Team. Model and design coordination will take place in the BIM 360 glue environment and will be navigated by the project manager. The project teams will work to correct mistakes and make changes live during this session with periodic breaks for updated models to be pushed to BIM 360 Glue. The coordination report will be updated at multiple stages during the exercise to demonstrate progress and to allow for continued effort by all stakeholders to occur. All project team members are expected to manage their assigned building areas and to actively participate in the problem identification and solving process. The Owner's representative will be attending the meeting as well, which means the utmost level of professionalism and effort is expected. Also, be prepared for a curveball or two throughout the meeting as the project develops during coordination.

Coordination Timeline

Project coordination meetings can vary in length and frequency depending on the project, however it is not uncommon to have a longer meeting at the start of the project to jumpstart the process. Ideally all of the project stakeholders who are responsible for the design, coordination or installation management of the various building systems are present at the meetings to streamline the decision making process. With everyone present it is possible to resolve issues live and to work more efficiently toward the development of a "buildable" product. In this spirit the coordination process you will experience in this stage of the exercise will simulate a longer, comprehensive review meeting focused on solving problems and making live updates.

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The 3-hour coordination meeting will follow the schedule below which will allow for multiple review stages and for every team to receive focused feedback on their areas. Furthermore, teams are only permitted to speak directly with one another when they are the “focus” team, outside of those times, they are expected to use the communicator in Revit. This will ensure clean communication channels between the working academic environment and industry partners. Please review the schedule and ensure you and your team are ready for your specified review times.

| Collaborative Coordination Timeline (3 hour) **Sample** | | | | |
|--|--------------------|---|---------------------|---------------------|
| Time | Coordination Focus | Group A | Group B | Group C |
| 5:00 | All | Exercise and Model Overview | | |
| 5:10 | | | | |
| 5:20 | Group A Area | Coordination Review | Internal Review | Internal Review |
| 5:30 | | | | |
| 5:40 | Group B Area | Internal Review | Coordination Review | |
| 5:50 | | | | |
| 6:00 | Group C Area | Internal Review | Internal Review | Coordination Review |
| 6:10 | | | | |
| 6:20 | All | Model Change Review and Common Issue Discussion | | |
| 6:30 | | | | |
| 6:40 | Upload to Glue | | | |
| 6:50 | Group A Area | Coordination Review | Internal Review | Internal Review |
| 7:00 | Group B Area | Internal Review | Coordination Review | |
| 7:10 | Group C Area | | Internal Review | Internal Review |
| 7:20 | All | Model Change Review and Iterative Review Discussion | | |
| 7:30 | | | | |
| 7:40 | Upload to Glue | | | |
| 7:50 | All | Final Review of Model Change and Coordination Processes | | |
| 8:00 | | | | |

Homework

Due prior to the start of Stage 03 of this exercise

- » Student are to complete the debrief survey, at the link below, for this exercise and reflect on the experience as a whole
- » Responses should be thorough and focus on how the experience has shaped your understanding of project coordination enabled by connected BIM

*Survey Link *****Insert the link to your online survey here for the students******

Appendix III

Sample documentation for the Stage 03 Assignment sheet template, ready for customization, can be found as part of the supplemental resources for this class. A copy for review and reference is included here.

Collaborative Coordination Exercise: Leveraging Connected BIM

Insert Academic Institution* – *Insert Industry Partner

Stage 03: Coordination Debrief

Overall Exercise Summary:

This collaborative BIM coordination exercise is designed to expose you to real-world BIM processes through a partnership with industry professionals. The exercise will be conducted using the BIM 360 suite of products, which provide project teams with a range of options for project collaboration that differ from the traditional ways of conducting business. Three parts will be conducted to provide a holistic experience, with multiple opportunities for reflection and skill development. Gaining exposure to **real-world collaborative BIM coordination experiences**, will prepare you for situations which will be faced as you begin your career in the architecture, engineering, construction, and owner-operated (AECO) industry.

Learning Objectives:

- By the end of Stage 03 of the exercise you will be able to:
- Demonstrate understanding of the complexities of the BIM coordination process
 - Identify common difficulties in the coordination process.
 - Meaningfully participate in real-world coordination processes.

Exercise Part 03 Goals:

In Stage 03 of this exercise a brief coordination meeting will be held to review final changes and to discuss the next steps should coordination continue, as it would in industry. This will be the project team's opportunity to review each other's work and have a discussion about the coordination process as a whole. The discussion will be facilitated by the course instructor and industry partners with the goal of inspiring an appreciation for the collaborative BIM coordination process. Furthermore, everyone will be able to share lessons learned and discuss how the use of the BIM 360 suite of products impacted the process. Prior to the start of Stage 03 everyone wrote a debrief statement where a concise review and reflection of the experience was shared and should be used to help shape individual contributions to this discussion.

This is your chance to gain valuable insight to the world of connected BIM and project coordination from the perspective of an industry partner who operates in the technological world every day. Ask questions, dig deep, and try to learn as much as you can. Experience is the key to meaningful learning and this exercise was your first step towards applying your academic knowledge to real world scenarios.

Homework

Moving forward into your career...

- » Take the lessons you have learned here and bring them to your internships and future careers in the AEC industry
- » Always remember to consider the roles of everyone on a project team and work toward everyone's success during coordination not just your own.
- » Build upon the foundation you have laid during this exercise to be an active and positive part of project coordination and BIM processes on all of your jobs, regardless of your role