BIM 360: Facilitating Collaboration Between Architect and Contractor

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**Learning Objectives**

- Discover the collaborative benefits of Autodesk's BIM 360 cloud services
- Discover the attributes and advantages of implementing BIM 360 Design, BIM 360 Field, BIM 360 Glue, and BIM 360 Docs
- Discover best practices during design to facilitate easy project transition from architect to construction manager
- Learn how to communicate concisely and efficiently with the entire project team and the owner to resolve design and construction challenges through the BIM 360 platform

**Description**

Vanderbilt University has recently embarked on one of the largest capital projects in the institution’s history—4 new residential colleges, totaling 1 million square feet in new construction, to open over the next 5 years. A single design team has the monumental task of successfully ushering all 4 new buildings to completion. Join the architecture and construction team—together—to learn how collaboration through BIM 360 software is improving construction and alleviating typical coordination headaches throughout all design and construction phases of the second residential college to open in the Fall of 2020.

**Speakers**

Christina Holden brings over thirteen years of experience and serves as the BIM Director at Hastings Architecture. She is responsible for the continued advancement of design, visualization, documentation, and construction coordination capabilities. Daily, she works with project teams to create and implement BIM best practices; firm-wide efficiency and quality of drawings; quality control of Revit projects; and curation, assistance, and maintenance of officewide BIM standards. Christina graduated from the University of Tennessee Knoxville with her Bachelor of Architecture in 2006. She is a member of the American Institute of Architects (AIA), the United States Green Building Council (USGBC), and is a LEED Accredited Professional.
Randy Christiansen started out in construction by sweeping floors on a new middle school project and has worked his way up from there. During his many years in the industry, he has worked in various positions, including laborer, carpenter, concrete finisher, superintendent, estimator, scheduler, project manager, and currently BIM Manager. His broad range of experience gives him an in-depth comprehension of the overall construction process, which has prepared him to be a valuable team player and help tackle constructability issues. He has a passion for solving problems and seeking innovative practices to bring projects to the next level of quality and efficiency. He enjoys being outside and working on projects around the house, but his favorite hobby is spending time with his wife and two young children.

The Project

Vanderbilt University is a private research University located in Nashville, TN. 12600 students are enrolled in graduate and undergraduate programs each year. The campus itself is a beautiful 330-acre arboretum with many collegiate gothic style buildings.

In 2014 Vanderbilt University embarked on a massive $600M project – 4 new residential colleges to house students, faculty advisors, and graduate students. It is the largest capitally funded project for the University thus far. These residential colleges provide on-site dining, study lounges, social spaces, and outdoor green spaces. The goal of the residential college
system is to break down the size of the residential community into smaller, more comfortable groups that can share a University ‘home’ – a space to live, learn, collaborate and socialize.

There are 4 phases to the overall project:

- **E. Bronson Ingram College** – 205,000 sf facility with 350 beds.
  - Construction began spring of 2016. Completion was fall of 2018.
- **RC-A** - 214,000 sf with 334 beds
  - Construction began winter of 2017. Completion expected summer of 2020
- **RC-B** - 232,000 sf with 335 beds
  - Construction begins spring 2019. Completion expected fall of 2022
- **RC-C** - 230,000 sf with 335 beds
  - Construction begins spring 2020. Completion expected fall of 2023

The new residential colleges take cues from the rich and stylistically eclectic blend of late 19th- and early 20th-century architecture found throughout the Vanderbilt University campus. Appropriate for the program and context of the site the design is further modified with elements of the collegiate gothic style.
BIM 360 + Design

Changing Technology
Unchanged through most of history, project information has been created and tracked on hard paper documents for centuries. While this was a reliable method in terms of not having to worry about low battery or internet outages, paper documentation is static and can’t change through the project. This means time and money is required to not only slip-sheet drawing sets in order to stay current, but it can be difficult to insure the latest information is relayed to all the affected people, such as field personnel, when details change. The advancements in technology have greatly reduced these problems and promise to improve efficiency in every aspect of design and construction.

In the past our firm had approached joint venture in a few ways with varying success. We had tried several IT solutions, including having computers located at one office with team members from the other firm remoting in to the project. These solutions were fraught with difficulties and provided a slow work environment. Looking for a better process, Hastings was on the verge of implementing Revit Server when Collaboration for Revit and BIM 360 Team were released. With no extra IT costs and the absence of issues seen with Revit Server, we jumped at the chance to test a new solution.

Joint Venture
We’ve all been there: joining forces on a project can be a wonderful marriage of design and teamwork, but it can also be a hard relationship to navigate. Many joint venture contracts provide for a handoff at some point in the design process. The most common situation seen is a split scope - one firm executing the exterior design and the other team the interior. The second common situation is one firm being responsible for conceptual design, handing off the project to the second architectural firm for developing the design, detailing, and general documentation. For these projects, there was a more complicated team structure to accommodate. As the conceptual designer, David M Schwartz was to begin the project, with a large overlap in scope during design development. In a project of this size this meant months of time where both firms would need to work closely together, sometimes on the same material. During some of our schematic design process and all of design development we were to work together through space planning, analysis, codes, materials, constructability. Doing this for 4 separate buildings, we knew we needed an efficient way to work together for the next 9-10 years.

Utilizing BIM 360 Team
During our first project in 2015 – Bronson Ingram Hall – we only utilized BIM 360 Team for our architectural team. We continued the traditional system of exchanging models and sharing information with our engineers. They would send us their model, we would load it into the cloud. We would publish our model, download it, and send it to them. With just our two Architectural firms participating in BIM 360, we were benefitting from the collaborative design environment.

Vanderbilt University’s residence hall project was our pilot project in the BIM 360 environment. We realized early on that we would need to set some ground rules. Our BIM kick off meeting and project plan was a bit more robust than our typical one. With two teams to accommodate, there were different modeling styles, model organization practices, and other varying standards. Our first step was to agree on a shared set of standards to keep the model in working shape. For example, we implemented parameters and a naming system to help separate documentation and help define each team’s scope.
In addition to our own BIM organization requirements, our client had documented BIM
requirements. Armed with this knowledge early on we were able to meet their expectations
about the BIM they were to receive from all the teams.

When we began RC-A in 2016, we convinced our engineering consultants to join us in the
cloud. The deadlines were going to be tighter and early release packages were inevitable. Early
coordination, especially between architecture and structure were critical. The information was
immediately accessible without the hassle of trading models. Moving walls or changing column
locations, these actions no longer required waiting a week to understand the impact to the
design. Hosting the models in the cloud didn’t decrease our need for communication, but it
surprisingly increased the activity. The difference was we didn’t wait to have weekly
conversations about long lists of coordination issues. It could, and was, happening in real time.

- Get all consultants in the cloud for a seamless integration. No model trading means
  updated linked files and time saved during design phases.
- Use the issues and markup tools to collaborate with other BIM 360 Design contributors.
- Consider storing your standards for your project within the folder structure to help teams
  create a cohesive model.

Challenges implementing BIM 360 Design
We encountered a new set of challenges working in the cloud. First, internet speed and
connection stability became very important considerations. In Nashville, we have a huge
construction boom resulting in occasional internet interruptions. We developed our own
“disaster plan” in which we laid out protocol for internet outages, archiving and backup files, etc.
There were also new troubleshooting issues to consider: new error messages, access to BIM
360 team, and license management. Each time we were able to find a solution. We utilized the
BIM 360 forums as well as working with our reseller’s BIM 360 expert. The monthly BIM 360
webinar keeps us informed and updated on the quickly developing platform. Even with these
new challenges, we were able to realize how big of an impact this new way of working was having on our teams.

- Review your internet speed and stability
- Create an internal "disaster plan"
- Frequent the BIM 360 forums and attend the monthly webinar to stay up on new features and future developments.
- If you’re just starting out with BIM 360 Design check out the Getting Started Guide.

BIM it up: Building out your best project
Fortunately, our entire design team was working in Revit, minus civil and landscaping, allowing the designers, engineers and contractors to fully realize the design in 3D. For this project, given the complexity of the design, the decision was made early on to model as much as we could. The skin design, mostly masonry and stone, was thought of as a kit of parts. It challenged our design team to think early on about materials and constructability. Often in a masonry project model lines and detail lines are used to convey the more intricate details and information, especially if the deliverables are 2D or the contractor isn’t working with BIM. Knowing our GC and owner were expecting a model we pushed the team to model more accurately with less 2D representations of many building components. Our goal was to make the project as realistic as possible and as quantifiable as possible. The window families are a great example of this approach. There were many windows - glazing size and muntin patterns - that were repeated but had unique stone head, sill and surround. Each window family was built by nesting the individual stone pieces into the head and sill surrounds, giving each stone a unique type tag. The surrounds were then assembled, along with the chosen window, and both were nested into the window family. This allowed us to tag each individual stone in all the various windows for better coordination. We didn’t go as far as modeling step-flashing, but after this last round of preconstruction meetings we have been asked to consider it! On many of our other projects the GC will rebuild the models. In this instance they were able to use our architectural model as-is. This provided great opportunity for the contractor and sub-contractors to coordinate during preconstruction.

- Determine how much and what type of information your contractor will use early in the process. The motto less is more is not always applicable! If you can avoid coordination
errors and RFI’s by modeling more than usual, it may be worth the time you spend on the front end.
Design/Assist

We were very fortunate to have the opportunity to begin working directly with the design team during design development of RC-A. This allowed the designers and contractors/subcontractors to not only become more familiar with the design intent much earlier, but it also opened the door for valuable feedback on constructability and drew attention to complicated details and potential problem areas. Throughout this entire process and even still today, the whole team is working openly together with the common goal of making this not only a successful project, but a landmark project for everyone involved.
Pre-Construction
As the design team was working through the latter half of construction document development, the construction team reviewed the 75% and 95% document sets to provide detailed feedback on the quality and completeness of the drawings. After discussion, we decided the easiest way to gather all the markups and comments and then send them on to the design team, was through a Bluebeam Studio Session.

We created the Studio Session, and then assigned everyone on the construction team to focus their review on specific sections of the drawings and markup any areas where there were questions, comments, or suggestions. These markups are automatically tracked and are seen by expanding the tab on at the bottom of the screen. A nice feature is that the page number, author, and date of each markup is also tracked. Additionally, the design models were also used alongside the drawings to more easily interpret the design intent and even catch other issues not identifiable with just the drawings. After everyone completed their assigned review, we got together and presented our findings to help everyone get up to speed and, in some cases, we figured out the answer as a group and didn’t have to forward every question the designers.

Bluebeam Studio Session

Once each review in the Studio Session was done, we exported the information we collected into an Excel Spreadsheet. We cleaned up the format a little and forwarded this spreadsheet along with the PDF drawings sets that were saved out of the Studio Session to the designers.
This entire process proved to be extremely helpful for everyone and let more people contribute their unique insight into simplifying a complicated design.

**Early Construction**
From the beginning, everyone knew one of the biggest challenges to this project was the schedule. Each building must be complete in time for students to move in at the start of the fall semester, so failure is not an option (or face cost of putting up students in hotels). In order to maintain our completion date for RC-A of August 2020, we had to begin construction onsite well before final drawings were completed.

To achieve this, an early foundation package was released to allow us to begin site demolition and excavation. Fortunately (or unfortunately), excavation down from street level to the basement building pad was about 25 ft. and most of that was solid bed rock. This meant 3-4 months of blasting which bought us some time to get farther along with the design. We began our BIM coordination early, starting with the basement underground and working up from there.

During these early coordination meetings, the design team was present in person to talk through any confusing or problematic areas. This was a great way to establish good relationships early on and sometimes get immediate answers to questions and allow coordination to continue. We decided at the time that the easiest method of tracking questions was in an Excel spreadsheet. New questions and any answers to previous questions would be submitted the day before the meeting. Updates were made to the spreadsheet and emailed out to everyone before the meeting. Although this worked well enough, a cloud-based collaboration platform is more favorable.

In addition to the spreadsheet, we actively used the 3D models to compliment the drawings and more easily and quickly visualize problem areas and conflicts. The design models were used for this and trade models were incorporated are they were being developed. Before the meeting began, viewpoints were setup in Navisworks corresponding to each item in the Question and Answer Log. This cut down the time zooming through the model and setting up sections to show the relevant area.

**Looking to the Future**
Over the early phases of a very complicated project involving many different companies, we have been able to try out different workflows and see pros and cons to each. Though we elected to use some more traditional methods mixed with newer technology, we are seeing product enhancements coming down the road and envision other improvements that can make a big impact on efficiency and overall quality.

**Laying the Foundation for Success**
In order to have effective communication on a project, every team member must have an open mindset and willingness to work toward the overall team’s/project’s goals. With that foundation, the project can be built for success as everyone works together to collaborate and tackle challenges efficiently. As we look for better ways to communicate while also saving time,
embracing a “Lean” mentality can really help focus everyone’s efforts on getting the job done more quickly and effectively. An example of this how RFI’s are created and processed.

Imagine how a subcontractor takes time after discovering an issue that needs to be brought to the attention of the design team. A lot of time and effort goes into researching a question before sending it “up the flagpole,” maybe taking an hour or more to look through all the drawings and other documents. When the question is drafted, drawings can be marked up and attached, but how about 3D model views or other information used to verify and create the RFI? It would be great to more easily bundle up all the trails through linked floor plans, sections, details, AND 3D viewpoints (not just screenshots) into the RFI. That way, when anyone else reviewing the same question can immediately see all the relevant documentation and models in one place without having to take the same amount of time to go through the same documentation to understand the question. Plus, being able to go right the areas in the drawings and models gives the viewer the advantage of using the linked and active context of a whole database and not just 2D documents.

**BIM 360 Priority Suggestions**

Autodesk is aware of the possibilities with cloud collaboration and is working hard to continue developing the BIM 360 platform to meet the needs of the AEC industry. With this in mind, we’ve pulled together some relevant suggestions for improvement that we feel will have a big impact on communication and productivity:

- Expand issue tracking features:
  - Link directly to drawings (not attachments)
  - Link directly to viewpoints in the 3D models
- Share/link files between BIM 360 projects
- Enhances Set Management
- Improve drawing navigation in Docs (add a drawing index pane instead of having to hit the back button)
- Provide a full feature Docs desktop application for local file viewing and/or enhance Desktop Connector to sync the ‘Plans’ folder in addition to the ‘Project Files’ folder

**BIM 360 Resources**

Getting Started with BIM 360 Design

BIM 360 Forum
https://forums.autodesk.com

What’s New & What’s Next BIM 360 Monthly Webinar
https://bim360hub.autodesk.com/webinars

BIM 360 Roadmap
Drop us a line!

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