

322525

BIM 360 Docs: One Collaboration App to Rule Them All

Roy Malcolm
DPR Construction

Learning Objectives

- Discover the value of BIM 360 Docs for collaboration, file sharing, drawing management, and model hosting
- Evaluate the features of BIM 360 Docs compared to other commercially available solutions
- Learn how to set up a folder structure and process for drawing management within BIM 360 Docs
- Learn how to implement lean tips and tricks while using BIM 360 Docs

Description

This is the story of how DPR Construction, along with its design and building-owner partners, was able to successfully implement BIM 360 Docs software as a project collaboration solution to a large healthcare project in Richmond, Virginia. Thanks to the growing number of features included with BIM 360 Docs, the team was able to eliminate or integrate the use of more than a dozen design and construction applications traditionally used by the various team members. This talk will discuss the decision that the team made in early 2018 to go with BIM 360, and will chronicle the peaks and valleys the team overcame on their journey to successful implementation. The talk will include insight into the benefits of using BIM 360 Docs on a large project with many stakeholders, including how the team utilized the software for file sharing, model collaboration, design reviews, and drawing management. We'll conclude with a discussion on future processes the team has planned as the project moves from design into construction.

Speaker(s)

Roy Malcolm leads development, implementation and support of all VDC process across DPR's Northeast Region. A 2012 Virginia Tech Building Construction Graduate, Roy has solid experience implementing and executing VDC strategies that add value to DPR projects. As a VDC Manager, he helps project teams to leverage established VDC technologies both in the office and the field, and supports model-based project management, process workflows, and construction technology deployment from pre-construction through closeout. Outside of construction, Roy enjoys sampling local craft beer and wine, hiking, and working on his family's cattle and sheep farm in the mountains of Virginia.

Introduction

This industry talk provides insight into why and how BIM 360 Document Management can be used as a multi-function solution for design and construction projects. By providing examples and lessons learned from a large healthcare project, this handout will serve as a reference for any firm looking to implement BIM 360 Docs on an upcoming project. The focus will be on BIM 360 Document Management but will reference additional modules such as Design Collaboration that the project is using or plans on using in the future. Also, this class and handout will veer away from any Forge integrations and will instead focus on what can be accomplished with out-of-the-box BIM 360 features.

At the time of Autodesk University Las Vegas 2019, the healthcare project referenced in this class was in the construction documents phase for the interior design and construction was underway on the shoring system. This handout will discuss the BIM 360 Document Management uses cases up to that point in time.

The Decision to Use BIM 360 Docs

In the spring of 2018 BIM 360 Document Management was still relatively unknown. DPR had used Docs on previous projects (here is a [link](#) to a course at AU Las Vegas 2018 discussing an earlier case study), but widespread adoption had yet to occur. The other project stakeholders were also unfamiliar with BIM 360. As with any shift in processes or technology, there needed to be a decision to commit to trying something new despite the risks. During early team alignment meetings for the large healthcare project in Richmond, VA, the decision was made to go with BIM 360 over similar solutions offered by the various stakeholders. The two major reasons for this decision can be summed up by the following desired outcomes that the project team defined:

1. **A model centric approach to design and construction** - Given the scale and timeline of the project, the team knew that the models needed to be utilized to the greatest extent possible in order to reduce latency and mitigate risk. The collaboration software solution needed to allow for advanced model viewing and sharing capabilities, which were limited in other document management solutions available at the time. The idea was also that team members would be more likely to view the models if they were housed the same location as other project documents.
2. **Limit the number of software applications** – There are many applications and software options available for design and construction, many of which provide immense value but do not support a wholistic solution to a project team. The team knew that there would eventually be many stakeholders involved with the project, and thus would require a substantial effort for user management and onboarding. Since the team was already committed to using BIM 360 Docs for model storage as part of the Revit Cloud Worksharing process, it made sense to host other project documents there as well.

The Value of BIM 360 Docs for Collaboration, File Sharing, Drawing Management, and Model Hosting

To understand the value that BIM 360 Document Management brings to a project, we will explore specific use cases documented by the project team.

Collaboration

One of the most important features of BIM 360 in general is that it enhances collaboration amongst all project stakeholders. Using Document Management, the project team created and shared markups to drawings, cooperatively edited files, and tracked issues. Keeping all documentation centralized created better transparency into the various processes and helped to break down traditional work silos.

Document Markups

Due to the fast-tracked design schedule for this healthcare project, the team onboarded design assist trade partners early in the project. Through the design assist process, the trade partners were responsible for working with the design team to help complete the construction drawings, so it was critical that the team select a solution that allowed for close collaboration. Document Management features a markup functionality that allowed teams to create markups on 2D files as well as 3D models. This provided trade partners the ability to provide feedback on design progress drawings without having to leave Docs. This markup feature was used to review pay applications, provide comments on contract language, and make corrections to meeting minutes.

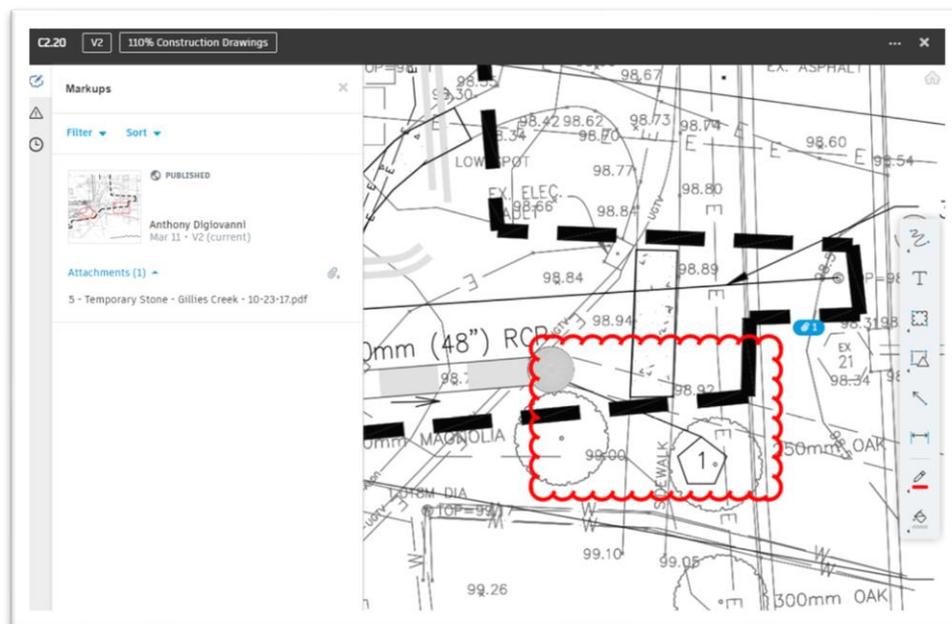


Figure A:
Markups
on 2D
drawing

For details on how to create and manage markups, please visit the Autodesk Knowledge Network at the following link:

[Autodesk Knowledge Network: Document Management - Markups](#)

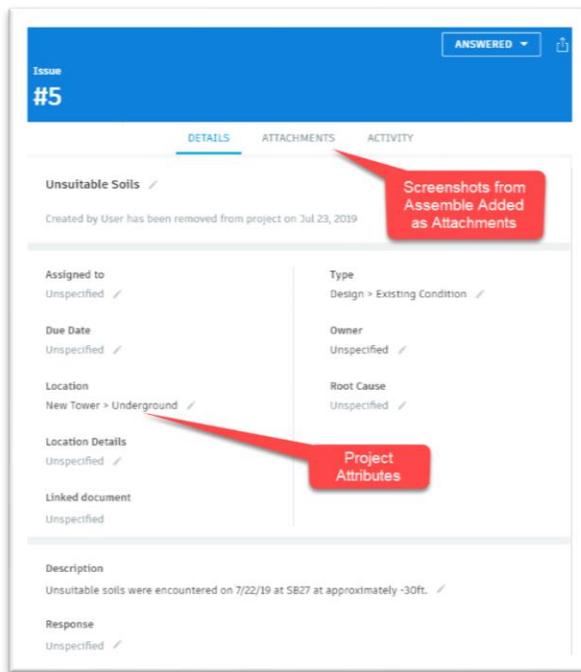


Figure B: Issue Attributes BIM 360 Docs Issues

Issues and Field Management Integration

Another valuable collaboration tool offered by BIM 360 Docs that the team utilized was the Issues function. While there are many use cases for issue tracking within BIM 360, the project team utilized this only to track field issues via the Field Management module. During the shoring and excavation phase, this mainly consisted of unsuitable soil reports and issues identified during inspections by the structural engineer. Docs allowed the team to create issues and tag them with certain attributes such as type and location, which helped team members solve the issues faster and provided more meaningful metrics. The issues were also assigned to certain team members and given a due date to help keep the team accountable.

Attachments were added to the issues to provide more clarity. For example, when unsuitable soils were encountered the team attached screenshots of the shoring model in Assemble highlighting the piles where the unsuitable soil was found.

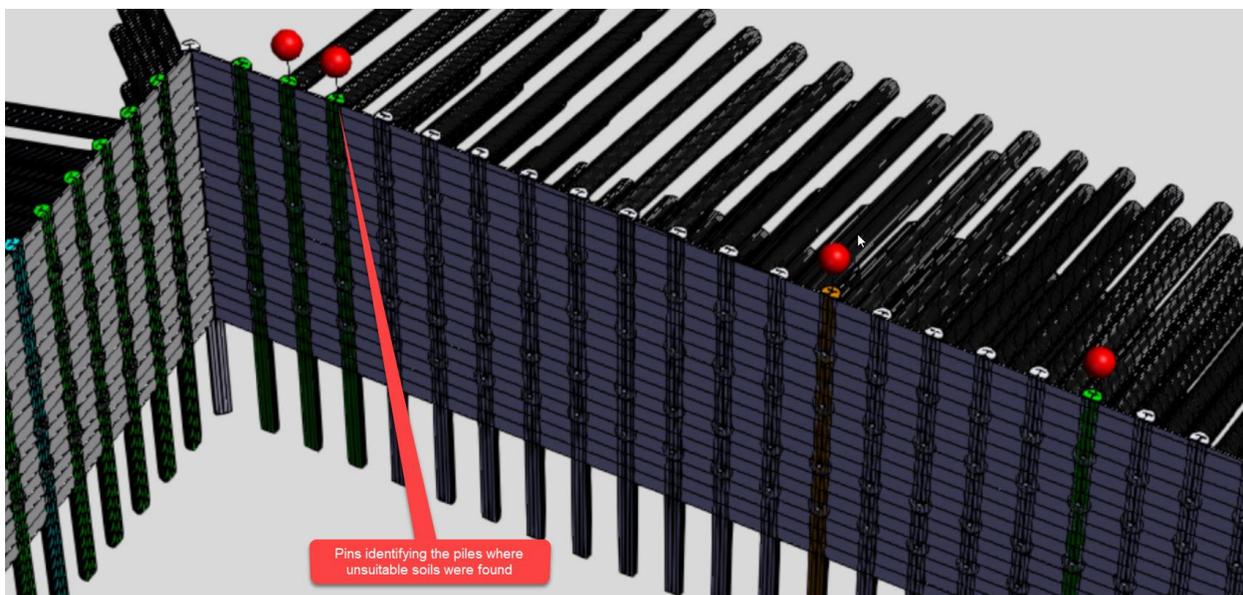
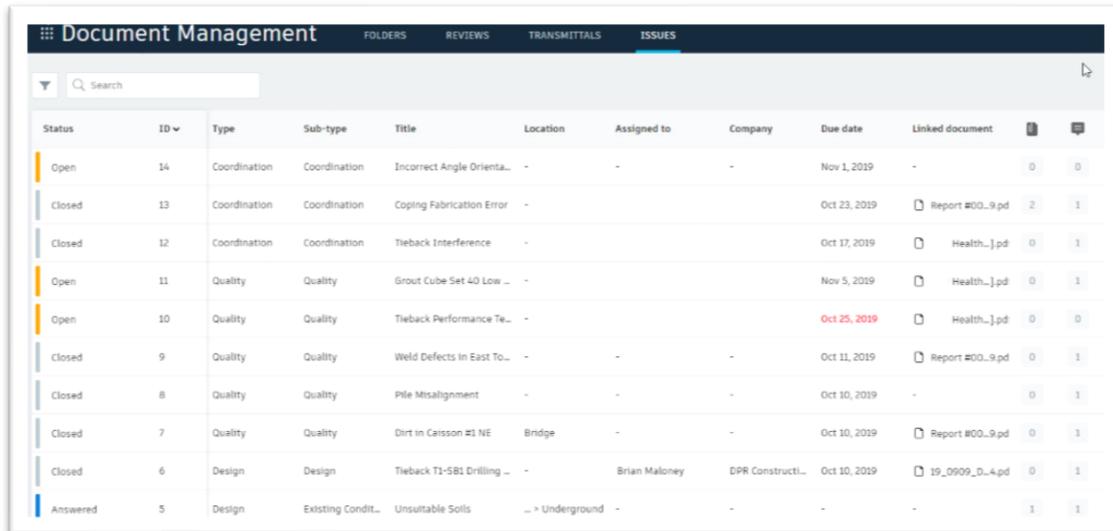


Figure C: Issue Attachment showing the location of piles where unsuitable soils were discovered

Besides attachments, Docs also allowed issues to be linked to a separate file. This helped teams to quickly understand the source of the issue so that it could be addressed more efficiently. The issue could even be linked to a specific page in the linked document. On this project, the team linked structural issues to the page in the structural



Status	ID	Type	Sub-type	Title	Location	Assigned to	Company	Due date	Linked document		
Open	14	Coordination	Coordination	Incorrect Angle Orienta...	-	-	-	Nov 1, 2019	-	0	0
Closed	13	Coordination	Coordination	Coping Fabrication Error	-	-	-	Oct 23, 2019	Report #00...9.pdf	2	1
Closed	12	Coordination	Coordination	Tieback Interference	-	-	-	Oct 17, 2019	Health...].pdf	0	1
Open	11	Quality	Quality	Grout Cube Set 40 Low ...	-	-	-	Nov 5, 2019	Health...].pdf	0	1
Open	10	Quality	Quality	Tieback Performance Te...	-	-	-	Oct 25, 2019	Health...].pdf	0	0
Closed	9	Quality	Quality	Weld Defects in East To...	-	-	-	Oct 11, 2019	Report #00...9.pdf	0	1
Closed	8	Quality	Quality	Pile Misalignment	-	-	-	Oct 10, 2019	-	0	1
Closed	7	Quality	Quality	Dirt in Carsson #1 NE	Bridge	-	-	Oct 10, 2019	Report #00...9.pdf	0	1
Closed	6	Design	Design	Tieback T1-SB1 Drilling ...	-	Brian Maloney	DPR Constructi...	Oct 10, 2019	19_0909_D...4.pdf	0	1
Answered	5	Design	Existing Condit...	Unsuitable Soils	... > Underground	-	-	-	-	1	1

Figure D: Example Issue Log in BIM 360 Document Management

engineer’s field report that had contained the photo of the issue. Reports were also exported to PDF and CSV format and used in project dashboards, meeting minutes, and external reports and saved back to Docs for record. The project team initially attempted to utilize the Issues function to track design related issues, but early in the project Document Management lacked some of the features related to Issues that would later be added. DPR instead utilized a third-party plug-in to Revit and Navisworks to track design issues directly in the models. Reports from this third-party software were exported to a PDF and saved in Docs. For future projects, DPR will explore using Issues in BIM 360 for all project issues from design through closeout. It should also be noted that “Issues” created in one module, such as Field Management, are viewable across the other modules including Docs.

For more details on Issues, please visit the Autodesk Knowledge Network at the following link:

[Autodesk Knowledge Network: Issues in Document Management](#)

Microsoft Integration

In May 2019, Autodesk released one of the most anticipated updates to BIM 360 Document Management; the ability to open and edit Microsoft documents. Collaborating on word docs, spreadsheets, and slide decks was a well-established practice at DPR, making the lack of that functionality in Docs a glaring disadvantage to many team members. Once this update was released, it allowed multiple team members to edit live documents, eliminating the common problem associated with file sharing platforms of having to lock or check out files in order to edit them.

File Sharing

The project team needed a solution that allowed for the sharing of all file types and uses, including 2D drawings and 3D models. User management also needed to be intuitive and adaptable as more team members were added throughout the project lifecycle and access needed to be controlled at the folder level.

When deciding on a software solution for file sharing, the project team saw the potential in BIM 360 Docs to promote lean behavior and eliminate redundancy in the process. Docs allowed a team member to upload a document once, then allow preceding processes then took place within Docs without team members having to download files or use additional applications. The submittal review process in particular was dramatically improved by implementing Docs.

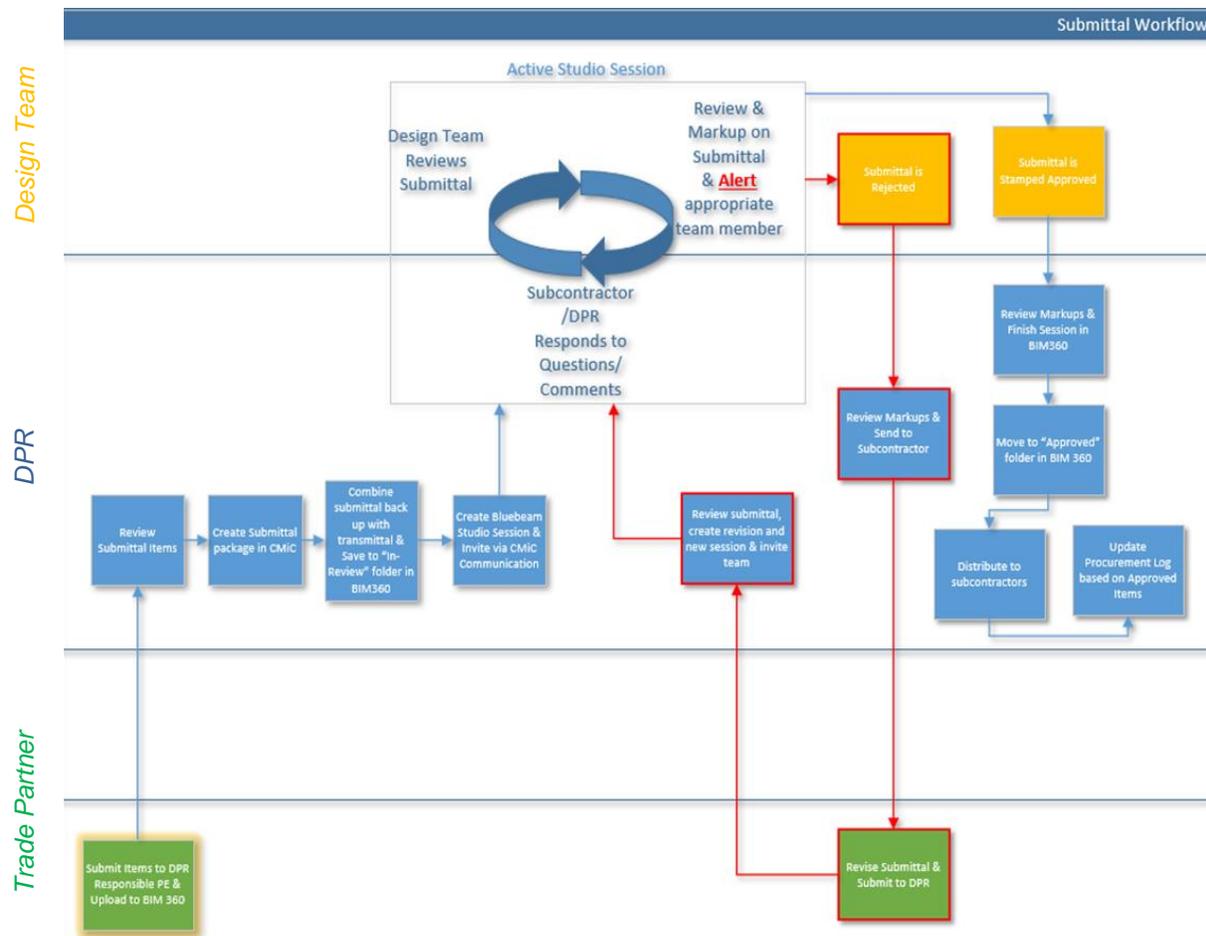


Figure E: Submittal Process w/ Docs, Bluebeam Studio, and CMiC

Submittal Review

BIM 360 has a separate Project Management module to help facilitate the review of RFI's and submittals, however, it was not ready for production use when the project started producing submittals. Document Management also contains a Review function that allows for a cascading review process, but this also was not used on this project. A solution for multiple parties to review submittals at one time was required, so the team elected not to use that function and instead implemented a Bluebeam Integration to BIM 360. There was a push to use Bluebeam for the reviews over the markup feature in Docs to cap the time spent reviewing the submittals, and because of the need to use custom Bluebeam tools for submittal markup. The team created the following workflow using Docs and Bluebeam Studio, which reduced the latency and turnaround time for submittal processing and review.

Drawing Management

As part of the goal to limit the number of software applications used on the project, it was important that the collaboration software solution have an integrated drawing management system. Initially, the team planned to print PDF design progress sets from Revit on a weekly basis. This was identified as a huge source of unnecessary waste in the process due to the time it takes to prepare and print these sets from Revit. The team drafted a process that defined drawings by three categories which determined where they were stored on Doc and how they were accessed:

1. Design Snap Shots – Live view of progress design drawings. These are the sheet views shared when Revit models are published to Docs. They are updated weekly at a minimum.

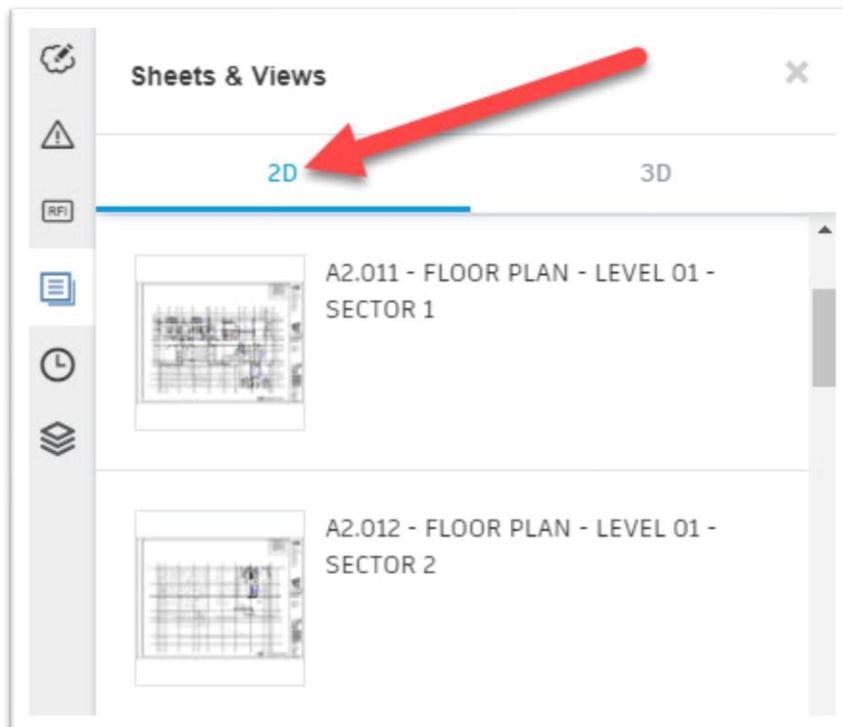
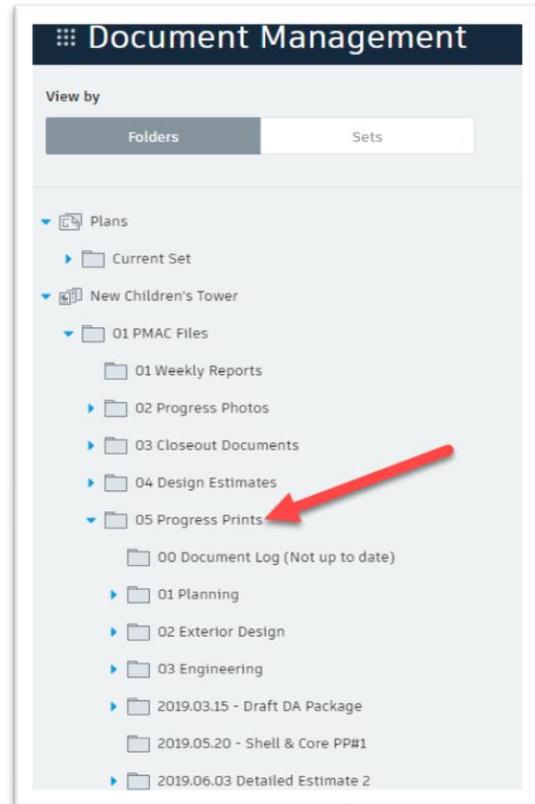


Figure F: Sheet Views from Model

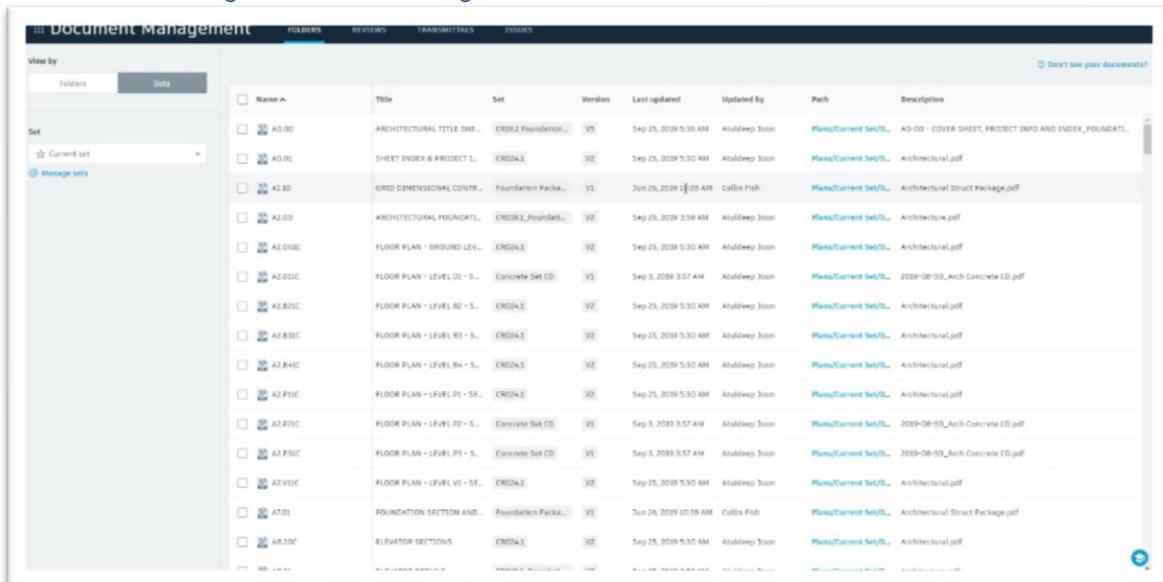
2. Progress Prints – PDF sets of drawings printed from Revit at certain milestones. These are saved under a folder with access restricted to DPR and the design team. Progress Prints were often reviewed using the Bluebeam Studio review sessions mentioned above.

3. Issued for Construction – Drawings issued to the field for construction. Since this project was fast tracked and construction on the shoring started before 100% construction documents were complete for the rest of the building, it became important to keep drawings issued for construction separate from design progress prints. The team found the best way to do this was to keep the IFC set in the Plans folder on Docs, while all other design progress drawings were kept under Project Documents. It also became difficult to manage sets when design snaps shots and progress prints were being issued on a weekly basis.



Right - Figure G: Progress Prints folder location. Access restricted to Design team and DPR

Below – Figure H: IFC Sets Organized in Docs



Name	Title	Set	Version	Last updated	Updated by	Path	Description
A0.00	ARCHITECTURAL TITLE SHEET	CR022_Foundation	V1	Sep 25, 2019 5:30 AM	Atuldeep Joon	Plans/Current Set/...	A0-00 - COVER SHEET, PROJECT INFO AND INDEX_FOUNDA...
A0.01	SHEET INDEX & PROJECT I...	CR024_1	V2	Sep 25, 2019 5:30 AM	Atuldeep Joon	Plans/Current Set/...	Architectural.pdf
A1.20	GRID DIMENSIONAL CONTR...	Foundation Packe...	V1	Jun 26, 2019 10:08 AM	Collin Fish	Plans/Current Set/...	Architectural Struct Package.pdf
A2.00	ARCHITECTURAL FOUNDATI...	CR024_1_Foundati...	V2	Sep 25, 2019 5:30 AM	Atuldeep Joon	Plans/Current Set/...	Architecture.pdf
A2.000C	FLOOR PLAN - GROUND LEV...	CR024_1	V2	Sep 25, 2019 5:30 AM	Atuldeep Joon	Plans/Current Set/...	Architectural.pdf
A2.000C	FLOOR PLAN - LEVEL 02 - S...	Concrete Set CD	V1	Sep 3, 2019 5:37 AM	Atuldeep Joon	Plans/Current Set/...	2019-08-03_Arch Concrete CD.pdf
A2.820C	FLOOR PLAN - LEVEL 02 - S...	CR024_1	V2	Sep 25, 2019 5:30 AM	Atuldeep Joon	Plans/Current Set/...	Architectural.pdf
A2.830C	FLOOR PLAN - LEVEL 03 - S...	CR024_1	V2	Sep 25, 2019 5:30 AM	Atuldeep Joon	Plans/Current Set/...	Architectural.pdf
A2.840C	FLOOR PLAN - LEVEL 04 - S...	CR024_1	V2	Sep 25, 2019 5:30 AM	Atuldeep Joon	Plans/Current Set/...	Architectural.pdf
A2.910C	FLOOR PLAN - LEVEL 01 - S...	CR024_1	V2	Sep 25, 2019 5:30 AM	Atuldeep Joon	Plans/Current Set/...	Architectural.pdf
A2.930C	FLOOR PLAN - LEVEL 02 - S...	Concrete Set CD	V1	Sep 3, 2019 5:37 AM	Atuldeep Joon	Plans/Current Set/...	2019-08-03_Arch Concrete CD.pdf
A2.930C	FLOOR PLAN - LEVEL 03 - S...	Concrete Set CD	V1	Sep 3, 2019 5:37 AM	Atuldeep Joon	Plans/Current Set/...	2019-08-03_Arch Concrete CD.pdf
A2.930C	FLOOR PLAN - LEVEL 04 - S...	CR024_1	V2	Sep 25, 2019 5:30 AM	Atuldeep Joon	Plans/Current Set/...	Architectural.pdf
A7.00	FOUNDATION SECTION AND...	Foundation Packe...	V1	Jun 26, 2019 10:08 AM	Collin Fish	Plans/Current Set/...	Architectural Struct Package.pdf
A8.20C	ELEVATOR SECTIONS	CR024_1	V2	Sep 25, 2019 5:30 AM	Atuldeep Joon	Plans/Current Set/...	Architectural.pdf

Please visit the Autodesk Knowledge Network at the following link for details on the difference between Plans and Project Files:

[Autodesk Knowledge Network: Document Management - Plans and Project Files](#)

Model Hosting

As stated above, one of the project goals was to promote the utilization of the models. This process has historically suffered from a lack of team engagement outside of the core VDC/BIM team. A source of this problem can partially be contributed to model sharing solutions that house the models separately from the rest of the project documents, or do not provide the ability to view the models without having to download the files themselves. The following uses cases demonstrate the value of Docs with regards to model integration.

Model Viewing

The BIM 360 large model viewer is one of the best ways to view models in the cloud and was heavily utilized by the project team. During design, the project team uploaded Revit models to their respective team folder in Docs. All team members were given “View” access so that they could open and view the models without having to download the files, which were quite large for this project. Intuitive features such as the ability to access views from Revit, automatically slice the model by floor, and view model element properties made the models accessible to a wider audience. It quickly became a common practice to have the models open on Docs for reference during all planning and coordination meetings.

To learn how to view and navigate 3D models on BIM 360 Docs please visit the Autodesk Knowledge Network at the following link:

[Autodesk Knowledge Network: Document Management - Viewing 3D Designs](#)

Model Comparison

One of the most used functions on the project quickly became the Compare feature. With the design moving so quickly, the team was concerned with keeping up with the changes as they happened. Clouthing or tagging the changes was an unrealistic request, but Docs eliminated this concern by providing visual change analysis.



Learn more about the model comparison feature on the Autodesk Knowledge Network: [Autodesk Knowledge Network: Document Management - Compare 2D and 3D Designs](#)

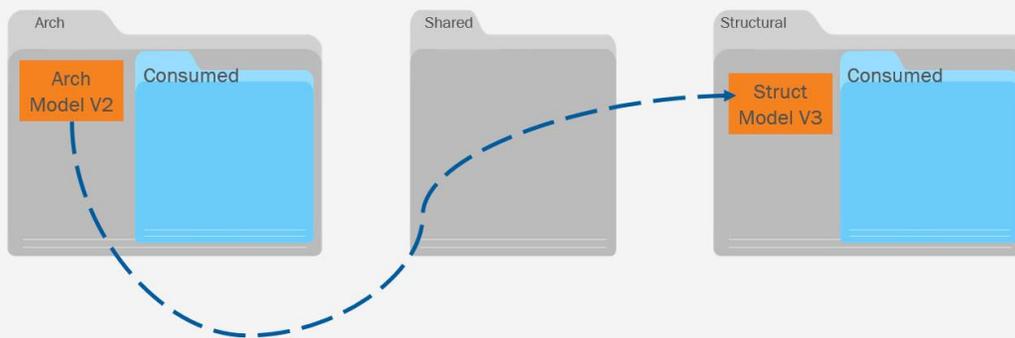
Figure 1: Model Comparison Feature

Live Linking vs Controlled Sharing

During the design phase, the team also evaluated the Design Collaboration module. It was determined that live linking was preferred for the design consultants and the design assist trades, as it was critical for each stakeholder to have a “live” view of each other’s models as they were designed. The team did, however, setup the teams under Design Collaboration so that folder structure was in place for future use. As the project moves into construction and design is locked in place, the design team planned on using the Design Collaboration module to control when design changes are issued to the team.

Live Linking

- Traditional process from classic C4R
- Creates a live link to latest version of model, so there is no control over what is shared
- Team providing live access to their model must give the other team “View” permission to access its team folder, which lets this team view and link to the model but not edit it



Controlled Sharing

- Full control over what version of model and plans are shared
- Each team controls what is shared with other teams and what is consumed from other teams
- Teams can only view models/sheets in their team folder or the shared folder

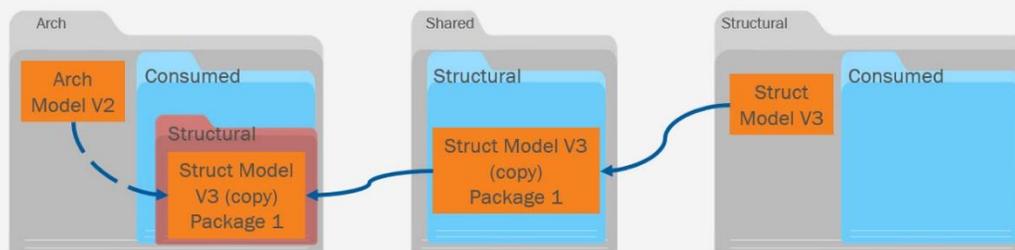


Figure J: Live Linking Setup vs. Controlled Sharing Setup

Evaluation of BIM 360 Document Management Compared to Other Commercially Available Solutions

The use of BIM 360 Document Management was largely successful, although not without setbacks and growing pains. The following table summarizes the comparison of features that the team used to evaluate the various software offerings available at the time:

Solution	Model Hosting	Model Viewing	Issue Management	User Management	Collaboration	Mobile Access
BIM 360 Docs	++	++	++	++	++	+
PlanGrid	-	-	++	++	+	++
Box	+	-	-	+	-	+
Bluebeam	+	+	+	+	++	+
Newforma	+	-	+	++	+	+

Legend:

- Poor functionality or not included
- + Function Available
- ++ Best in class

As the table indicates, there was a strong inclination from the project team to using PlanGrid, especially for drawing management and mobile access. DPR and the other team members were very comfortable with using PlanGrid and its implementation had provided positive outcomes on previous projects. Ultimately the team went with BIM 360 Docs because it aligned the most with the goals for a model-based workflow and limiting the number of applications.

Drawbacks to BIM 360 Document Management

There were known shortcomings to BIM 360 when the team made the decision to use it, but many of these were resolved by Autodesk in various updates. As of October 2019, below is a list of the ongoing drawbacks the team has encountered while using Docs.

- There was a **greater learning curve** with Docs, as it does function differently than other software, especially when users were accustomed to another solution and expected it to function in a similar way.
- **Links can only be shared at the folder level**, not by individual files. This was not a deal breaker but did require teams to think differently. This therefore **only works for sharing with the internal team**. Sharing files with external parties, such as trade partner bidders, became an issue.
- There are some great features to link to various external dashboards and datasets on the Project Home feature of BIM 360, but these **dashboards cannot set as a default for all users**.
- The **BIM 360 Coordinate** module was still lacking important features when the project kicked off, including the ability to link to Navisworks, so the team chose to use **Classic BIM 360 Glue for model coordination**. In the future once the Coordinate module either improves its functionality or links to Navisworks, this will eliminate the need for yet another separate application.
- The **mobile application for BIM 360 is not as user friendly** as some other applications, such as PlanGrid.

Folder Structure and Process for Drawing Management

The folder structure for the project was incredibly important since the team planned on using Document Management for multiple processes. The team needed a system that would allow for permissions to be set for certain folders so that information was distributed to the right stakeholders at the appropriate time. The structure also needed to be intuitive and easy to follow to ensure that documents were uploaded to the correct locations and that everyone understood where to find the information that was important to their role. Figure K outlines the folder structure and provides a general description for each folder. This is the document the team used to communicate folder intent when onboarding new team members.

1. The Document Management module  is where you will find all project related drawings and documents.
1. **Current Set**
 - This folder hosts all current contract drawings broken down by discipline.
2. **Project Mananer, Architect, Contractor files**
 - This folder is for the sharing of files between these stakeholders
3. **Shared Files**
 - Hosts all project related documents including specifications, approved submittals, answered RFI's, safety plans, etc
4. **VDC**
 - Houses live models from each team member as well as all documentation related to BIM/VDC
5. **Sub File Transfer**
 - This folder is for subcontractors to upload project specific documents for review
6. **Sandbox**
 - Personal storage for each team and project member to use as needed

BIM 360 - DOCUMENT MANAGEMENT

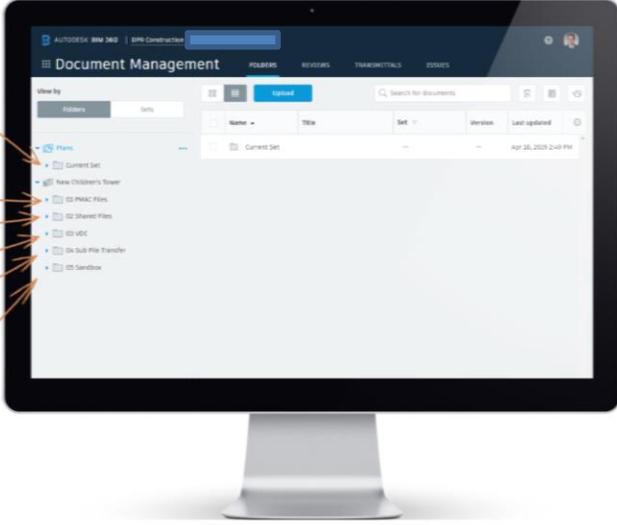


Figure K: DPR BIM 360 Document Management Folder Structure

Lean Tips & Tricks While Using BIM 360 Document Management

During setup and execution of Docs, the project team recorded issues and lessons learned. The following is a summary of these tips, tricks, and best practices to keep in mind when using BIM 360 Docs on future projects.

Tips & Tricks

- Use Google Chrome when using BIM 360, as the team encountered substantially fewer problems with users using Chrome as compared to other browsers. This was especially true with the model viewer.
- Create a desktop shortcut “application” for BIM 360.
 1. In Chrome, select the “Customize and Control Google Chrome” button
 2. In the drop-down menu, select “More Tools”, then “Create Shortcut”
 3. Type “BIM 360 Docs” for the name, and make sure “Open as window” is checked.
 4. Optional: Pin the shortcut to your Toolbar. This will allow for quick and easy access to Docs

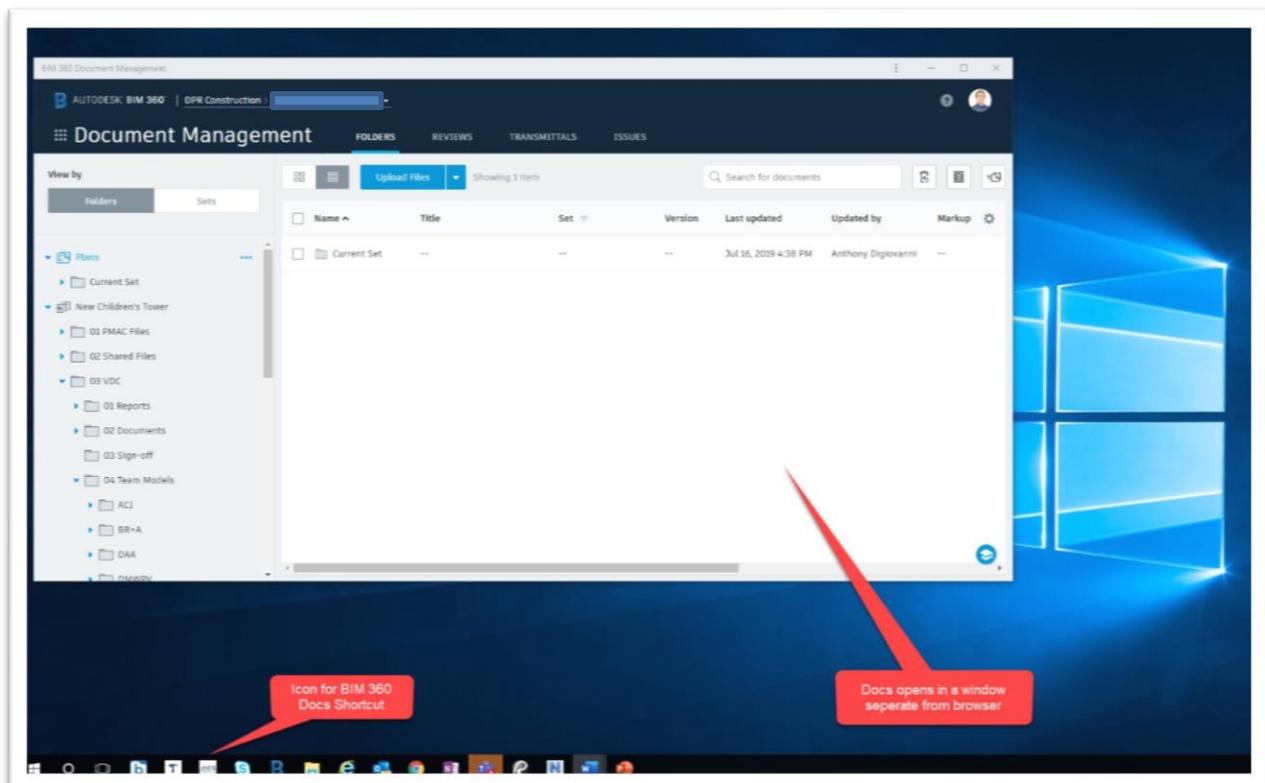


Figure L: Docs Toolbar Shortcut

- Link dashboards created in PowerBI to the BIM 360 Project Home
*As noted in the Drawbacks section, this can only be set on an individual level and not as a default for all users
- In Assemble, links can be established with BIM 360 projects.
- Take advantage of the Desktop Connector but ensure that the project team understands that while it may look like the standard Windows File Explorer, there are limited functions such as the mentioned ability to move folders.

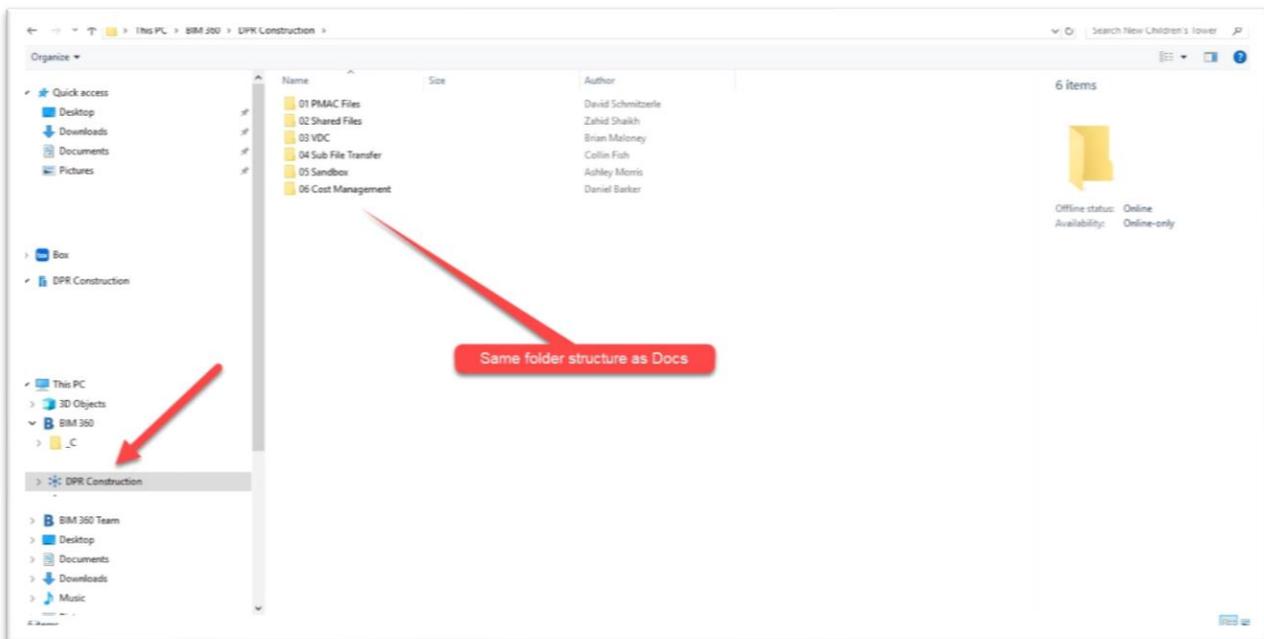
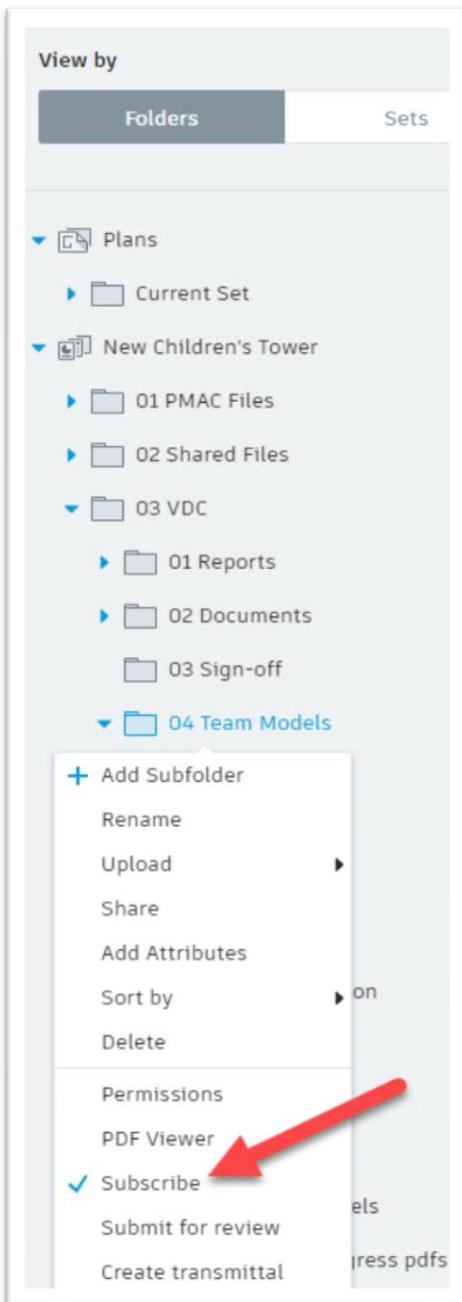


Figure M: Desktop Connector

- Create permissions by both company and role. This will allow flexibility when giving permission to certain folders. For example, for project models we gave “View” permission to each company but gave greater access to the “BIM Manager” group to allow these more knowledgeable users to have more control over the models.
- On large projects with multiple stakeholders identify a BIM 360 “Champion” for each of the major team members, such as the architect, building owner, and contractor. This distributes the accountability for tasks such as adding new users, folder maintenance, and training. The expectation is that each of these major stakeholders is responsible for their own users as well as their consultants or subcontractors.
- At the beginning of the project, take extra care that everyone understands the folder structure and agrees with it. Files can now be moved from folder to folder, but folders themselves cannot be easily moved.



- Make sure that mobile users have the correct devices powerful enough to run BIM 360. Older iPads tended to crash, and the project team had to purchase new devices for the field team.
- If a firm manages users and companies at an enterprise level via BIM 360, make sure protocols are in place for who can create companies. The team had issues with duplicate companies in BIM 360 (DPR vs DPR Construction for example), and since permissions can be based on companies this caused problems with users not having access to the files when they were assigned to the wrong company.
- Subscribe to folders to get email notifications when a user uploads, edits, or comments on a file.
- Hyperlinks can be created in files, but they only link to individual files and not folders
- Subscribe to [BIM 360 Release Notes](#) to get updates on new releases, bug fixes, and improvements.

Figure N: Folder Subscriptions

Conclusion

BIM 360 Document Management was proven to be a great solution to the collaboration and file sharing concerns the project team encountered while executing a major healthcare project. The team's criteria of a model-centric solution that reduced the number of applications required to manage the design and construction of the project was accomplished. While there were challenges, Docs provided the collaboration that the project team required and resulted in a successful implementation.