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Building Owner Managing a Major Airport Redevelopment Project with BIM 360

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Learning Objectives

- Set up BIM project files to be collaborated in BIM 360 Docs with different firms in different offices and countries.
- Use a well-developed BIM Project Execution Plan to guide management and production throughout the entire Project timeline.
- Discover, manage, track and resolve clashes with Navisworks.
- Not everything was perfect. Take heed of the Do's and Don’ts to reduce wasted time, errors, coordination issues and headaches.

Description

Denver International Airport (DEN) is over 23 years old and currently going through major redevelopment such as adding 33 new gates to all of its concourses and renovating the main terminal. Having already constructed the Westin Hotel and Convention Center with the aid of BIM and Cloud Collaboration, DEN has gone full-blown with implementing BIM 360 Docs for the Main Terminal Renovation, also known as The Great Hall Project. It was the logical choice and platform! The BIM Models needed to be centralized and collaborated with several design teams across different offices throughout three continents.

We'll present our approaches, challenges, and solutions from project kick-off through construction. BIM 360 Docs became the Single Source of Truth for a large and complex project. Autodesk products used in the project include BIM 360 Docs, BIM 360 Glue, BIM 360 Field, Revit 2018, and Navisworks Manage 2018.

Speaker(s)

Sonepraseuth Emmy Thammasine is the BIM/Asset Manager of the Special Projects Division at Denver International Airport, DEN, and currently managing the "Great Hall Project," a major redevelopment of the airport's main terminal. DEN has grown and has become of the busiest

airports in the world, and in the BIM and Asset Management world, DEN has set the bar high for Airports by being a leader in BIM Technology and Innovation. Emmy has contributed to DEN's BIM adoption and implementation in ways of research & development, establishing standard operating protocols and discovering solutions to enhance existing workflows & procedures and turning latest ideas and visions into realty. If he wasn't busy with managing projects, it'd be hard getting him to step away from Dynamo.

Brendan Dillon is the Manager of the Digital Facilities & Infrastructure Program for Denver International Airport. DEN is the sixth busiest airport in the United States and has developed a comprehensive BIM and Asset Management plan unsurpassed by any airport in the country. DEN's DFI program manages over 120 projects at a time with a net value in excess of $2 billion. Prior to joining DEN, he had managed over $1B in BIM projects, including as the BIM standards coordinator for the design team on Denver International Airport's South Terminal Redevelopment Project. Brendan is also the founder of the annual Airport Information Integration and Innovation (AI3) forum and is the founder of Red5ive Consulting, specializing in BIM deployment and integration for airports. Along with managing DEN's Digital Facilities & Infrastructure program, Brendan still enjoys getting into the weeds with Revit, writing scripts in Dynamo and generally getting his hands dirty.

Ignacio De La Hera Sola is a senior architect experienced in overall project lifecycle management, including design, construction, coordination, and execution. Ignacio is currently a BIM Manager at Ferrovial Agroman US corp. and working on the remodeling and commercial operation of the Jeppesen terminal at Denver International Airport, handling the BIM process from the conceptual stage through design, preconstruction, execution and maintenance. Between 2015 and 2017, Ignacio worked in the BIM Department in TYPSA, a multidisciplinary team focused on providing support to the design and management teams in implementing BIM processes on projects, gathering state-of-the-art information, developing procedures and helping to consolidate and increase company's BIM related "know-how" and, therefore, its overall capacities

The Great Hall Project

Denver International Airport (DEN) has embarked on a renovation of the Great Hall, which is the area under the tents of the airport's Jeppesen Terminal. The Terminal encompasses 1.5 million square feet. Overall, the Great Hall Project (GHP) will enhance security, provide a more flexible and open airline check-in space and add new dining and shopping options. It will also increase the capacity of the Terminal, update the aging facility and improve the overall passenger experience at DEN.

GHP is a P3 (Private-Public Partnership) project that is led by Great Hall Builders (GHB), a partnership between Ferrovial Agroman West and Saunders Construction. GHB is responsible for the design and construction of the Great Hall Renovation.

Initial Project Plan

BIM Project Kick-off Meeting(s)

Acknowledgement and Implementation of DEN's BIM Design Standards Manual (BIM DSM)

The use and implementation of DEN BIM DSM was required by all consultants under contract to DEN, to tenants and all other Consultants under contract to any other entity of the Great Hall Project (GHP). The BIM DSM is a legally binding document and it crucial that consultants involved with the GHP reviewed it carefully and fully understood the BIM requirements and expectations.

Complete DEN's BPXP (BIM Project Execution Plan), review, and approval

Prior to starting work in BIM, GHB was required to complete a BPXP using DEN's BPXP template. DEN'S BPXP is based off the BIM DSM and is an extension of the BIM DSM.

DEN BIM DSM (Latest Version)

Features & Challenges of B360 Team

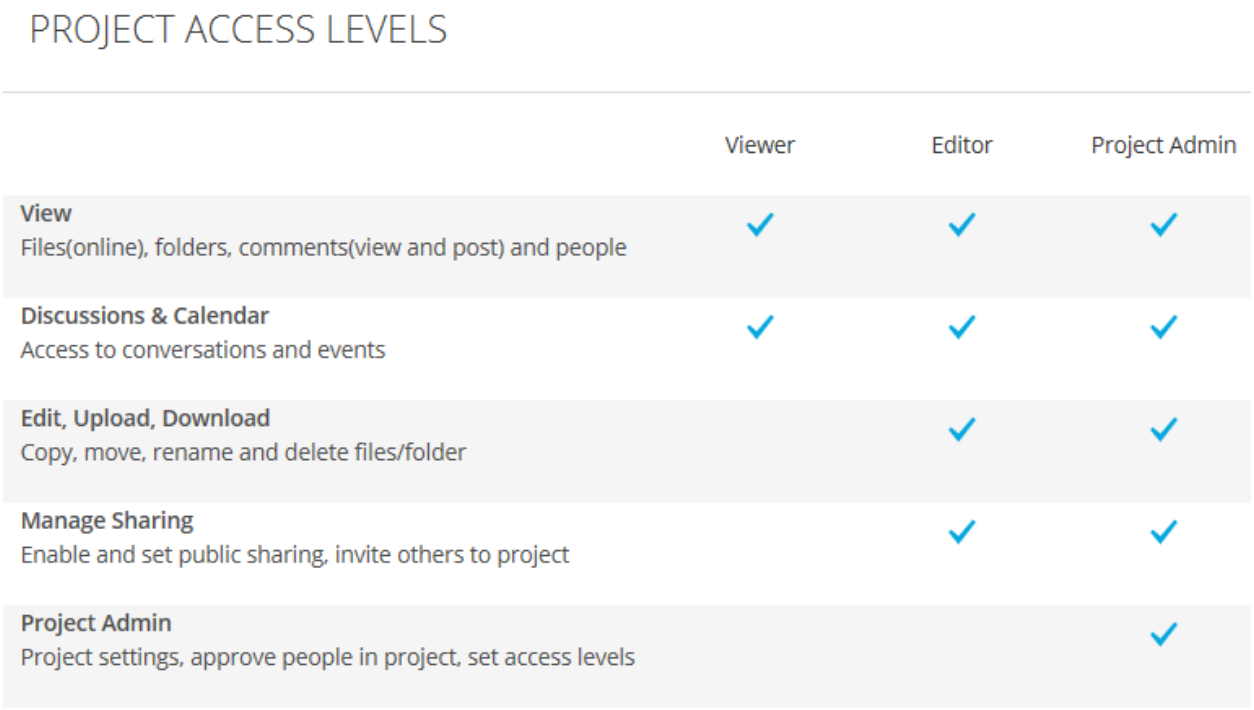
Features

Centrally Located Models and Files

With over 400 users spread out through three continents, sharing files needed to be done efficiently. For tight coordination, all files and documents, in addition to Revit models, were shared in the B360 Team environment. It is the sing source of truth for the GHP. B360 Team was a perfect and logical platform of choice.

Folder Access and Rights

There is a certain level of access right but very limited, Basically 3 types of users, Project Admin, Editor and viewer. not being possible to filter too much what user can do.



Folder Permissions and Settings

Versioning and Comparisons

The system works with versions, the versions are published from Revit, having the capability of publish and share “views”, 3d views and sheets, the versions can be

compared. This allows to monitor the evolution of the design without being a Revit User, the WIP can be follow.

Challenges

Big Team, Little to No B360 Experience

In general, GHB team was new to B360, DEN's support and know how was key for success, C4R worked very well and the teams were able to produce without too much interferences. This is a high trust environment where there is no chance of limitation what other consultants were permitted to do.

Model Sizes and Performance

In general, B360 Team worked extremely well, but the sizes on the model were increasing weekly and the performance started to become sluggish. Teams were experiencing long file opening, synchronizing and publishing.

Name		Owner	Type	Size
TML_LVA-A_GHP_Central-2017.rvt	V34		Cloud Revit model	571.6 MB
TML_MM-S_GHP_Central_2017.rvt	V37		Cloud Revit model	186.1 MB
TML_SSR-M_GHP_Central_2017.rvt	V43		Cloud Revit model	161.9 MB
TML_IHA_FFE_GHP_Central-2017.rvt	V3		Cloud Revit model	139.7 MB
TML_SSR-P_GHP_Central_2017.rvt	V42		Cloud Revit model	107.1 MB
TML_SSR-FX_GHP_Central_2017.rvt	V32		Cloud Revit model	104.5 MB
TML_SSR-E_GHP_Central_2017.rvt	V33		Cloud Revit model	82.3 MB
TML_SSR-T_GHP_Central_2017.rvt	V30		Cloud Revit model	72.7 MB
TML_SSR-FA_GHP_Central_2017.rvt	V36		Cloud Revit model	69.3 MB
TML_JHA-LS_GHP_Central-2017.rvt	V9		Cloud Revit model	50.7 MB
TML_SSR-R_GHP_Central_2017.rvt	V8		Cloud Revit model	25.6 MB

File sizes increased, affecting performance

Multiple Phase Project

The project was configured based on the Permit packages, 11 Phases were implemented in the Revit Models.

PAST

	Name	Description
1	00-EXISTING	FOR ALL THE EXISTING CONDITIONS
2	01-CMF	CMF
3	02-AOB Str	AOB Structural
4	03-AOB	AOB
5	04-Ph1 Str	Phase 1 Structural
6	05-Ph1 VT	Phase 1 Vertical Trans. Permit expected to be done by DFD on behalf of the St
7	06-Ph1 AMEPF	Phase 1 Arch, Mech, Elec, Plumb, Fire
8	07-Ph2	Phase 2 all disciplines
9	08-Ph3	Phase 3 all disciplines
10	09-Ph4	Phase 4 all disciplines

Phases and rooms/spaces provided difficulties

Folder Access and Rights

Content

Launch of B360 Design

Improved Features

There much improved features in B360 that although the project was in full production mode, DEN decided to make the move to convert the project from B360 Team to B360 Design!

Changing Platform Midstream: Things to Consider

Time and Downtime

The total downtime required for the conversion and changing from B360 Team to B360 Design was minimal. It was completed on the weekend and only affected design team members who usually worked on the weekends. However, the amount of time it took to carefully lay out a plan and schedule when the conversion would happen took well over a month. Not only did the effort and planning involve the GHB BIM team, all consultant's BIM managers and DEN BIM Managers, but external assistance and expertise were relied upon Autodesk B360 experts.

Getting Consensus and Agreement from All Design Teams/Companies

Everything was taken into consideration and every possible scenario were assumed. One crucial factor was the design team; the production staff who worked tirelessly on this project for the past year. Design work and data loss would prove to be valuable time lost and time required for the team to redo the work. The result would be a devastating domino effect on the project, impacting schedule and cost. Working will the design team in open discussions helped immensely in understanding everyone's concerns and resolving each concern. Once there was

a consensus that every possible scenario was thought of and resolved, it was time to proceed with planning for the big move!

Plan, Plan, Plan, and Plans some More! Then Document

Everything considered, planning for the conversion commenced. Meetings after meetings. Emails after emails. Drafts after drafts of the plan. At some point, all the planning had to be executed. First order of the process was to create a test conversion, debug and test again until it was ready for the real deal. But, before the real deal, every step of the process was documented. When the conversion happened, GHB BIM Management made sure to not skip any steps.

BACKUP and ARCHIVE

At the end of the conversion, all files and data were backed up locally to DEN's server and the entire project safely archived the B360 Team environment, never to be touched again, except when needed.

Rollout & Conversion

The conversion to the new platform was successfully executed in one weekend.

GHB BIM manager updated all the files from 2017 to 2018.3, collaborated the files into the new platform and re-linked all references within the Revit files.

On the Friday of the conversion weekend, the consultants delivered a cleaned set of Revit files in the old platform and the following Monday, they started working in the new platform.

Results

- The new platform is a hybrid in the sense of production. The team could either work with live models or the team can work with Shared information. For GHP, the consultants opted to keep working with live models.
- All Revit models were working well except for some minor unforeseen occurrences. Some tags were lost. Dimensions and references were also deleted and lost its associations. It seemed these issues were present mainly in the MEP models. However, the issues were resolved rather quickly.
- During the upgrade the team decide to split the architectural model into three different models: a demolition model, a level 1 to 4 model, and a model from levels 5 to the roof. This came up because the architectural becoming very heavy and inefficient to work with. Since then, the architecture firm has reaped the benefits (minus a few issues here and there, which were expected)

- During the span of one week, some of the users where having problems accessing the platform. Again, experts came together, including Autodesk experts, and resolved the issue after only ten days.

Use of Glue & Navis

Glue

GLUE is key for coordination! It is the common place where all the shared information provided is combined to generate the coordination models. GLUE is the HUB for the Navisworks.

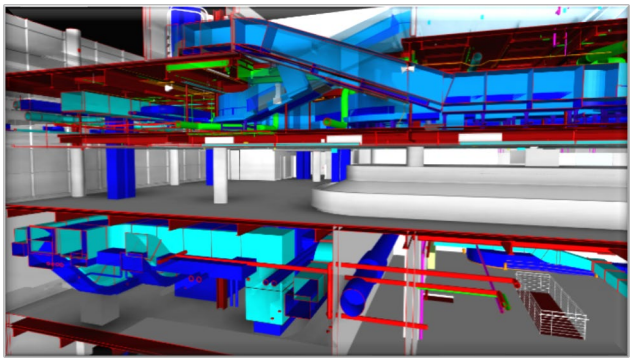
With the models in the platform, a set of NWC is published to glue weekly to generate a set of coordination models. In total, there are five main coordination models Based on construction Phases.

For this project, most Glue users were DEN's design team and engineers.

Navisworks

Navisworks is the tool used by GHB for spatial coordination purposes, for both, design and construction Phases.

On Thursdays, the GHB team runs the clashes, generates the reports and share in B360 Design. Tuesday afternoons are reserved for the spatial coordination meeting that focuses on specific disciplines and the appropriate consultants attend this meeting with GHB and DEN and resolve clashes during the meeting.



Clash Detection in Navisworks

Model Coordination for Analytics

Using coordination data from both Glue and Navisworks, DEN BIM has developed a process that combines these coordination data with Business Intelligence, such as Power BI and

Tableau. The analytics and reports that come out of this is valuable information consumed by DEN Design, Planning and allow DEN executives to make informed decisions.

B360 Field

Identify DEN Assets in the Model

DEN and DEN's Asset Management Team (AMT) relies on data from all BIM models that contain assets and consumes these data in IBM Maximo, an Enterprise Asset Management (EAM) Database. AMT outlined a comprehensive list of what are DEN assets (covered DEN DSM) and it is the designer's responsibility to correctly identify all DEN assets in the Revit models. DEN's BIM teams, as the part of the model review process, carefully checks if the designers have properly identified which Revit elements are or are not DEN assets.

Table 11 - DEN Asset Types and Functional Areas

ASSET TYPE	FUNC AREA
ACE	AOM
ACTUATOR	HVAC/PLUMBING
AIR COMPRESSOR	HVAC/PLUMBING
AIR CONDITIONING UNIT	HVAC
AIR CURTAIN	HVAC
AIR DRYER	HVAC
AIR HANDLING UNIT	HVAC
AIR SOLID SEPARATOR	

ASSET TYPE	FUNC AREA
DESSICANT FILTER	HVAC
DISCONNECT	ELECTRIC/HVAC
DOMESTIC WATER PUMP	PLUMBING
DOOR INTERNAL ROLLING STEEL	BUILDING
DRINKING FOUNTAIN	PLUMBING
DYNACO	BUILDING
ECOLOGY AIR UNIT	HVAC
ECS/MICROPHONES	

Populating Asset Data (from DEN BIM DSM)

Review Asset Data Information

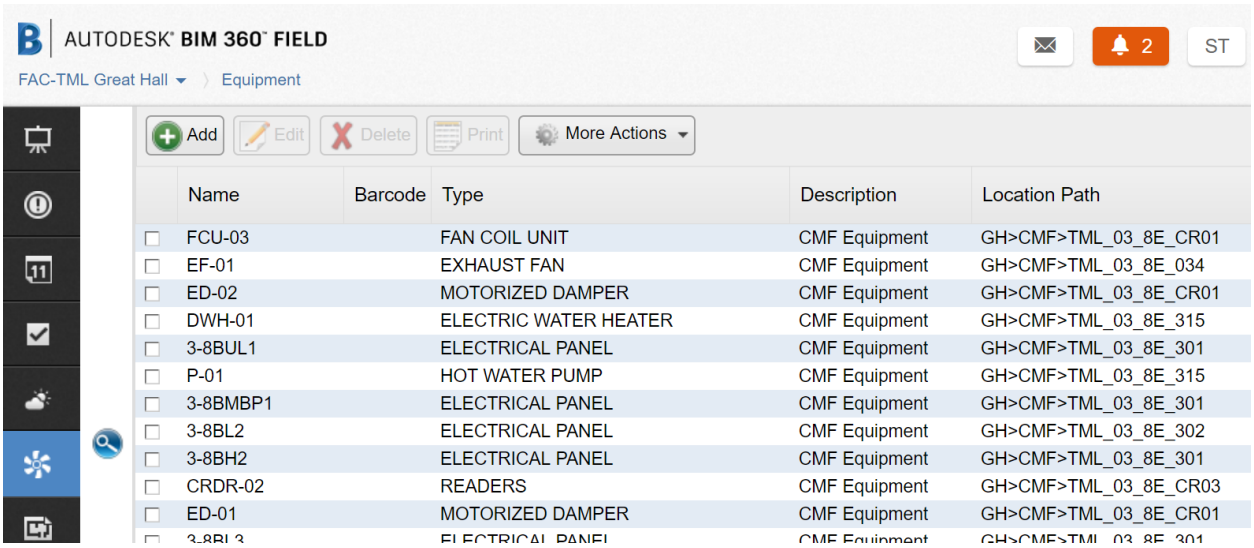
At 100% or IFC submittal, designer's models are expected populate certain asset information in Revit. The asset information required includes the element's Mark, Asset Type, Location, Functional Area and Status. If any parameters are null or incorrect, the model review for a model receives a fail.

Data Type	Data Description
Mark	Asset identifier, e.g., VAV-13, FSD-12
Asset Type	DEN Asset Type, e.g., Fan Power VAV. Refer to Appendix C.
Functional Area	Functional Area group that will maintain the Asset, e.g., HVAC. Refer to Appendix C.
Status	This value shall be set to **Designed** for all Assets at 90 percent CD
Asset	Indicating the element is an asset. If it is a DEN asset, set to **Yes**; otherwise, **No**.

Populating Asset Data (from DEN BIM DSM)

Export Asset Data to Field

Once the models have passed DEN's review for correctly identifying assets and populated the information correctly, the data is ready to be exported and imported into B360 Field. As equipment is installed, the installer is responsible for populating the data for all assets, such as an asset number, barcode (QR Code), Manufacturer, Model Number, Serial Number, Install Date and Warranty information into B360 Field platform, as well as validating existing data.



DEN Assets Populated in B360 Field (GHP Phase 1)