Managing Mega Projects in BIM 360

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Introductions
Martin Coyne

BIM Practice Manager

An architect by trade, Martin joined KPF back in 2013 to lead BIM efforts in the London office. Having worked as an architect/BIM lead at 3DReid and Aedas in London and Suters in Sydney, he now oversees project implementation in KPF’s London office and works closely with the team in NY to manage global BIM strategy and development.
Veronica Quintero

BIM Practice Manager

Veronica is the BIM Practice Manager at KPF who works within the Digital Practice Team. She received her B.Arch from NJIT and M.Eng in Product Architecture and Engineering from Stevens Tech. As KPF’s BIM Practice Manager, Veronica Quintero engages with each team, in the early stages of the project, to strategize and implement a successful BIM workflow.
Alex Wilson

Senior BIM Practice Specialist

Alex is a Senior BIM Specialist at KPF. After graduating with a Master of Architecture from the University of Melbourne, he moved to New York where he has worked in design and technology. At KPF his responsibilities include the supporting multiple projects, research into emerging technologies, and spearheading the use of Dynamo.
Learning Objectives

• Learn how to manage folder structures in BIM 360 Docs to manage large projects.

• Learn how to create additional data fields for information management purposes.

• Learn how to capitalize on ideal approaches to model division when using BIM 360 Design for large projects.

• Learn how to utilize basic aspects of data extraction in the BIM 360 platform.
What We’ll Cover

WHY BIM 360?
We will explore the reasons behind our decision to implement BIM 360 on our largest projects

INITIAL PROJECT SETUP
Before moving to the cloud, we take a look at what we define as a mega project and how that shapes our approach internally

CASE STUDY: INITIATING BIM 360 DESIGN
We will take a deeper dive in to a case study looking at moving a large project to the cloud

MANAGING MODELS IN THE CLOUD
We will share our best practice tips and tricks for maintaining quality and standards across a large number of cloud hosted models

BIM 360 AS A CDE
We review how suitable the BIM 360 platform is for use as a Common Data Environment, not just a collaboration platform
Assumptions

In order to get more quickly to our mega-project advice, we have assumed the following:

• You are generally familiar with the BIM 360 interface, uploading files, initiating files to BIM 360 Design, etc.
• You have a rough understanding of BIM 360 Docs vs. BIM 360 Design
• You are generally familiar with Autodesk Revit
How We Work
1976
KPF FOUNDED IN NEW YORK

9
OFFICES WORLDWIDE

6
6 OF THE 11 TALLEST COMPLETED BUILDINGS IN THE WORLD

670+ STAFF

54 DIFFERENT COUNTRIES

40+ LANGUAGES SPOKEN

77
LED BY 31 PRINCIPALS & 46 DIRECTORS

350+
350+ DESIGN AWARDS & 100+ GREEN RATINGS
What Makes a Mega Project?

Our work typically falls in to the ‘large’ category to put it lightly... so what makes a ‘mega project’?
**SMALL**

**SMALL SINGLE BUILDING**
A single building, manageable in a single Revit file, typically up to around 150m tall with limited footprint

**MEDIUM**

**SKYSCRAPERS**
Typically up to 300m tall with either a homogenous massing or clear podium/tower breakup, usually split into internal and façade models to improve performance

**LARGE**

**SUPERTALL/GROUPED TOWERS**
A single tower 300-600m tall, may be manageable with internal/façade model split but may need to broken up further and/or a group of tall towers with associated podium/facility structures with at least 2 files for each building

**‘MEGA’**

**MASTERPLAN OR AIRPORT**
A large ‘groundscraper’ building typically at least 500m long in at least one dimension requiring multiple model files to handle geometry or a developed masterplan project, typically in excess of 10/20+ buildings, each typically consisting of multiple files
Pre-BIM 360: Our Existing Tech Stack

NEWFORMA
Our longstanding tool for information exchange, allowing project transmittals and use of ‘shared folders’ as a basic extranet with some data tracking capabilities

REVIT SERVER
Prior to implementing Panzura we had relied on Revit server to exchange model data between offices

PANZURA
KPF’s global file-management system, utilizing a combination of cloud-hosting and local cache servers to enable access to files from all KPF offices

A360 TEAM
The pre-cursor to the BIM 360 platform, we had carried out limited testing of project file sharing via the platform.
Pre-BIM 360: Why Did We Need a New Solution?

**NEWFORMA**

External file sharing capabilities limited to the ‘shared folder’ option, we had access to backend audit trail, but external parties did not.

Uploading new file versions typically overwrite earlier versions, or require separate folders.

**REVIT SERVER**

Primarily limited to Revit files only, a typical KPF project will often see a need for Revit, AutoCAD, Rhino information to be seamlessly linked.

Constant issues with files locking and preventing user access.

**PANZURA**

Bandwidth limitations in some offices (particularly in Asia) made global Revit collaboration tricky on occasion.

Perceived performance issues seemed to hold back

**A360 TEAM**

Initial tests were not overwhelmingly positive. With concerns among industry peers around server downtime added in, we were not keen to push uptake too far.
Considering BIM 360 for Mega Projects

**Securely publish and distribute construction drawings, documents and models in a single, cloud-based repository**

**KEY CAPABILITIES:**

- Unlimited storage
- Document Control & versioning for all file types
- Revit (& AutoCAD) publishing
- 2D & 3D viewing and compare#
- Document sets
- Approvals workflow
- Design issues & markups
- Mobile access
- Reporting & analytics

**Connect teams, enable secure real-time design collaboration, manage the exchange of design data and easily understand design changes**

**KEY CAPABILITIES:**

- Revit cloud worksharing
- Access controls
- Tracking & timeline
- Revit cloud worksharing
- Access controls
- Tracking & timeline
- Coordinate deliverables
- Change visualization
- Assign issues and add markups
Audit Trail

BIM 360 Docs allows for easy review of who uploaded information, who has viewed/downloaded files and clearly shows which version current information is on. We also found it much easier than other platforms to go back and review earlier versions of shared information where necessary.

Version Tracking & Compare

Not only can you view previous versions of uploaded documents/models, you can view changes between different versions of those files with ease. This is a particular benefit when you are dealing with skyscrapers and major infrastructure projects where changes can number in the hundreds or even thousands.
Cloud Worksharing

After generally remaining wary of Collaboration for Revit (C4R), the apparent stability and performance of tests of BIM 360 Design reassured us. For projects where we are working with other designers around the world, sharing a common data hub for models made a lot of sense.

Access Control

As it should be with any business, data security is a major concern for us. Controlling access to information on BIM 360 seems simple and easy to control. There are useful levels of access control, also enabling relevant parties the ability to view but not edit information, an essential part of effective collaboration.
One Hub to Rule Them All…?

On collaborative projects, the question always comes up... who is going to host the data? Ideally the client, as the unifying party would provide the BIM 360 hub, but (in our experience) this is typically done by the Lead Consultant. This becomes an issue though when contractual reasons or security/trust concerns lead to a consultant's desire or requirement to host their own information and there is no obligation to use any single hub/CDE...

It is not currently possible with the standard BIM 360 platform to sync data between two separate hubs.
The ‘2020 Factor’

In addition to pushing ahead with a couple of major projects in BIM 360, the switch to vastly increased levels of remote working (largely a combination of DaaS and VPN methods) were putting a strain on some of our Revit projects.

Particularly where VPN was employed, we found that BIM 360 Design offered improved model access and synchronization performance.
BIM 360 Setup Considerations
Learning Strategies

- When working on mega projects with large teams, there is a larger risk of an inexperienced user (or users) causing problems
- How do you verify skill levels?
- Education should not stop with Revit, especially on mega projects hosted on BIM 360
- The BIM 360 platforms comes with its own set of essential skills
- Does your eLearning platform cover BIM 360 Material?
**Plans vs. Project Files**

**PLANS:** Primarily intended for use with the current set of CONSTRUCTION documentation – basically the digital equivalent of a set of printed contract drawings. Only PDF, DWF, RVT, IFC, and DWG file types permitted. Plans does not work with BIM 360 Design/Desktop Connector.

**PROJECT FILES:** Allows uploads of all file formats, drawing/model status is confirmed by the person sharing information and allows files to be accessed through BIM 360 Design/Desktop Connector.
Discipline by Discipline

• Every consultant that will be sharing information via BIM 360 (Docs or Design) should have their own folder at the top level of Project Files.

• A 2nd level of folders can be created for each individual building/plot or rely on naming standards.

• Any project-wide documentation, i.e. BEPs, project standards, etc. should also be kept at the top level.

Plot by Plot/Zone by Zone

• Each individual building plot should have its own top-level folder within Project Files.

• Each plot could then either contain sub-folders for each discipline OR rely on file naming and descriptions to identify files.

• Any project-wide documentation, i.e. BEPs, project standards, etc. should also be kept at the top level.
Discipline by Discipline

PRO – each discipline has a defined area in which to work and share information, making for easier access control

CON – can require a lot of moving between folders to locate relevant information

Plot by Plot/Zone by Zone

PRO – works well in situations where teams are large enough to have dedicated team for specific plot(s), locating relevant information is much quicker

CON – does not work well with BIM 360 Design, access control by discipline can only be maintained file by file
Folder Naming Tips ‘n’ Tricks!

When initiating BIM 360 Design, you designate a location within Project Files where each discipline’s information is to be stored.

It gets very confusing if the final level folder has the same name for each discipline i.e. ‘Models’ or ‘WIP’ – you either need to locate cloud worksharing models in the top-level discipline folder or in a uniquely named sub-folder i.e. ‘Structural Models’ or ‘Architecture WIP’

Multiple ‘Models’ folders will cause problems when trying to initiate new organizations within BIM 360 Design.

Give each folder containing cloud worksharing models a unique name, such as “Arch Models”.

Hosting these files in a sub-folder gives greater flexibility over access control.
Case Study: Initiating a Project on BIM360 Design
Mega Project Case Study
Project Data

- **AREA** – 11,646,927 SF | 1,082,035 m²
- **OCCUPANTS** - 10,000 Students
- **PROGRAM** - Housing, Teaching and Research, Athletics, Performing Arts, and Amenities
- **RATING** - LEED Platinum, HK-BEAM (Hong Kong) Platinum, 3-Star (China)
KPF Team

- BIM LEADS/SPECIALISTS – 24
- TEAM MEMBERS - 82
- REVIT MODELS - 53
- SHEETS IN 100% SD - 476
Project Team

- BIM360 ADMINS – 24
- BIM360 MEMBERS - 102
- REVIT MODELS - 97
- SHEETS IN 100% SD - 1007
File Setup

• **Active BIM Execution Plan**
  o Update Update Update.

• **Storyboard out the model breakup**
  o Include Design team and consultants in this conversations.

• **Review similar projects**
  o Both geographic and Scale.
  o Review sets to pre-empt any parameters/views/workflows.

• **Automate**
  o Ensures consistency across models.
Server-Side Files

- Files location
  - Stored locally.
  - Can be mirrored by a global cloud file system.
- Access
  - Anyone (in office) who can access the server.
  - Syncs are restricted by network speed.
- Backups
  - Server backups/Shadow Copies easily accessible.
- Links/Exchange
  - Anything on the server.
  - Traditional file exchange with consultants.
  - Email/FTP.
Cloud Hosted Files

• Features
  o Single source of truth.
  o Access to the Hypermodel.

• File Location
  o BIM360 cloud services (Amazon S3).
  o Automatically mirrored globally.

• Access
  o Controlled per project.
  o Anyone with permission (and licenses).
  o Syncs times faster due to Revit Accelerator constantly communicating/updating with the Central.

• Links/Exchange
  o Variety of options for exchanging/linking consultant files.
Linking Within BIM360

• **Live**
  - Linking directly to consultant live models.

• **Shared**
  - Snapshot of live model saved to shared folder.
  - Less bandwidth, will not update with every consultant sync.

• **Consumed**
  - Allows team to consume a package once published by the owners of that content.
  - Not a requirement to accept changes.
Autodesk Desktop Connector

• **Features**
  o Global cloud storage to any file type.

• **Files Types**
  o Links for Revit Files (IFC, Image, DWG, DXF, DGN, SAT, SKP, TXT)
  o Unlimited Storage with versioning of files.

• **Continuity**
  o Same ecosystem as Central Models ensures no packet loss.

• **Local Storage**
  o Needs large local storage as ADC mirrors all files on team members C Drives

• **Versioning**
  o Extreme difficulties if Version is not consistent.
Restrictions of BIM360

• Backups
  o No way to temporarily open older version without rolling back all changes.
  o Can only automatically publish once a week.

• Links
  o Need to be uploaded to BIM360 Hub to eliminate corruption by packet loss.
  o Shared Parameter File is locally stored.

• Automation
  o Cannot Automate files through headless Dynamo as BIM360 path currently inaccessible through API.
  o Dynamo can be run through a Task Server/Orkerstra.
Managing Models on the Cloud
Managing the Project Data

What to do with all the data you’ve collected over the life cycle of the project.
Clarity allows us to automate manual tasks, provides valuable Revit model health metrics and helps us manage room data sheets for our Mega projects. We can track file size, open times and use Dynamo to send custom metrics to our Revit home page.

Unifi’s project analytics dashboard provides us with real-time data that updates with every sync to central. It helps us maintain a proactive approach before issues happen on a Mega project. Users can also review warnings by urgency and keep track of major changes to the models.
Automate Processes

Automated scheduled tasks that run daily and weekly as needed.

IMAGiNiT Clarity

- Export CAD
- Publish to B360
- Print PDF
- Backup Project

- 50%
- 20%
- 20%
- 10%
The purpose of the BIM performance KPI dashboard was to help improve accuracy and consistency of design information, as an EIR requirement. The KPIs focused on model quality, model data, coordination, level of development and spatial design.

- **Clarity**
  - Used to analyze and verify model data is compliant to the required non-graphical attributes and model classification.

- **BIMCollab**
  - Used to track issue resolution progress with priorities ranging from critical to low.

- **Solibri**
  - Used to measure model quality and BIM object integrity. This includes, but not limited to model setup, file integrity, model location, file size, etc.
Model Metrics Dashboard
Revit Project Home Page

The Revit Project Home Page can serve multiple purposes. It can provide insight to the project and also keep track of the activities and health of the model when they open.

- **Project Team/Information**
  - Contains important project information and notices that you want to share with team members.
  - Agreed BIM Uses
  - Project Management information

- **Model Information**
  - Model Management Checks
    - Last Purge, Last Audit, Last Compact and # of Warnings
  - Special features used in the model
  - Quick view of current 3D model
  - List of all the associated Revit models/links
Quality Control Workflows

We use Ideate BIMLink’s quality control libraries to check various elements like naming standards, room data, and fire rating attributes. This workflow allows users and non-Revit users to quickly view items in the model in a table format and check for compliance or review issues and discrepancies. Through BIMLink we can then take some of the data into excel, make necessary adjustments, and bring it back it to the model. This becomes super helpful when you’re managing over 20+ revit models in a project.
“Without standards, there can be no improvement.”

Taiichi Ohno
Container File

The project specific container file allows us to maintain system and custom families in one file, which you can visualize and simply copy/paste it into your project. This method also allows us to maintain other standards like view templates, scope boxes, and materials.

Cloud Content Library

Using a content management system’s private project folder allows the team members to easily find content specific to their project. The pros to using this system is version control, having a rating system and its accessible globally via cloud storage.
Automation through Dynamo

REVIT HOME PAGE UPDATE
Using Dynamo, we’re able to update critical information like ‘Last Audit’, ‘# of Warnings’ and ‘Last Compact’ on the home page so its front and center for the entire project team.

PUSHING STANDARDS TO ALL MODELS
View templates create consistency and efficiency for your project. We used Dynamo to update view templates across 20+ models to ensure graphic standards across all sheets.
BIM 360 As CDE for a Mega-Project?
ISO 19650 & THE CDE

Common Data Environment (CDE) - introduced as a concept in the BS1192 and reinforced in ISO 19650-1:2018

CDE Workflow – the process to be used for the controlled exchange of information

CDE Solution – the technology solution used to host the CDE

Can BIM 360 be used as the CDE solution?
1. Under PROJECT FILES hit the settings cog and click ADD ATTRIBUTE near the bottom.

2. For attributes with pre-defined options, use the ‘Drop-down menu’ option and enter your values.

3. Move your new attribute(s) up and down the list so they're easy to find (and hide attributes you don't use!)

4. Using the drop-down menu feature ensures everyone sticks to the same values.

Adding Metadata Attributes
The Work In Progress (WIP) State

As per ISO 19650:

- Used for information while it is being developed by its task team
- Should not be visible or accessible to any other task team

In BIM 360

- BIM 360 Design works well for WIP data hosting, and Docs now allows editing of Word/Excel Docs
- Take care to set view/edit permissions as appropriate
Creating Approvals Workflows

- Should be created and managed by party hosting the BIM 360 Hub
- Different options available for multi-step approvals
- You can set who *initiates* the approval and who is the *approver*
- Also set up post-review actions, i.e. move to Shared Folder
- NOTE while you can set review status (i.e. approved/rejected) you cannot automatically change the Suitability Code data field
The Shared State

• All information in the Shared State should ideally be located on a single hub
• It should be “visible and accessible but should not be editable”
• Prior to information moving to the Shared environment, the relevant party should verify that the information is suitable for sharing
• Note that WIP may be stored ‘offline’ and reviewed prior to upload to BIM 360
• If BIM 360 is used to host both WIP and Shared state information, the approvals process within BIM 360 can be used
The Published State

- This may relate to specific data drops at the end of project phases or when information is formally issued for tender or construction
- The approvals workflow should again be used to allow information to move to the published state
- Permissions should be set to ensure the information is not editable but can be downloaded
- You may wish to use the shared folder or create a separate one for specific uses, but in either case be sure to update the suitability status! You may also choose to move information to the ‘Plans’ area of Docs when approved for construction
Archived Information

- All information containers within BIM 360 Docs is, in theory, ‘archived’ within the platform, previous versions of most file types remain accessible
- However, you need to consider how sustainable BIM 360 is as an archive, who maintains the costs going forward for hosting and allowing access to information
- Archive all information to an offline location also, including the entire project activity history, not just the information containers themselves
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