



### **Table of Contents**

DTGO BIM Project Execution Plan	
Issue and Revision Register	
Section A: BIM Project Execution Plan Overview	2
A1: Introduction	2
Section B: Project Information	5
B1: Project Information	5
B2: Project Schedule	5
B3: Key Project Contacts	6
Section C: Project Goals and BIM Uses	9
C1: BIM Goals and Objectives	9
Section D: Software Agreement	11
D1: BIM Platform	11
D1.1: BIM Software and Working Platform	
D1.2: Possible Upgrades to the Project for As-built Model Submission	
D2: BIM360 Seats	13
D3: Unit Measurement	15
Section E: Organizational Structure	17
E1: Organizational Structure	17
E2: Role Descriptions	18
Section F: BIM Project Process	20
F1: BIM Master Workflow	20
F2: Information Transmittal Milestone	27
F2.1: Project Deliverables	
F2.2: Model Submission	31
F3: Meeting Procedure	
F3.1: BIM Kick-off	35
F4: Information Management	
F4.1: Information Exchange	
F4.2: BIM 360 Docs Folder Structure	
F4.3: Design Collaboration	
D4.5: BIM360 Issue Workflow	
F4.6: QNAP Folder Structure	
F5: Model Management	
F5.1: Model File TypeF5.2: Model Structure	
F5.3: Model Responsibility	
F5.4: MQDC Family Standard	
F5.5: Naming Conventions	
F5.6: DTGO LOD-LOI	

F5.7: Model Exclusions	68
Section G: Quality Control Check	70
G1: Quality Control	70
G1.1: Model Validation Check	71
G1.2: Model LOD-LOI Check	72
G1.3: Shop Drawing Protocol	73
G1.4: QC Model Validation Checklist for Site Inspection	
G2: Clash Detection Protocol	74
G2.1: Clash Detection	
G2.2: Clash Workflow	
G2.3: Color Coding for Inter-Discipline Combination	
G2.4: Clash Matrix	
G2.5: Clash Management	80
G2.6: Clash Report	
G2.7: Return on Investment (ROI)	85
G3: QA&QC Site Inspection	
G3.1: Site Photo	
G3.2: Photo Folder Structure	88
Section H: Asset Information Management	93
H1: Asset Information Model (AIM) Input	93
H1.1: FM Inventory Format	
H1.2: Model Information Input	95
H1.3: Specific Information Input	96
H2: Asset Information Deliverables	
H2.1: BIM Deliverables	
H2.2: Non-BIM Deliverable	
H2.3: Deliverable Package Management	110
Section I: Project Closed-Out	117
I1: Project Lessons Learned	117
I1.1: Project Top 5 Issues	117
I2: Evaluation and Impact Assessment	
I2.1: Project Return on Investment (ROI)	118
Section O: Annendices and Attachment	120



# **SECTION A**

**BIM Project Execution Plan Overview** 

### **Section A: BIM Project Execution Plan Overview**

**OIR "DTGO"** 

### A1: Introduction

**BIM Project Execution Plan (BEP)** is a digital work plan documentation that supports the project working procedure and governance the organization information management (organization refers to **DTGO Corporation**) for enhancing the organization's efficiency and standard. This comprehensive documentation applies the principles of ISO 19650 for the Organization Information Requirement (OIR), in, at a stage of maturity to implement the whole life cycle of project feasibility, strategic planning, initial design, design development, construction, and operation-maintenance according to residential and mixed-uses development project. To define the information management in the three main stages are follows;

# AIR Asset Information Requirements "Quality Control & Facility Management" EIR Exchange Information Requirements AIM Asset Information Model PIM Project Information Model

Figure A1: DTGO Organization Information Requirement

- Asset Project Management is the process of organizing and planning the digital assets and information
  across a project under DTGO Corporation who identifies the information exchange procedures and usages
  that respond to design standards, life-safety, and environment as follows below;
  - PIR (Project Information Requirement) is to identify the key significant information that acquires to use from the initial stage towards design, construction, and operation maintenance. Therefore, to achieve the identified BIM goals mentioned in C1: BIM Goals and Objectives
  - AIR (Asset Information Requirement) is to identify specific information on the graphical and non-graphical data, information, and documentation needed for the lifetime operation and management of a built asset. Therefore, to achieve the identified AIR mentioned in the BEP Construction.



- 2. Information Management is to manage all information exchanges, technical aspects and uses information that responds to all stakeholders and parties for identifying the exchange information requirement (EIR) protocol relevant to the regulation, cost control, management of the risk of design, and construction during the project procedure. Therefore, to achieve the identified the EIR in Section F4: Information Management
- 3. **Project Deliverables** is to identify the details of project deliverables for the whole project lifecycle are below;
  - PIM (Project Information Model) is to identify the project deliverable details in both geometries of the level of details (LOD) and non-geometry of the level of information (LOI) and including the model ownership according to PIR. Therefore, to achieve the identified PIM mentioned in <a href="Section F2.1">Section F2.1</a> Project Deliverables and Section F5.6: DTGO LOD-LOI
  - AIM (Asset Information Model) is to identify the level of details and geometry that responds to AIR for
    information needed for instance; the equipment registers, records of installation, maintenance dates,
    lifetime operation, and management of a built asset. Therefore, to achieve the identified AIM
    mentioned in Section H: Asset Information Management

# **SECTION B**

**Project Information** 



### **Section B: Project Information**

General information describes the project information, ownership, stakeholders, project location – coordination point, and project schedule. This session is a placeholder for project modification.

### **B1: Project Information**

Project Owner	Magnolia Quality Development Corporation Limited (MQDC)	
Project Shareholder	(Project Shareholder)	
Project Name	(Project Name)	
Project Type	(Project Type)	

Table B1: Survey point

Project Coordinates	N/S	E/W	Elevation
Survey Point	0.00	0.00	0.00
(By Project Owner)			

### **B2: Project Schedule**

Table B2: Project Schedule Rev.0 Date: dd/mm/yy

Project Phase / Milestone	Estimated Start Date	Estimated Completion Date	Designer	Deliverables
Construction Phase				
Piling	(Date: mm/yyyy)	(Date: mm/yyyy)	(Company Name)	(2D Drawing)
Excavation	(Date: mm/yyyy)	(Date: mm/yyyy)	(Company Name)	(2D Drawing)
Substructure	(Date: mm/yyyy)	(Date: mm/yyyy)	(Company Name)	(2D + 3D)
MEP	(Date: mm/yyyy)	(Date: mm/yyyy)	(Company Name)	(2D + 3D)
Superstructure	(Date: mm/yyyy)	(Date: mm/yyyy)	(Company Name)	(2D + 3D)
Architecture	(Date: mm/yyyy)	(Date: mm/yyyy)	(Company Name)	(2D + 3D)
Façade	(Date: mm/yyyy)	(Date: mm/yyyy)	(Company Name)	(2D + 3D)

Note - The schedule would be updated and confirmed by owner and CM/PM

### **B3: Key Project Contacts**

### Owner - MQDC / QSHE

Role	Contact Name	E-Mail	Phone
РМ	(Name)	(Email)	(Tel.)
PD	(Name)	(Email)	(Tel.)
Project BIM Mgr.	(Name)	(Email)	(Tel.)
QSHE / FM	(Name)	(Email)	(Tel.)

### Construction Manager (CM/ PM)

Role	Contact Name	E-Mail	Phone
Project Mgr.	(Name)	(Email)	(Tel.)
Project Architect	(Name)	(Email)	(Tel.)
Project Engineer	(Name)	(Email)	(Tel.)
Project BIM Co.	(Name)	(Email)	(Tel.)

### **BIM Consultant**

Role	Contact Name	E-Mail	Phone
BIM Mgr.	(Name)	(Email)	(Tel.)
BIM Co.	(Name)	(Email)	(Tel.)
BIM Project Support	(Name)	(Email)	(Tel.)

### Designer

Role	Contact Name	E-Mail	Phone
Project Mgr.	(Name)	(Email)	(Tel.)
Designer	(Name)	(Email)	(Tel.)
BIM Modeler	(Name)	(Email)	(Tel.)

### **Façade Consultant**

Role	Contact Name	E-Mail	Phone
Project Mgr.	(Name)	(Email)	(Tel.)
Designer	(Name)	(Email)	(Tel.)
BIM Modeler	(Name)	(Email)	(Tel.)



### **Main Contractor**

Role	Contact Name	E-Mail	Phone
Project Mgr.	(Name)	(Email)	(Tel.)
Designer	(Name)	(Email)	(Tel.)
BIM Modeler	(Name)	(Email)	(Tel.)

### **Sub-contractor**

Role	Contact Name	E-Mail	Phone
Project Mgr.	(Name)	(Email)	(Tel.)
Designer	(Name)	(Email)	(Tel.)
BIM Modeler	(Name)	(Email)	(Tel.)

### Supplier

Role	Contact Name	E-Mail	Phone
Project Mgr.	(Name)	(Email)	(Tel.)
Designer	(Name)	(Email)	(Tel.)
BIM Modeler	(Name)	(Email)	(Tel.)

# **SECTION C**

**Project Goals and BIM Uses** 



### Section C: Project Goals and BIM Uses

### C1: BIM Goals and Objectives

With regards to ISO19650, It is necessary to setup the Project Information Requirement at the initial state in accordance with the BIM goals and objectives as follows;

Table C1: BIM Goals and Objectives

Project Phase	BIM Goals and BIM Uses	Check
Construction	1. 3D Coordination and Design Review	
Phase	1.1 Construction-level coordination	
	1.2 Development of Shop and Fabrication Document	
	2. Construction Planning (4D Modeling)	
	2.1 Construction Planning and Monitoring	
	Note – The details of 4D scheduling implementation are in <u>BIM Handbook – Section5: 4D Schedu</u> .	
	3. Return on Investment	
	4. Asset Management (7D)	
	4.1 Recorded Asset Model	
	4.2 Asset Information Management	

**Note** - This table is only suggestions and may be modified according to specific demand.



## **Software Agreement**



### **Section D: Software Agreement**

D1: BIM Platform

D1.1: BIM Software and Working Platform

Table D1: BIM Software and Working Platform

Usage	Vendor	Software/ Product	Version	File format
Document Management	Oracle	Conzol	Up to date	
	Autodesk	BIM360 Docs		
Cloud Collaboration	Autodesk	BIM360 Design	Up to date	
3D modelling (All discipline)	Autodesk	Revit	(2021 or as agreed)	.rvt
3D coordination	Autodesk	Navisworks Manage	(2021 or as agreed)	.nwc, .nwf,
				.nwd
Construction simulation (4D)	Autodesk	Navisworks	(2021 or as agreed)	.nwc, .nwf,
		Manage/ Simulation		.nwd

**Note** - Autodesk Revit® has a pop-up reminder on every update. The program shall always be updated to the latest release (on the project start date). The product build can be in each product's Help menu by clicking on About Revit.

### D1.2: Possible Upgrades to the Project for As-built Model Submission

A construction project could be operated throughout the construction phase two years for the minimum duration. In order to prevent technical issues from possibly updating Revit model version, the Revit model version shall be updated to the latest released version yearly.

In compliance with DTGO policy, the As-built models shall be gradually developed as constructed. Contractors are required to upgrade the approved Revit models to the lastest Software Version at each submission milestone, in order to archive and further use as hard evidences. The archiving procedure shall be manipulated throughout As-built as shown in figure D1.

For the Project Closed-out, contractors must do the final upgrade and submit the latest Software Version of the whole building models, according to <u>Section F2.2 Model Submission</u>.

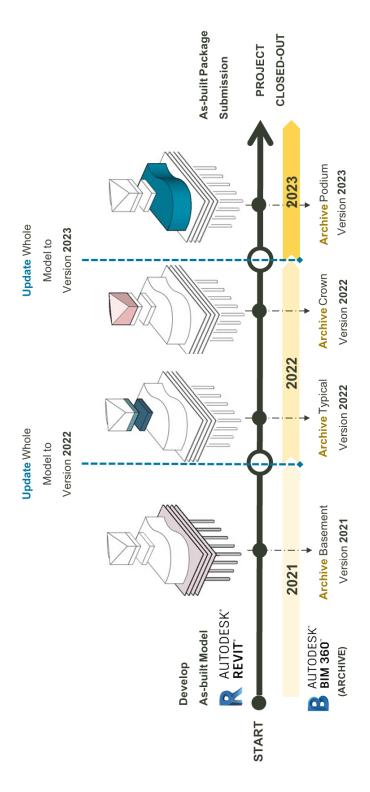


Figure D1: Example of As-built model upgrades for As-built submission



### D2: BIM360 Seats

Regarding Autodesk BIM360 Platform accessibility, a member limit is typically set for each BIM360 service associate with a BIM360 account. Therefore DTGO strategizes BIM360 account management as described in table D.2

Table D2: DTGO BIM360 Seats Policy

BIM360 Usage	License Type	Task Team	Amount
Document Control, Document	BIM360 Docs	PD	2 Licenses
Review and Approval	(Provided licenses)	PMC	4 Licenses
Cloud Collaboration/	BIM360 Design	Designers/	Equal to accessing
Information Exchange	(Bring one's own	Contractors	project member
	subscription)		
Document Management/	BIM360 Design	BIM Consultant	Equal to accessing
Project Admin	(Bring one's own		project member
	subscription)		

For the additional task teams e.g. QS, QSHE, or specialist consultant as necessary, which are not identified in the table D2 above, are to separately request the access from DTGO BIM manager. However, Project BIM consultant is responsible for monitoring and managing project members, which affect project's BIM360 seats.

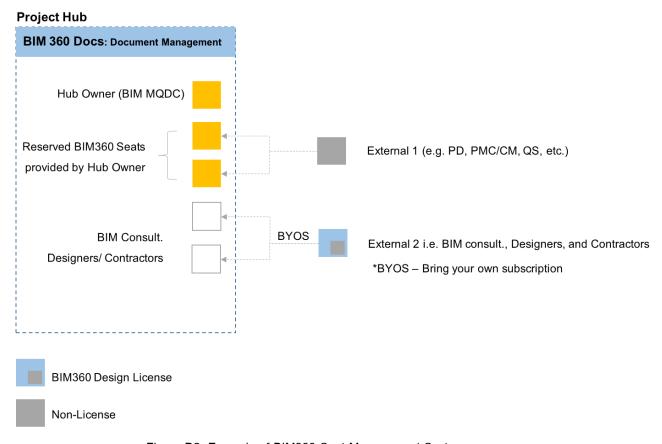


Figure D2: Example of BIM360 Seat Management System



### **D3: Unit Measurement**

The unit measurement of all project models shall be in the metric system with 2 decimal places. This shall be applied to all relevant file drawings and models embodying the 2D CAD linked file. The project unit can be set with regards to Table D.3

Table D.3: Project Unit

Туре	Unit	Example
Length	m	1.23 m
	mm	1235 mm
Area	m <sup>2</sup>	1235.00 m <sup>2</sup>
Volume	$m^3$	1235.00 m <sup>3</sup>
Angle	0	12.35°
Slope	0	12.35°
Mass Density	kg/m <sup>3</sup>	1234.57 kg/m <sup>3</sup>

# **SECTION E**

**Organizational Structure and Staffing** 



### **Section E: Organizational Structure**

### E1: Organizational Structure

This section demonstrates an organization chart to underline the relationships and hierarchy of all parties in the project and describe the roles of all stakeholders to clarify their responsibilities in the project. Moreover, the implementation of the project must follow the BIM Execution Plan (BEP) as the recommended standards. Each party should have skilled person who has an expertise in BIM use. Besides, it is their responsibility to complete the project deliverables. In response, each team shall have the staffs as follows:

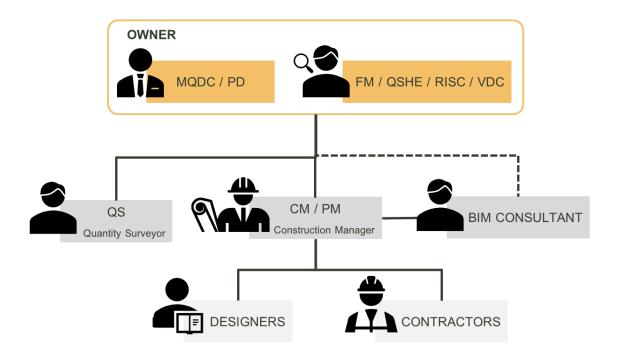


Figure E1.1: Organization Chart

Note – For dash line ———• , CM shall revise organization chart depending on project's contracts and argeeements.

### **E2: Role Descriptions**

Table E2: Role Descriptions

Project Member	Role Description
Owner / MQDC	A person who is responsible for setting goals and objectives.
PD	A person who is responsible for advising, review and approval design and construction process.
QSHE / RISC	A person who is responsible for QA/QC of design and construction process with regards to MQDC Standard.
VDC	A person who is responsible for advising and QA/QC for BIM process with regards to MQDC Standard.
QS	A person who is responsible for estimating cost of construction.
CM / PM	A person who is responsible for directing the project schedule, advising for construction review and planning for construction process.
BIM Consultant	A person who is responsible for BIM implementation and project coordination with regards to project's BIM uses.
Designers	A person who is responsible for creating the design and model with regards to the project standard and responsible for a request for information (RFI).
Contractors	A person who is responsible for correcting design package used for construction process together with collecting all relevant information for asset and facility management.



# **SECTION F**

**BIM Project Process** 

### **Section F: BIM Project Process**

### F1: BIM Master Workflow

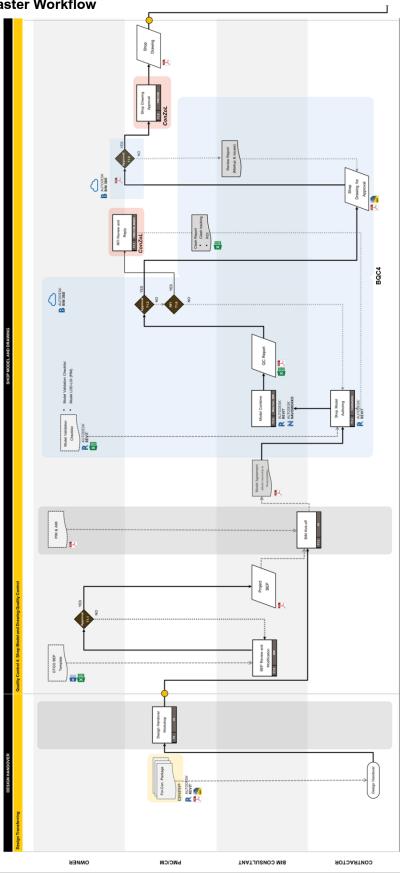


Figure F1.1: BIM Master Workflow for Construction Phase



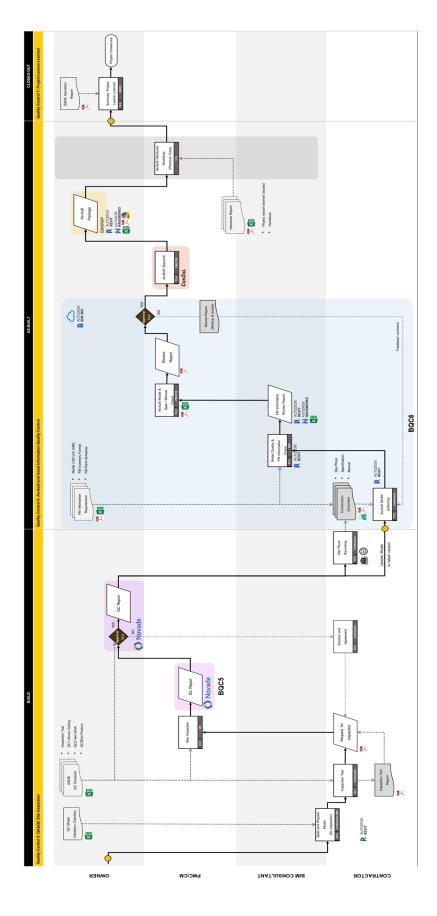


Figure F1.2: BIM Master Workflow for Construction Phase

Table F1.1: BIM Workflow for Construction Phase

Task No.	Activities	Description	Action By	Output					
Construc	Construction Phase								
T0 Desig	n Handover								
ТО	Design Handover Workshop	Arrange a workshop to allow clarification and	All (including	For-construction					
		discussion for design handover deliverables	designers)	package					
				Minutes of Meeting					
T1 Shop	Model and Drawing								
T1.0	BEP Revision & Modification	Modify DTGO BEP Template to create new Project	BIM Consult.	Project BEP					
		BEP.		(Construction)					
T1.1	Approval Project BEP	Review and approve Project BEP	Owner	Project BEP					
				(Construction)					
T1.2	BIM Kick-off	Arrange a meeting for BIM Kick-off to announce the	BIM Consult., CM/	Project Information					
		BIM execution plan and model standard in	PM, Owner	Model/ Model					
		Construction Phase.		Responsibilities					
T1.3	Shop Model Authoring	Develop a shop model to represent constructible	Contractors	Shop Models					
		building components corresponding to actual project							
		coordinates							



Task No.	Activities	Description	Action By	Output
T1.4	Model Combine	Review and combine models to allow clash detection	Main Contractor, BIM	QC Report,
		and visualization review and create QC Report, as	Consultant	ROI
		well as, initiate Clash Detection Report used for T1.5		
		Shop Model Approval		
T1.5	Shop Model Approval	Review and manage construction coordination issues	CM/ PM	
		and public clash report to allow further completion		
		shop drawing details.		
		If the model is rejected, responsible person must		
		revise and resubmit the model again.		
T1.6	RFI (Request for Information)	Should there be critical conflicts or subtle ambiguities	Contractor	RFI Document
		corresponding construction documents, contractors		
		shall submit RFI to allow providing clarification.		
T1.7	Review and Reply RFI	Review RFI and provide final queries answered.	CM/ PM, Owner,	RFI Respondance
			Designer	
T1.8	Shop Drawing Approval	Review and Approve Shop Drawing Package.	CM/ PM, Owner	Review Report
	(BIM360 Approval Workflow)	If the package is rejected, responsible person must		
		revise and resubmit the package again.		
T1.9	Shop Drawing Approval	Approved Shop Drawing (BIM360 Approval) will be	CM/ PM	
	(Conzol)	submitted to Conzol system for official approval		

Task No.	Activities	Description	Action By	Output
T2 Build				
T2.0	Build and Prepare Model (for inspection)	Prepare model Navisworks with saved viewpoint	BIM Consult.	QC Models and
		corresponding to RFS (Request for Inspection) to		Drawings
		facilitate site inspection for T2.1.		
T2.1	Inspection Test	In order to submit RFS (Request for Inspection), the	Contractors	Inspection Report
		construction qualification and equipment performance		
		must be inspected corresponding to QSHE Inspection		
		Test Checklist,		
T2.2	Site Inspection	Inspect construction quality regarding Section G3:	CM/ PM	QC Report
		QA&QC Site Inspection.		
T2.3	Site Inspection Approval	Approved construction quality.	Owner (QSHE)	
		If defects are detected, responsible person must		
		remedy the defects and resubmit the RFS.		
T2.4	Solution and Agreement	The detected defects shall be resolved regarding	Contractors	
		DTGO Quality Control Standard		
T2.5	Photo Recording	To ensure As-built drawing reliability, as-constructed	Contractors	Site Photos
		photos recording is required after each Site Inspection		
		Approval.		



Task No.	Activities	Description	Action By	Output			
T3 As-bu	T3 As-built						
T3.0	As-built Model Authoring	Develop As-built model to illustrate as-constructed	Contractors	As-built Models			
		component and add asset required data in					
		accordance with Section H1: Asset Information Model					
		(AIM) Input.					
T3.1	Model Quality & FM Information Check	Review As-built models and asset information	BIM Consult.	QC Report			
		according to Model LOD-LOI and Model Validation					
		Checklist the create QC Report used for T3.3 Approval					
T3.2	As-built Model & Spec./ Manual Check	Review As-built model and all relevant documents to	CM/ PM	QC Report			
		ensure data quality for asset management					
T3.3	As-built Approval	Review and Approve As-built Package.	CM/ PM	Review Report			
	(BIM360 Approval Workflow)	If the package is rejected, responsible person must					
		revise and resubmit the package again.					
T3.4	As-built Approval	Approved As-built Package (BIM360 Approval) will be	CM/ PM	As-built Package			
	(Conzol)	submitted to Conzol system for official approval					
T3.5	As-built Handover Workshop	Arrange a workshop to announce Asset Information	BIM Consult., CM/	Asset Information			
		Deliverables (refer to Section H2: Asset Information	PM, Owner	Deliverables			
		Deliverables) and clarify the usage.		Minutes of Meeting			

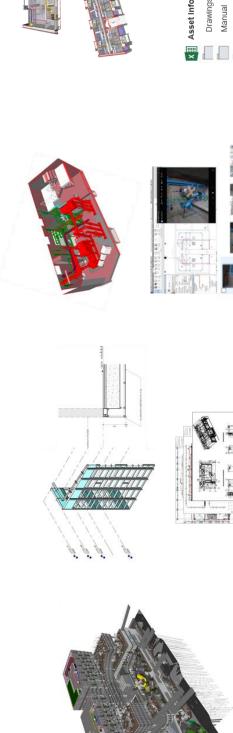
### DTGO BEP Construction Version 6.00

Task No.	Activities	Description	Action By	Output
T4 Closed	d-out			
T4.0	Summary Project Lesson Learned	Summarize project lesson learned to allow improving	Owner (QSHE), CM/	Project Lesson
		DTGO quality control standard throughout project life	PM, BIM Consults	Learned
		cycle		Minutes of Meeting



### **F2: Information Transmittal Milestone**

Information Transmittal Milestone represents the construction operating procedures of BIM between design handover and projected closed-out by combining all relevant disciplines consisting of architecture, structure, building services, landscape and interior design. This intends to reduce time spent on communication by gathering information delivery obligation from all relevant factors required for pursuing work. These result in the sequential submission as shown in Figure F2.1.



The as-built model shall captures the condition and relevant information at the end of the construction.

for fabrication and construction

coordination

model and be main tool used

design team that captures the

intended design

The design model with major clash free is delivered from

be developed from design

The construction model shall

Contractors shall submit the model as the authoritative source and a reference for the building as-constructed.

model with ZERO regulation

Contractors shall submit

necessary) e.g. installation

details, pre-fabrication

details, etc.

SHOP MODEL & DRAWING

Construction Details (as

and major clash free.

IILT





The asset information models (AIM) is derive from the as-built model where only information specified in the AIR is to be retained.

Contractors shall deliver asset information to facilitate the information process throughout the entire asset lifecycle.

OPERATION & MAINTENANCE

AS-BUILT

DESIGN HANDOVER

Figure F2.1: Example of Information Transmittal Milestone



### F2.1: Project Deliverables

According to the previous diagram, the project deliverables of the construction phase shall be allocated as follows;

Table F2.1.1: Project Deliverables

		Construction Phase				
		Design Handover	Shop	Construction (Build)	As-built (FM)	Closed-out
		- Design Handover	BQC4	BQC5	BQC6	BQC7
		Workshop	- Fabrication and	- QA&QC Site	- As-built Review	- Summary Project
		- BIM Kick-off	Construction	Inspection	- Model Validation	Lesson Learned
	Se		Coordination Review	- Model Validation	Check	- Evaluation and
	Activities		- Model Validation	Check (for Site	- Asset Information	Impact
	Ac		Check	Inspection)	Review	Assessment
			- 3D Coordination	- Site Photo	- Asset Information	
			- Return on	Recording	Handover	
			Investment (ROI)			
		- For-Construction	- All models	- All models as per	- All models as-	-
<u>e</u>		Model Package	(combined) with	Request for	constructed (As-built	
Model			<b>ZERO</b> regulation and	Inspection (RFS)	models)	
			major clash free.			
	les	- For-Con. Drawing	- Shop Drawing	- Request for	- As-built Drawing	-
Drawing	Deliverables	Package	- Installation Details	Inspection (RFS)	Package	
Δ	Deliv			Package		
		- Model Handover	- QC Report	- QC Site	- Manual and	- Evaluation and
nent		Report	- ROI	Inspection Report	Specification	Impact
Document			- Design Specification	- Site Photos	- FM Inventory List	Assessment
_						Report

Table F2.1.2: BIM Deliverables and Validation

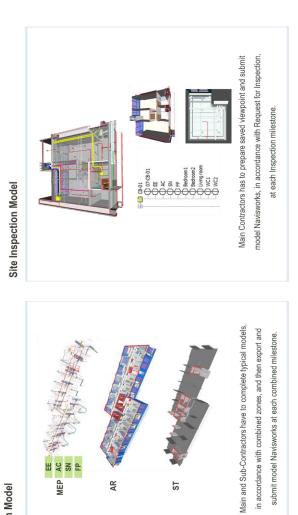
BIM Submittal Item	Stage	Approximate  Due Date	Format	Notes
Design Phase				
Architectural Model	EIA	-	.rvt/.nwc	
Structural Model	Tender		.rvt/.nwc	
MEP Model	render			
Interior Model				
Landscape Model	For-Con.		.rvt/.nwc	
Façade Model	FOI-COII.			
Automated Parking Model				
Room data sheets by				
Architect	Design		.xlsx	To include material
Area Summary (CFA, GFA,	Develop	-	.rvt	and area
NFA)				
QC Report	Every Stage	End of Stage		
Model Report	Every Stage	End of Stage	.pdf	
Clash Detection Report	Tender –	F	.pdf	
	For-Con.	Every month		
QTO Report	Tender	End of Tender	.pdf	
ROI Report	For-Con.	End of Pre-	.pdf	
		Construction		



### F2.2: Model Submission

BIM Deliverables during construction phase are distinguished regarding model uses, as shown in Figure 2.2

- 1. Clash Model 3D coordination and construction review require Navisworks models, including architectural, structural and MEP models representing each typical combined area/zone.
- 2. Site Inspection Model Main contractor shall provide .NWD combine models with saved viewpoints of request for inspection areas, to facilitate BIM utilization on site.
- 3. As-built Model After the As-built approval process all approved BIM deliverables package shall be combined into one single file by linking all typical linked model into main model before publishing and archive the package at the end of As-built stage. Additionally, contractors must separate and duplicate model element by level to complete the whole building and then export into Navisworks file format to submit at the end of Construction Phase.





(Combine All) Main Model

Linked Model (Typical)

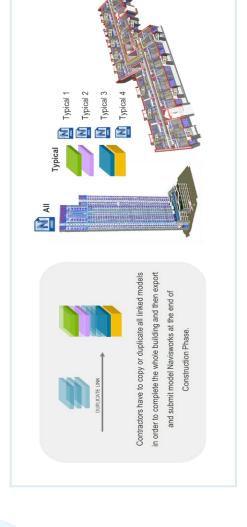


Figure F2.2 Model Submission

R AUTODESK' REVIT

Linked Model 1

Linked Model 2

Linked Model 3

Linked Model 4

Clash Model



### F3: Meeting Procedure

Table F3: Meeting Procedure

Project Stage - ช่วงการดำเนินงานโครงการ			
Shop Model & Drawing	As-built	Project Closed-out	
Once at the end of the			
design phase	-	-	
Discussion about For-Con.	-	-	
Package			
Designers, BIM Consult.,	-	-	
CM/ PM, Contractors and			
Owner Representative (PD			
and PM)			
Once before the project			
start	-	-	
BEP announcement and	-	-	
BIM model agreement			
Owner, Contractors, CM/	-	-	
PM, BIM Consult.			
Weekly	Weekly	-	
QC1: Review	QC3: Review Asset	-	
Construction, Clash/	Information		
Issues review			
QC2: Review QC Model			
Owner, Contractors, CM/	Owner, Contractors, CM/	-	
PM, BIM Consult.	PM, BIM Consult.		
	Once at the end of the design phase  Discussion about For-Con. Package  Designers, BIM Consult., CM/ PM, Contractors and Owner Representative (PD and PM)  Once before the project start  BEP announcement and BIM model agreement  Owner, Contractors, CM/ PM, BIM Consult.  Weekly  QC1: Review Construction, Clash/ Issues review QC2: Review QC Model  Owner, Contractors, CM/	Once at the end of the design phase  Discussion about For-Con. Package  Designers, BIM Consult., CM/ PM, Contractors and Owner Representative (PD and PM)  Once before the project start  BEP announcement and BIM model agreement  Owner, Contractors, CM/ PM, BIM Consult.  Weekly  QC1: Review Construction, Clash/ Issues review QC2: Review QC Model  Owner, Contractors, CM/	

Meeting Type –	Project Stage - ช่วงการดำเนินงานโครงการ					
ประเภทการประชุม	Shop Model & Drawing	As-built	Project Closed-out			
Monthly Meeting						
Frequency	Monthly	Monthly	-			
Objective	Track and report project	Track and report project	-			
	progress	progress				
Participant	Owner, QSHE, Designers,	Owner, QSHE, Designers,	-			
	CM/ PM, BIM Consult.	CM/ PM, BIM Consult.				
BIM Technical						
Support Meeting						
Frequency	As required	As required	As required			
Objective	Clarification and	Clarification and discussion	Clarification and			
	discussion BIM technical	BIM technical issues	discussion BIM technical			
	issues		issues			
Participant	BIM Consult., CM/ PM,	BIM Consult., CM/ PM,	BIM Consult., CM/ PM,			
	Contractor	Contractor	Contractor			
Asset Information						
Deliverables						
Handover						
Frequency		Prior to Asset Information				
	-	Handover	-			
Objective	-	Clarification of Asset	-			
		Information Deliverables				
Participant	-	BIM Consult., CM/ PM,	-			
		Owner				
Summary Project						
Lessen Learned						
Frequency	-	-	Once before project closed			
			-out			
Objective	-	-	Summarize and evaluate			
			project execution			
			throughout its life cycle to			
			improve organizational			
			quality control standard			
Participant	-	-	Owner			

**Note** - The schedule would be updated and confirmed by the owner.



# F3.1: BIM Kick-off

During the transition stage from design handover to construction phase, project stakeholders shall participate the two relevant workshops as follow;

- 1. Design Handover Workshop
- 2. Construction BIM Kick-off

The agendas of individual workshop is identified (but not limited to) in table F3.1.

Table F3.1: BIM Kick-off for Design Phase

	Agenda	Description	BEP reference	Key Person
1. D	esign Handover			
1.	.1. Model Structure	Clarify model structure to allow	-	BIM Consultant
		further developing of delivered		
		design models.		
1.	.2. Model Integrity	Clarify model integrity which	-	Designers
		facilitates contractors to strategize		
		one's model development plan.		
1.	.3. Coordination	Clarify the remaining coordination	-	CM/ PM
	Issues	issues as well as clash issues from		
		design phase for contractor		
		consideration.		
2. B	IM Kick-off (Construction	on Phase)		
2.	.1. BIM Goals and	BIM Goals and Objectives	Section C: Project Goals	BIM Consultant
	Objectives	BIM Uses	and BIM Uses	
2.	.2. Organization Chart	Roles and Responsibilities	Section E: Organizational	All
			Structure	
2.	.3. BIM Software	BIM Platform and Software	Section D: software	All
	Agreement	Version	Agreement	
		BIM360 Seats Policy		
2.	.4. Project Timeline &	<ul> <li>Project Deliverables</li> </ul>	Section F2: Design	All
	Deliverables	Model Submission	Milestone	
2.	.5. BIM Master	Shop Model & Drawing	Section F1: BIM Master	BIM Consultant
	Workflow and	QA/QC Site Inspection	Workflow	
	Construction	As-built		
	Timeline	Project Closed-out		

Agenda	Description	BEP reference	Key Person
2.6. Information	BIM360 Docs Folder	Section F4: Information	BIM Consultant
Management	Structure and Permission	Management	
	Information Exchange		
	Protocol		
	Shop drawing approval		
	process agreement		
	(Conzol/ Conzol + BIM360)		
2.7. Model	DTGO Naming Convention	Section F5: Model	All
Management	Model Structure	Management	
	Project Coordinates		
	Model Responsibilities		
2.8. Quality Control	Coordination Target &	Section G1: Quality	BIM Consultant
Check	Clash Zoning	Control and Section G2:	and CM/ PM
	Clash Workflow	Clash Detection Protocol	
	Clash Management		
	Clash Report and ROI		
	MQDC Top 20 Issues		
2.9. Asset Information	Asset Information	Section H: Asset	BIM Consultant
Requirement	Management	Information Management	
	FM Inventory Format		



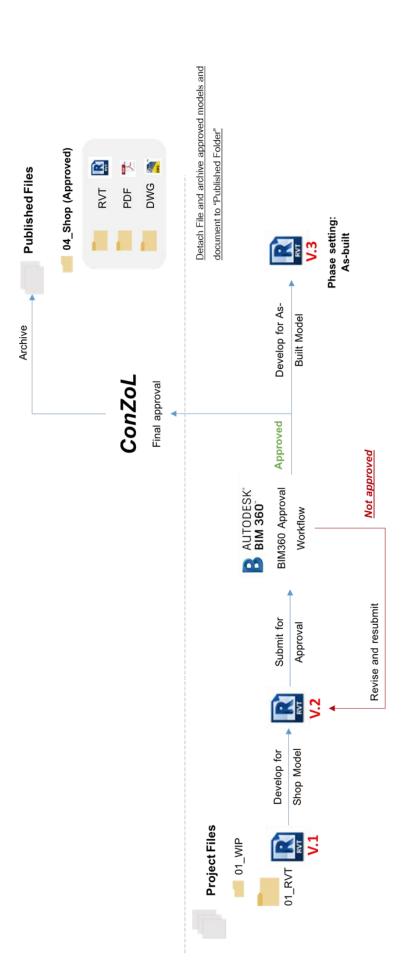


Figure F3.1: Example of Shop Drawing Approval Process

# F4: Information Management

# F4.1: Information Exchange

The diagram shown in figure 4.1 represents the project information management and information exchange which can be divided into 3 main parts, as follows:

- 1. **BIM360 Design** is Revit cloud worksharing used for model collaboration between the Revit program and the BIM360Docs platform.
- 2. **BIM360 Docs** is a cloud-based storage for the project information management. All project stakeholders shall use this central platform to collect, review, share, and publish the project information.
- 3. **CONZOL** is cloud-based project management system used as official document submission and approval platform throughout construction phase.
- 4. **NOVADE** is a field management software for construction quality, safety, and progress monitoring under QSHE authorization.
- 5. **QNAP** is the internal cloud-based storage used to archive and back-up the published design package of each stage. This allows only the team project owners.
- 6. Goodwill is the internal database used to collect BIM issues and ROI report after the project closed-out.

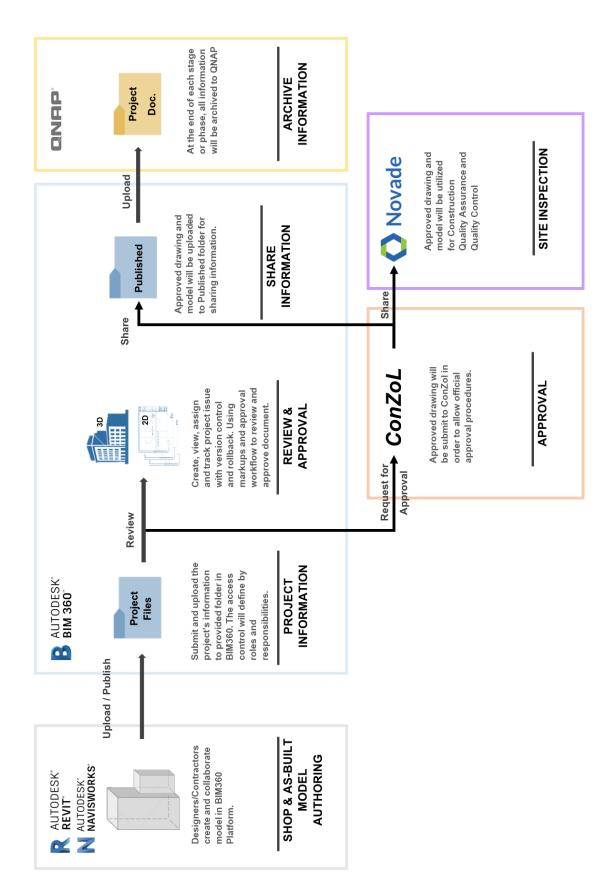


Figure F4.1: Information Exchange

#### F4.2: BIM 360 Docs Folder Structure

**BIM360 Docs** is the central platform used to collect and share all the project information since the design phase to the project closeout at the end of the construction phase. This can be divided into 2 main parts as follows:

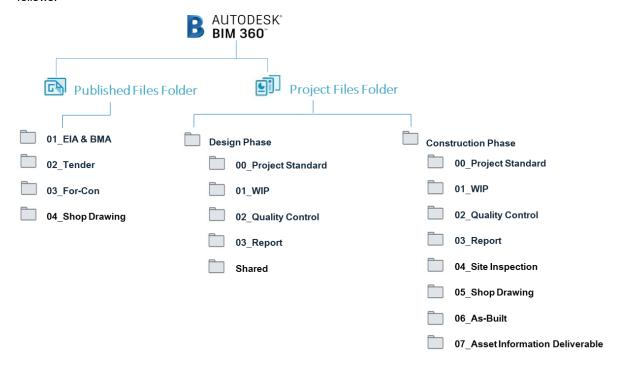


Figure F4.2.1: BIM 360 Docs Folder Structure

For the large project which consists of many multiple buildings, it is vital to create sub folder accorading to project name.



Figure F4.2.2: Folder Structure for the Large Project



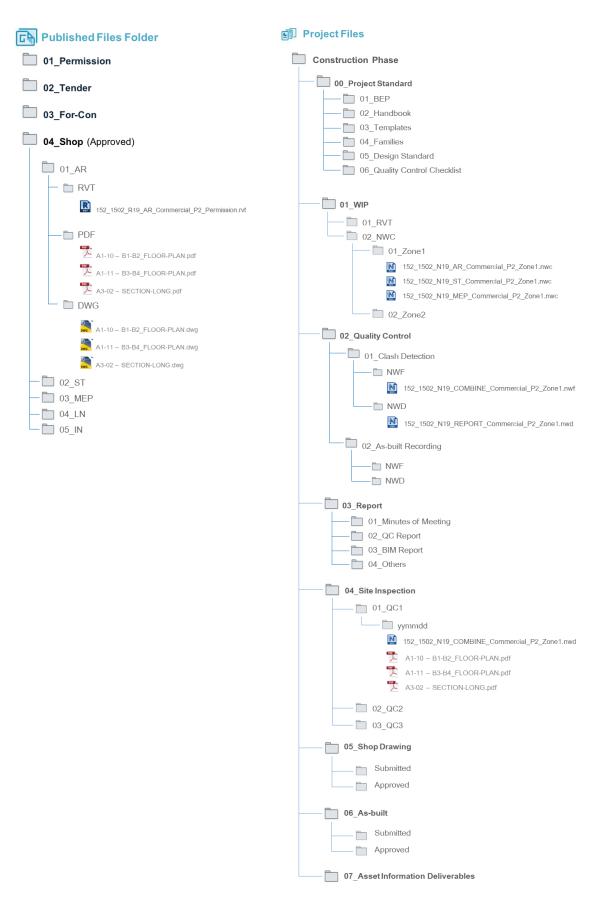


Figure F4.2.3: BIM 360 Docs Folder Structure

**Published Files Folder** is used for submitting an approved Drawing & Model Package according to the project deliverables and project schedule.

Table F4.2.1: Publish Files Folder

Folder Name	Sub-Folder	Sub-Folder	Description	Resp. Party
Published Files	Folder			
01_Permission			Published and shared document of EIA	PM/CM
			Package	
02_Tender			Published and shared document of Tender	PM/CM
			Package	
03_For-Con			Published and shared document of For-Con.	PM/CM
			Package	
04_Shop			Published and shared document of Shop	PM/CM
			Drawing & Model Package	
	01_AR	BIM Summary	BIM Summary Report	BIM Consult.
		01_RVT	3D Revit Model Package	PM/CM
		02_PDF	2D Drawing Package	PM/CM
		03_DWG	2D AutoCAD Files Drawing	PM/CM
	02_ST			
	03_MEP			



**Project Files Folder** is used for storing all relevant information in the project which includes model, drawing, and related document.

Table F4.2.2: Project Files Folder

Folder Nam	e Sub-Folde	er Sub-Folder	. Description	Resp. Party	
Project Files	Folder				
00_Project S	tandard				
	01_BEP		Project BEP and Appendix	All	
	02_Handb	ook	DTGO BIM Handbook	All	
	03_Templa	ate	DTGO Standard Template	Contractors, BIM	
				Consult.	
	04_Family		MQDC Family Standard	Contractors	
	05_Design	Standard	MQDC Design Standard	Designers	
	06_Quality	Control	BQC Checklist	PD, CM/ PM,	
	Checklist			Designers	
01_WIP			Work in Process files folder for designers		
	01_RVT	01_AR	Revit Model	Contractors	
		02_ST			
		03_MEP			
	02_NWC	01_Zone1	NWC Navisworks Model	Contractors	
		02_Zone2			
		03_Zone n			
02_Quality C	ontrol		Clash Detection and As-built model and report		
	01_Clash I	Detection	Clash Detection Report		
		01_NWF	NWF Navisworks Model used for Clash	BIM Consult.	
		02_NWD	NWD Navisworks Model Report	CM/ PM	
	02_As-bui	It Recording	As-built Model Report		
		01_NWF	NWF Navisworks Model used for As-built review	BIM Consult.	
		02_NWD	NWD Navisworks As-built Model Report	CM/ PM	

Folder Name	Sub-Folder Sub-Folder	Description	Resp. Party
03_Report		Project Report	
	01_Minutes of Meeting	Minutes of Meeting	CM/ PM, BIM
			Consult.
	02_QC Report	Quality Control Report	Contractors, CM/
			PM, BIM
			Consult.
	03_BIM Report	BIM Report	BIM Consult.
	04_Others	Other relevant information	BIM Consult.
04_Site Inspec	tion	Site Inspection model	
	01_QC1 Above Ceiling	Above ceiling recorded photos	Contractors, BIM
			Consult.
	02_QC2 Wet Work	Wet work recorded photos	Contractors, BIM
			Consult.
	03_QC3_End Product	End product recorded photos	Contractors, BIM
			Consult.
05_Shop Draw	ing	Shop Drawing Package submitted for approval	
	Submitted	Submitted shop drawing	Contractors
	Approved	Approved shop drawing	CM/ PM
06_As-built		As-built Drawing Package submitted for approval	
	Submitted	Submitted As-built drawing	Contractors
	Approved	Approved As-built drawing	CM/ PM
07_Asset Infor	mation Deliverables	Asset Information Deliverables Package	

# F4.3: Design Collaboration

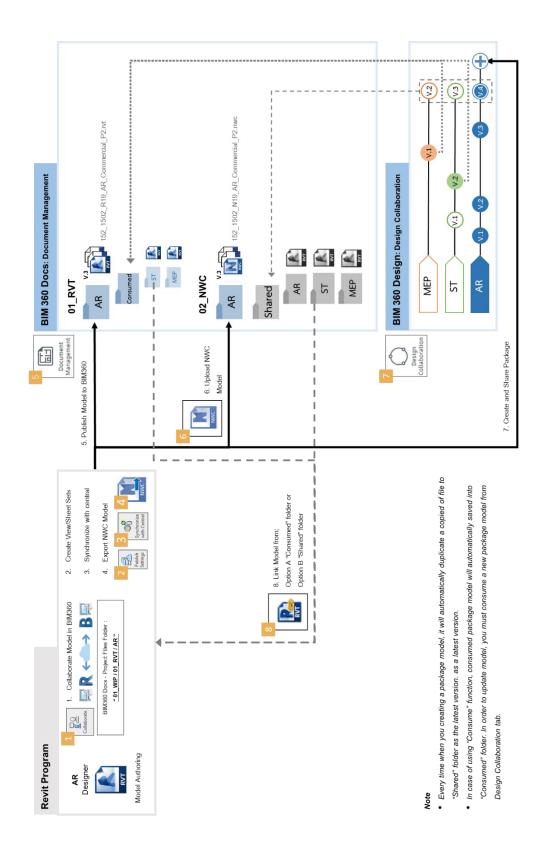


Figure F4.3: Model Collaboration

This section shall describe the steps of the design collaboration through the use of BIM360 Design and BIM360 Docs as follows:

Table F4.3.1: Design Collaboration Process

Task No.	Activities	Description
1	Collaborate Model	Collaborate model from a local server into BIM360Docs via
		could server of the Revit program.
2	View/Sheet Sets	Create View/Sheet sets according to the project deliverables.
		This shall include both 2D sheets and 3D view.
3	Synchronize to Central	Relinquish and synchronize model to update model central via
		Revit Could Worksharing.
4	Export NWC Model	Export NWC Navisworks model for the clash detection process
5	Publish RVT Model	Publish model to update and submit a model to BIM360Docs
6	Upload NWC Model	Upload exported NWC model to folder "02_NWC"
7	Create & Share Package	Create and share a package model in the Design Collaboration
		window.
8	Link Model	Model coordination can be done by these 2 methods as follows
		1. Link Live – selecting live model from folder "Shared"
		2. Link Non-Live – selecting model package from folder
		"Consumed".



### F4.4: BIM360 Docs Approval Workflow

During Construction Phase, shop and As-builts are essentially required reviewed in BIM360 Docs system, i.e., BIM360 Docs Approval Workflow. The official approval will be proceeded in Conzol system, once the status of submitted drawings in BIM360 Docs is changed to approved. BIM360 Docs Approval Workflow allows creating single source cloud-based review processes for the project, which reviews, markups and issues on document or set of documents can be archived and called out anytime on the platform.

The drawing approval processes (figure F4.4) include the following steps;

- Contractors must submit drawings for approval in both platforms, BIM360 Docs and Conzole, once at the time.
- · The processes of review and comment are manipulated via BIM360 Docs Approval Workflow.
- Once the BIM360 Docs review procedure is completed, only documents with the status "Approved" will be officially approved in Conzol system and allowed futher construction steps.

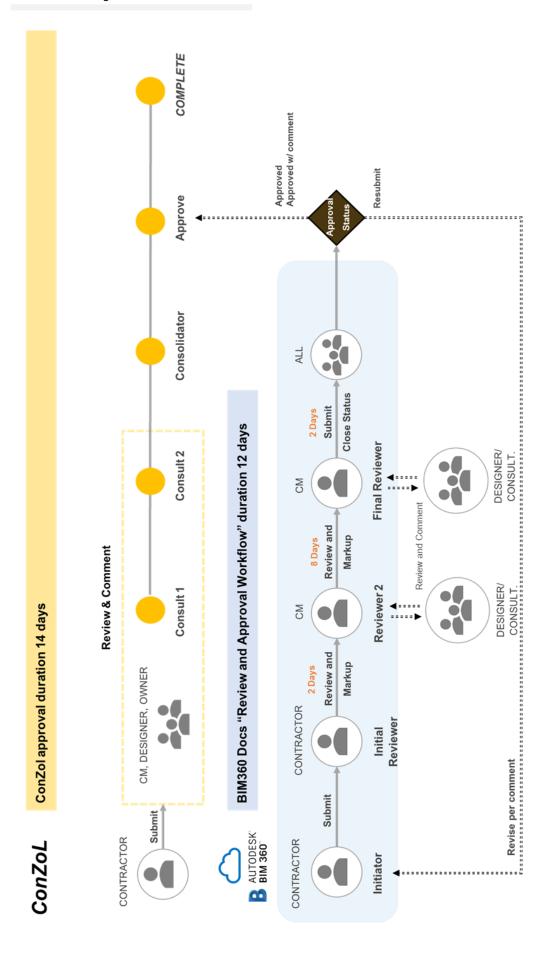


Figure F4.4: BIM360 Approval Workflow



# D4.5: BIM360 Issue Workflow

2D & 3D markups with thumbnail views, notifications, and open/close workflows in BIM360Docs shall be used to create, view, assign and track project issues for the exchange information requirement. The process shall be followed instruction in Figure F4.5 and more details can be found in <a href="BIM Handbook">BIM Handbook</a> – Section 1: BIM360

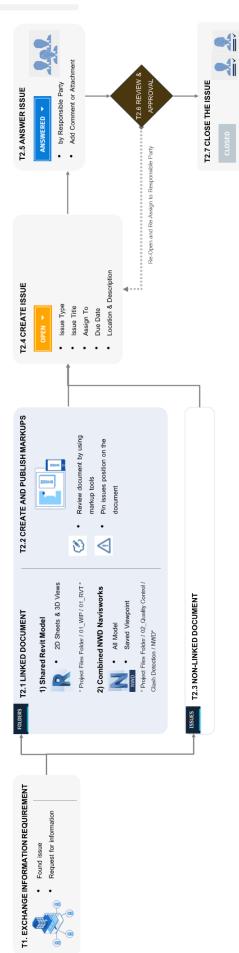


Figure F4.5: BIM360 Issues Workflow

by Issue Creator or Authorized Person



# F4.6: QNAP Folder Structure

**QNAP** is the project's owner central platform to archive and backup the project's information by Owner. The Project's data and deliverables will be uploaded into the appropriate folders with regards to project deliverables.

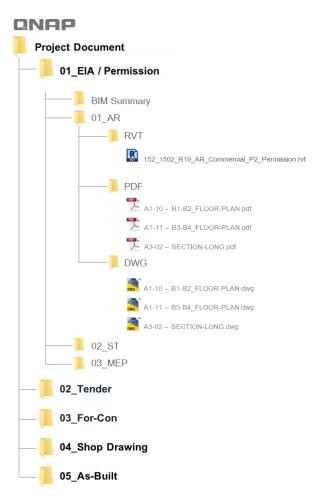


Figure F4.6.1: Example of QNAP Folder Structure

For the large project which consists of many multiple buildings, it is vital to create sub folder according to project name.



Figure F4.6.2: Folder Structure for the Large Project

# F5: Model Management

# F5.1: Model File Type



Figure F5.1: Model file type

File Type	Description
.RFA	Revit Loadable Family File
.RVT / .RTE	DTGO Standard & Schedule Template File. This shall be used as a reference
	template for creating model in Revit.
.NWC	Model cache file which is exported from Revit. This shall be combined in
	Navisworks for 3D Coordination.
.NWF	All cache models shall be attended to create Navisworks File Set. This working file
	is used for visual check and clash check.
.NWD	Navisworks Document File is known as publishing a Navisworks file where all
	loaded models are all saved to a single file. This shall include information of clash
	report and saved viewpoint.



#### F5.2: Model Structure

To avoid large file size which is difficult to manage and revise, modelers are encouraged to:

- Create a Grid & Level file separately to be a reference for all modelers. This Grid & Level file shall have the correct coordination, so the modeler can Copy Monitor grid lines and levels as well as Acquire Coordinate from this file.
- · Create a model in the correct level using Grid & Level file as the reference.
- Divide the model into different parts to be compiled in a separate file. However, try to avoid links within links. Each party shall identify model structure description while submit the model

Example of the linked model structure report can be found in Appendix Q3.1: Model Management

#### **COORDINATED MODEL**

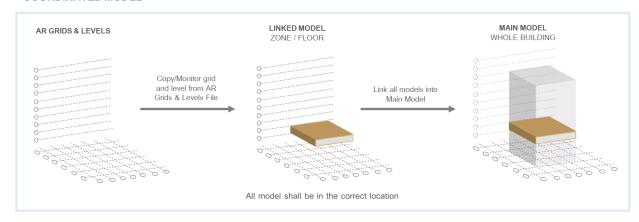


Figure F5.2.1: Project Coordinates

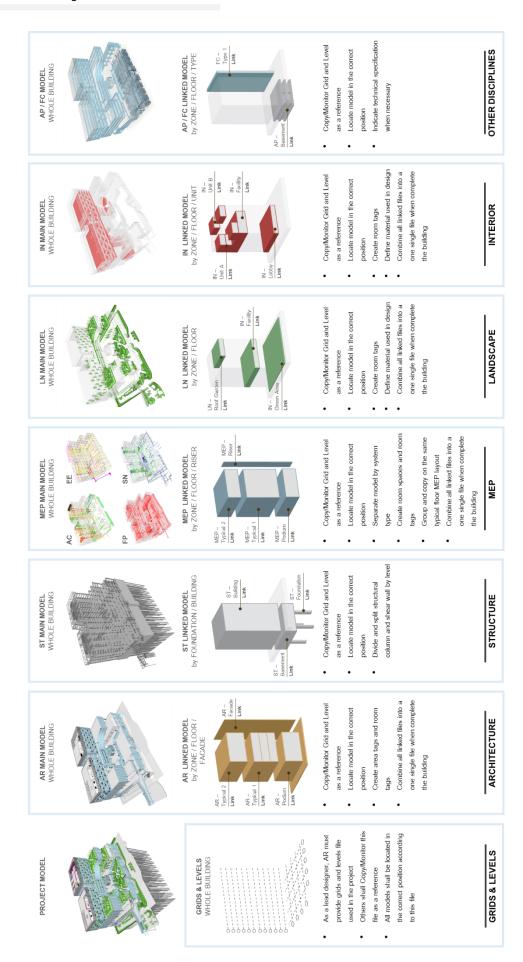


Figure F5.2.2: Example of Model Structure Concept



# 5.2.1 Project Coordinates

Coordinate System in Revit compiles of these 2 main points:

- · Survey Point Represents a known point in the physical world such as a geodetic survey marker.
- · Project Base Point Represents a position of the building/design element on the site project.

These points relate to each other since the survey point is the common point used for all buildings within the project while the project base point used to identify the location and orientation of each building based on the project's survey point.

In the construction phase, the main contactor has to set up project coordination of the Grids & Levels file. This shall include a survey point and project base point at the gridline A-1 or as agreed. With regard to this, all project models shall acquire the project coordination from this file model. On the contrary, for the project with multiple buildings, each building shall acquire the project base point from the master layout.

Example of the project coordination report can be found in Appendix Q3: - Model Management.

The master layout or site layout shall include the following

- · Project Gridlines
- · Site Boundary includes adjacent property lines, town subdivision, parking areas, ingress & egress to the site

Building Boundary and A-1 Gridlines illustrate building outline and orientation aligned to real-world coordinates at Gridlines A-1 each subdivision.

Table F5.2.1: Project Coordinates

Project Coordinates	N/S	E/W	Elevation	Angle to True North	Gridline	Level
Design Phase						
Single Building - โคร	งการเดี่ยว					
Survey Point	0.00	0.00	0.00	-	-	-
Project Base Point	0.00	0.00	0.00	0.00	A-1	-
Multiple Building - กล	งุ่มอาคาร					
Survey Point	0.00	0.00	0.00	-	-	-
Project Base Point	*Refer to	*Refer to	*Refer to	*Refer to	A-1	-
	Master	Master	Master	Master		
	Layout	Layout	Layout	Layout		

Note - The Survey Point (SP) and Project Base Point (PBP) are required modification according to actual value measured on site.

**Single Building** – All designers shall acquire project coordination from Grids & Levels file which has been set the coordination by AR Designer

**Multiple Building** – Each Grids & Levels file of isolated building shall acquire project coordination from master model with regards to master layout plan.

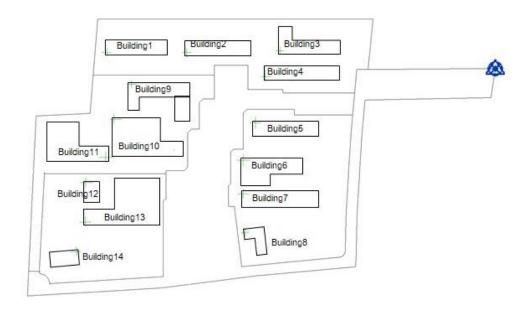
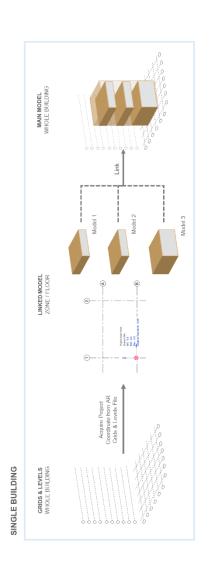


Figure 5.2.1.1: Example of Project's Master Layout





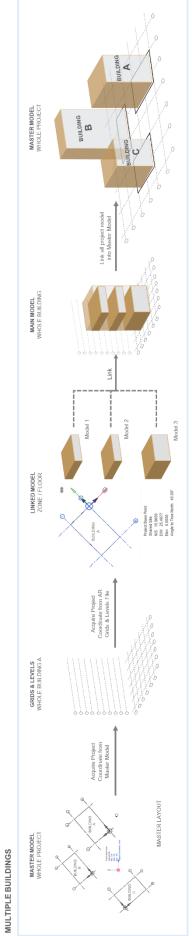


Figure 5.2.1.2: Example of Survey Point and Project Base Point Setup

# 5.2.2 Workset Management

Workset management largely benefits the following procedures:

- 1. Facilitates visibility control of components and any further model revisions.
- 2. Controls edibility in each workset, subject to the management. However, all worksets shall be relinquished before submission for the next responsible parties to revise.

Workset Management can be found in Appendix Q3.2: Workset Management

Table 5.2.2: Example of model workset management

Workset Color – สีของ Workset	Workset Name – ชื่อ Workset	Type of work in Architectural and Structural Model – หมวดประเภทของงานสถาปัตยกรรมและงานโครงสร้าง
(128,128,128)	Level and Grids	Shared Grid & Level
(124,51,132)	Workset1	Default
(144,0,25)	Structure	Column, Floor Slab, Core Elevator, Shear wall and Stair
(0,0,255)	Facade	Façade and Envelope
(0,128,0)	Sitework	Other external building elements such as paving
(148, 128, 48)	Landscape	Landscape Works
(255,128,0)	Interior	Interior Works



# F5.3: Model Responsibility

This section shall describe the state of being an owner of model elements, also known as Model Ownership. This shall allocate roles and responsible parties for those who needs to provide, create, or use those information model. Moreover, this section shall assign ownership of elements within a model to avoid ambiguity when the information model being unclear.

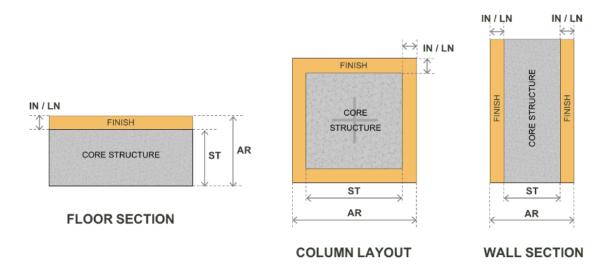


Figure F5.3.1: Example of Model Responsibility

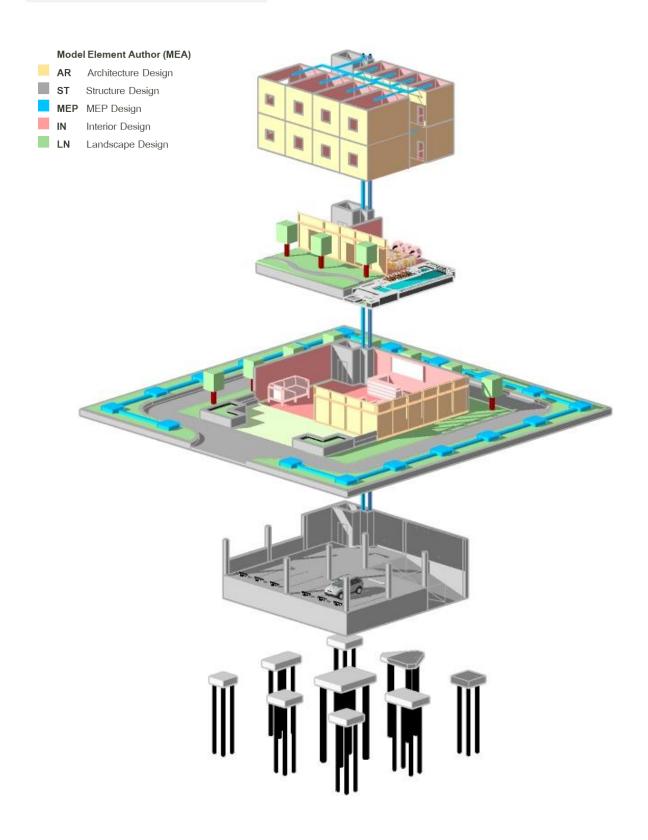


Figure F5.3.2: Example of Model Element Author



Table F5.3: Model Ownership

Model Ownership M : Model Owner ผู้รับผิดชอบโมเดล Info. : Information ผู้ให้ข้อมูลสนับสนุน

							Info.	: Information	ผู้ให้ข้อมูลสนับ	สนุน
	ď					AREA / ZONE				
Model Elements	Model Ownership	Façade, Building Shell	General Area, Back of House	Corridoor, Lobby, Lift Lobby, Facility Area	Unit Room, Rental Area	Swimming Pool, Roof Garden, Outdoor Area,	Site, Front of House	Site, Back of House	Parking	MEP Room, Machine Room
Architectural Wall, Floor Finish, Ceiling, Railing	M Info.	-	AR	IN	IN	LN	LN	AR	AR	AR
Door, Window, Opening	M Info.	FC AR	AR	IN	IN	LN	LN	AR	AR	AR
Grille, Louver	M Info.	FC MEP	MEP	MEP	MEP	MEP	MEP	MEP	MEP	MEP
Area Boundary, Layout	M Info.	-	AR	AR	AR	LN AR	LN AR	AR	AR	AR MEP
Room Boundary, Room Space	M Info.	-	AR	AR IN	AR IN	LN AR	LN AR	AR	AR	AR MEP
Road Surface	M Info.	-	-	-	-	-	AR	AR	-	-
Water Tank, Retention Pond	M Info.	-	-	-	-	-	-	ST MEP	-	-
Power Outlet, Switch, Plug, Lighting Fixture	M Info.	-	MEP	IN	IN	LN	LN	AR	MEP	MEP
Plumbing Fixture, Sanitary Ware	M Info.	'	AR	AR	IN	LN	LN	AR	AR	-
FHC, Extinguisher	M Info.	-	MEP AR	MEP AR	-	-	1	-	MEP AR	MEP
Fire Alarm System, Smoke & Heat Detector	M Info.	-	MEP	MEP IN	IN MEP	-	-	-	MEP	MEP
Air Terminal, FCU, AHU, CDU	M Info.	-	MEP	MEP IN	IN MEP	-	-	-	-	MEP
Constructed Concrete Planter	M Info.	-	-	-	-	ST LN	ST LN	-	-	-

# F 5.3.1: Asset Information Model Clarification

Regarding DTGO Asset Information Requirement (AIR), some assets are separately assigned modeling and information specifying to two different responsible parties. In order to satisfy asset manager and allow practically utilizing Revit FM Schedule Template (refer to Section H1: Asset Information Model (AIM) Input), the asset information shall be managed as follow (table F5.3.1)

Table F5.3.1: Example of Asset Information Model (AIM) Responsibilities

Item	Ownershi	ip	Remark
1. Fire Alarm			
1.1 Fire Exist Door	Model	AR	Architectural modelers must identify asset parameters, i.e.,  System and Item of fire exist doors. The asset information  will be specified by MEP modelers using FM Revit Schedule
	Info.	MEP	Template by linking AR models.
2. Access Control			
2.1 Magnet Lock	Model	AR	Architectural modelers must identify asset parameters, i.e.,  System and Item of doors with magnet lock. The asset
	Info.	MEP	information will be specified by MEP modelers using FM
2.2 Gate Barrier	Model	AR/LA	Architectural modelers to identify asset parameters, i.e.,  System and Item of gate barriers. The asset information will
	Info.	MEP	be specified by MEP modelers using FM Revit Schedule Template by linking AR models.
3. Tank	Structure		Structural Tanks, e.g., septic tanks, aeration tanks, sludge tanks, surge tanks, etc.
e.g. Septic Tank, Aeration Tank,	Model	MEP	MEP modelers to create a generic placeholder form in Plumbing Fixtures category, representing tanks, to identify
Sludge Tank, Surge Tank, etc.	Info.	MEP	the specification and orientation of the tanks. The models shall be precisely placed at the structural tank location.
4. Lift	Structure		
	Model	MEP	MEP modelers to create a generic placeholder form in Mechanical Equipment category, representing lift machines,
	Info.	MEP	to identify the specification and orientation of the machines.  The models shall be precisely placed at the core wall lift location.
5. Others	2D Inform	ation	Assets provided by suppliers, e.g., swimming pool system, etc.
	Model	MEP	MEP modelers to create a generic placeholder form in suitable category, i.e, Mechanical Equipment or Plumbing
	Info.	MEP	Fixtures, to identify the specification and orientation of the equipment. The models shall be precisely placed within the provided areas.

Note The details of Asset List and Asset Naming Convention can be found in Appendix Q6.1:FM Inventory Format Attachment.



# F5.4: MQDC Family Standard

With regards to the basics of the MQDC standard, responsible parties shall consider and apply MQDC Family Standard to create the project model. The model elements shall be allocated based on the model category mentioned in Model LOD-LOI. In response, the model standard and template can download from the folder "00\_Project Standard" on BIM360Docs. For further information please see <u>BIM Handbook Section 2.1: MQDC Family Standard</u>

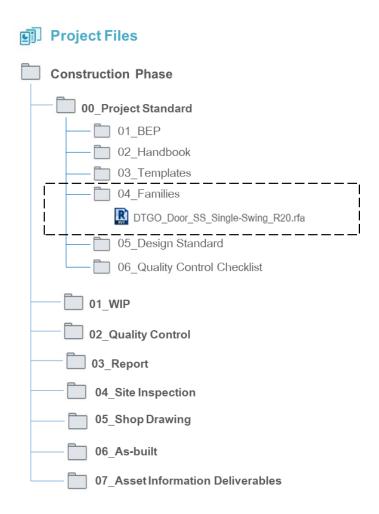


Figure F5.4: MQDC Family Standard File Folder

# F5.5: Naming Conventions

Naming Conventions aim to create understanding between parties through naming and data management. It consists of two main conventions; File Naming and Family and Type Naming.

# 1. File Naming

### **Discipline Abbreviations**

Abbreviations	Disciplines	
AR	Architecture	
ST	Structure	
MEP	Mechanical	
AC	Air Conditioning System	
EE	Electrical System	
FP	Fire Protection System	
SN	Sanitary System	
IN	Interior	
LN	Landscape	
AP	Auto-Parking	
FC	Facade	

# **Example of Revit Model**

```
XXX-XXXX_ProjectXX_AR_Prodium_V20.rvt
```

# Example of Navisworks Model

```
XXX-XXXX_ProjectXX_AR_Prodium_V20.nwc
XXX-XXXX_ProjectXX_Combine_V20.nwf
XXX-XXXX_ProjectXX_Report_V20.nwd
```

- Project Code: Project number providing by the owner.
- · Project Code: Project name providing by the owner.
- Discipline: 2 letter abbreviations for design discipline.
- **Zone**: Additional detail to specify floor level or zoning as appropriate. "\_": Using the symbol underscore or underline in the sentence instead of pressing the spacebar.
- Software Version: Software code name and its version such as Version 2020 is V20 or Version 2021 is V21



### 2. Family Naming

<Publisher>\_<Category Code>\_<Sub-Category Code>\_<Description>

# Example of Revit Family Name

MQDC\_Door\_SS\_Single-Swing\_R20.rfa

DTDESIGN\_Door\_SS\_Flat-Panel-with-Handle.rfa.

- · Publisher: Designer name or model maker
- Category Code: The Revit category name without "s" at the end and instead of pressing the spacebar, it requires using the symbol dash "-" to separate words.
- Sub-Category Code: Please refer to the standard acronym list in BIM Handbook Section 2.1: MQDC Family Standard
- **Description** (If any): Additional description and detail of the model element. To press the spacebar, it requires to use the symbol dash "-" to separate words.

# 3. Type Naming

<Type Mark>\_<Function>\_<Function>\_<Type>\_<Type Description>

#### Example of Type Name

ID01\_EN\_900x2400\_Digital-Door-Lock
D04\_CO\_LOBBY\_2100x2200

- · Type Mark: Material and model type mark
- Function (If any): The area or zoning code of the model, please refer to the standard acronym list in Appendix: Family and Type Naming Convention.
- · Function Description (If any): Additional description and detail of the model function.
- · Type: Type or sizing of the model.
- Type Description (If any): Additional description and detail of the type. To press the spacebar, it requires to use the symbol dash "-" to separate words

#### F5.6: DTGO LOD-LOI

For thorough modeling, both physical and information of elements, to serve design and construction goals, DTGO specifies the model's detailed requirements with designated responsible parties. The requirements are divided into:

- · Level of Details (LOD) physical details i.e. shape and size.
- · Level of Information (LOI) information details of the elements that cannot be seen in the physical model.

  More details of DTGO Model LOD-LOI can download from Appendix Q3.3: DTGO Model LOD-LOI

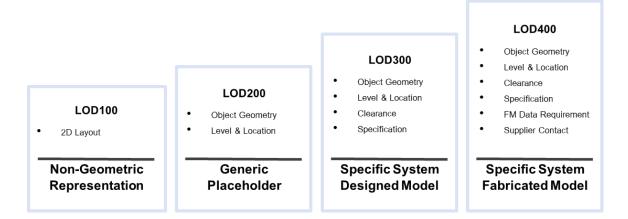
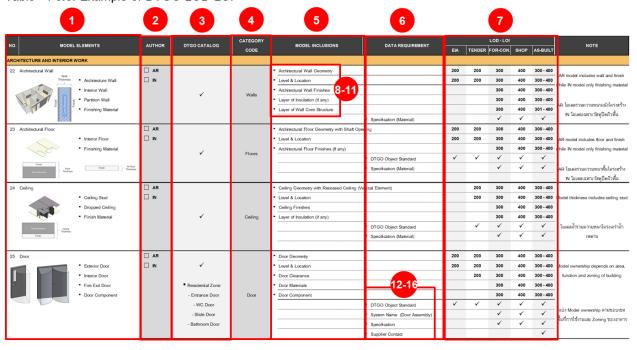


Figure F5.6: Model LOD Definition



Table F5.6: Example of DTGO LOD-LOI



No.	Keyword	Description
1	Model Elements	Model Element Lists
2	Author	Model Element Author
3	DTGO Catalog	DTGO Standard family used to create each element
4	Category Code	Category Code used to create each element
5	Model Inclusion	Model Inclusion
6	Data Requirement	Non-BIM Information
7	LOD-LOI	Level of Model LOD-LOI
8	Model Geometry	Model Sizing and Dimension
9	Level & Location	Model Area, Room, or Zone
10	Model Finish	Model and Material Finishing
11	Model Clearance	Model Clearance
12	DTGO Object Standard	Refer to DTGO Standard Family
13	Specification	Detail of Design Specification
14	System Name	Detail of System Name
15	FM Data Requirement	FM Data Requirement
16	Supplier Contact	Detail of Supplier Contact

#### F5.7: Model Exclusions

Not all elements are required to be modeled as each project has different goals. In this case, the elements that can exclude are as follows:

• Any elements detailed to a scale lower than 1:50 will be drawn in 2D drafting with/without cross-referencing from the actual Revit model.

Unless specifically instructed to do so, level 5 assets are not to be included in the models. If the modeler is unsure into what category level an asset belongs to, confirmation should be sought from the BIM Manager responsible for that model. All assets in category levels 1 - 4 to be included. See the table below for asset-level definitions.

Table F5.7: Level of Asset for Model Exclusions

Asset Level	Description – คำอธิบาย	Examples – ตัวอย่าง
1	Total Built Asset	Project Site
2	Individual Buildings	Tower, External Services, Driveway, Drop-off, Landscape,
		etc.
3	Systems	Ventilation Systems, Façade Systems, Structural System
		(Core wall, Slabs, Columns)
4	Systems Components	FCU's, Ducts, Windows, Window Frames, Core wall, Slabs,
		Columns
5	Sub-Components	Hangers/Unistrut, Brackets, Handles, Door Hardware, Rebar



# **SECTION G**

**Quality Control Check** 

# **Section G: Quality Control Check**

## **G1: Quality Control**

The quality check procedure aims to ensure the basic of the design and model management with regards to the project's BEP. This shall focus on 2 parts as follows;

- 1. QC Checklist is used in review and approval process of the project's design and model standards.
- 2. Clash Detection is the process of finding any conflict between element in the 3D model.

Table G1: QC Checklist

	Construction Phase									
	Shop Model and Drawing	Build	As-Built							
	BQC4	BQC5	BQC6							
st	- Model Validation	- Model LOD-LOI	- Model Validation							
Checklist	- Model LOD-LOI	- QC Model Validation for Site	- Model LOD-LOI							
ਠਂ	- Shop Drawing Protocol	Inspection	- Asset Information Transmittal							

The checklist can be downloaded from BIM360 Docs from folder "00\_Project Standard"

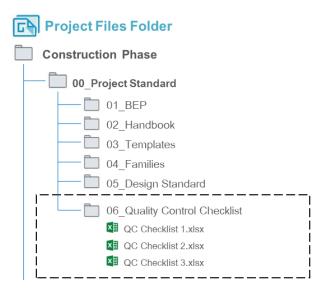


Figure G1: QC Checklist File Folder



## **G1.1: Model Validation Check**

Model quality check largely affects model transfer. The model's completeness, accuracy, and connection of information reduce interferences caused by modeling errors. This allows the next responsible parties to handle the model to proceed immediately.

Quality check procedure shall use Model Validation Checklist in Appendix Q4: Quality Control

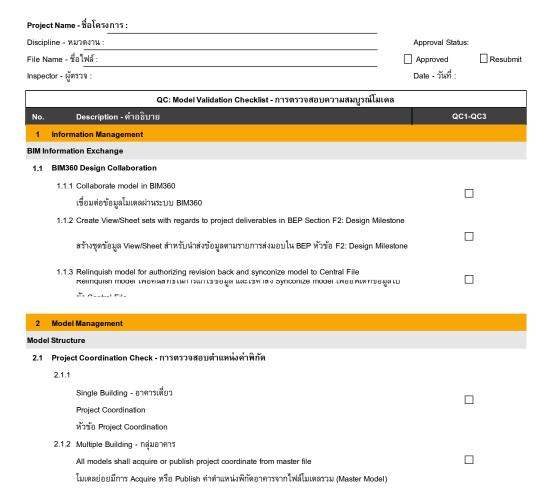


Figure G1.1: Example of Model Validation Checklist

**Note** - This checklist only covers information of the model accuracy but does not cover design validation. Thus construction manager shall validate the design through the model, in addition to the model check.

#### G1.2: Model LOD-LOI Check

It is vital to ensure the level of detail and information of the model, according to the LOD-LOI standard of DTGO, to accomplish the project goals in each stage.

The details of the LOD-LOI checklist can download from Appendix Q3.3: DTGO Model LOD-LOI

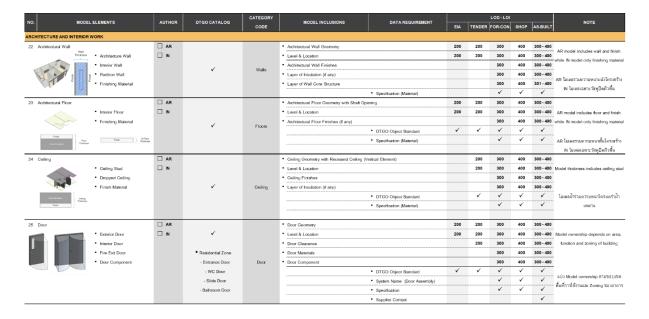


Figure G1.3: Example of Model LOD-LOI Checklist

**Note** - This checklist only covers the level of detail and information of the model but does not cover design validation. Thus, the construction manager shall validate the design through the model, in addition to the model check.



### **G1.3: Shop Drawing Protocol**

Shop drawings generated in terms of Revit Sheeting enhance preventing discrepancies between drawings by referencing single source information, i.e., model. However, some drawing details can be omitted (refer to Appendix Q4: Quality Control), considering to BIM vital benefits and time consumption.

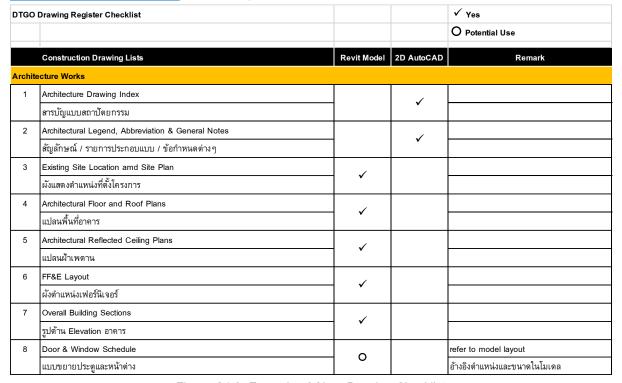


Figure G1.3: Example of Shop Drawing Checklist

## G1.4: QC Model Validation Checklist for Site Inspection

Contractors are expected to effectively utilize BIM as part of site inspection. Approved Shop models shall be prepared according to DTGO QA/QC Standard specified in QC Model Validation Checklist as shown in figure G1.4. In order to ensure model accuracy modified as constructed with acceptable tolerance.

The QC Model Validation Checklist can be downloaded from Appendix Q4: Quality Control.

รายก	ารตรวจสอบความสมบูรณ์ของโมเดลสำหรับตรวจคุณภางานก่อสร้าง - QC Model Validation Chec	cklist)			
Projec	t Name - ชื่อโครงการ :				
Discip	ine - หมวดงาน :		Approval St	atus:	
File N	ame - ชื่อไฟล์ :		Approved		Resubmit
Inspec	tor - ผู้ตรวจ :		Date - วันที่	:	
	☐ QC1 Above Ceiling ☐ QC2 Wet Work ☐ QC3 End Product ☐ As-built				
No.	Description - คำอธิบาย	S ite	e Inspecti	o n	
		QC1	QC2	QC3	As-built
1	Model Management - การจัดการโมเดล (for check)				
Model	Integrity - ตรวจสอบความสมบูรณ์ขององค์ประกอบโมเดล				
1.1	Building Services: Review and correct the connection of pipework and ductwork				
	<b>งาน</b> ระบบ: ตรวจสอบความสมบูรณ์การเชื่อมต่อของท่อ				
	Building Services: Review and correct slope of pipework				
	งานระบบ: ตรวจสอบความถูกต้องของความชั้น (Slope) ท่อ				
1.3	Review and correct model included all the required elements mentioned in Model LOD-LOI				
	ตรวจสอบความครบถ้วนของข้อมูลรายการและขนาดองค์ประกอบ ตามขอบเขตการสร้างโมเดล (อ้างอิงจาก BEP				
	Section G1.2: LOD-LOI check)				
1.4	Review required model elements and information as specified Model LOD-LOI (refer to BEP Section				
	ตรวจสอบความถูกต้อง/ครบถ้วนของข้อมูลตามมาตรฐาน (อ้างอิงจาก BEP Section G1.2: LOD-LOI check)				
1.5	Model elements are in the correct Workset according to BEP Section F5.2: Workset Management				
	องค์ประกอบโมเดลต่างๆ อยู่ใน Workset ถูกต้องตามมาตรฐาน อ้างอิงจาก BEP Section F5.2: Workset				
	Management				

Figure G1.4 Example of QA Model Validation Checklist

### **G2: Clash Detection Protocol**

#### **G2.1: Clash Detection**

Clash Detection is the process of finding any conflicting, overlapping, or interference between elements in the 3D space to identify any design errors before the actual construction. This process reduces risk associate with CO/VO using 3D model simulation to discover the overlapping rather than 2D imagination. It increases the efficiency and accuracy of the process but requires the model's precision.

Clash Detection Protocol explains the process in the Navisworks program to detect any clashes in the model and how to deal with them as well as explains data management and record after the detections. These record data could be used to enhance the design process and facility management. Detail of how to archive the process is in BIM Handbook – Section3: Clash Management

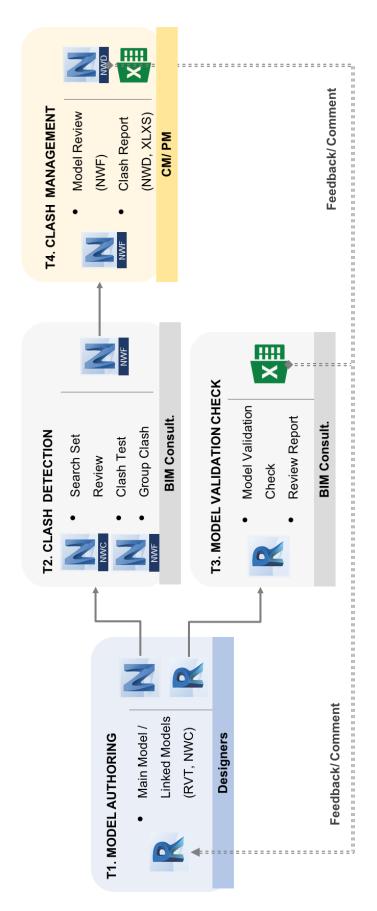


Figure G2.2.1: Clash Workflow

Table G2.2: Clash Responsibility

Task No.	Activities	Description	Action By
T1	Model Authoring	<ul> <li>Create Model</li> <li>Internal Clash Detection</li> <li>Provide NWC Model for Clash Detection</li> <li>Revise model as per clash issues or design changes</li> </ul>	Designers / Contractors
T2	Clash Detection ตรวจสอบ Clash	<ul> <li>Recheck NWC Model, Search Sets and update Clash Tests</li> <li>Prepare NWF Model for grouping and running clash</li> </ul>	BIM Consult.
Т3	Model Validation Check ตรวจสอบความ สมบูรณ์โมเดล	<ul> <li>Review RVT Model in accordance with DTGO Model LOD-LOI and Model Validation Checklist</li> <li>Create Model QC report</li> </ul>	BIM Consult.
T4	Clash Management จัดการ Clash	<ul> <li>Review design standard and constructability</li> <li>Manage group clash with regards to the DTGO Standard and Top 20 Issues.</li> <li>Create Clash Report and prepare relevant document needed for project meeting</li> <li>Summarize the meeting outcomes and create Clash Tracking</li> </ul>	CM/ PM



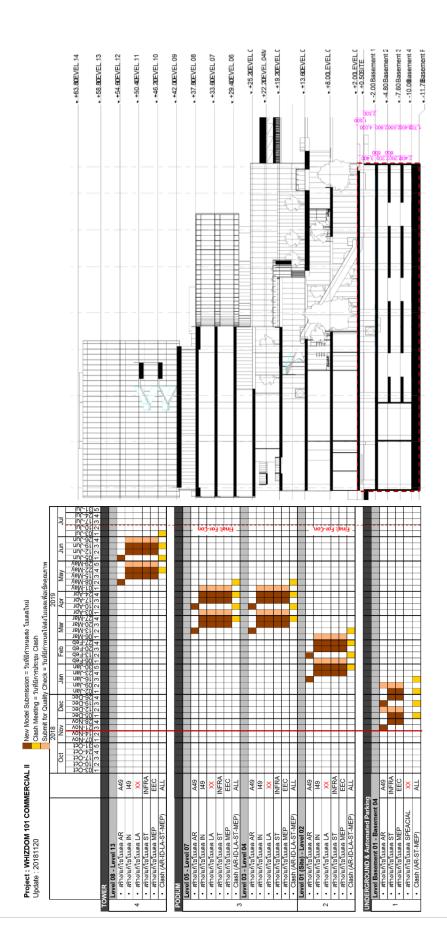


Figure G2.2.2: Example of Clash Detection Plan

# **G2.3: Color Coding for Inter-Discipline Combination**

Distinguish between each discipline while managing clash helps speed up the process, therefore the suggested color codes are chosen to not be the same as Navisworks default color.

Color Code Template, provided in <u>Appendix Q5.1: Color Appearance</u> โดย, is setup in the basis of Search Sets. The details can be explored in <u>BIM Handbook – Section 3.3: Color Appearance</u>

Table G2.3: Color Coding for Inter-Discipline Combination

Color Code รหัสสี	Color Name ชื่อสี	Search Set	Model โมเดล		
(128, 128, 128)	Grey	STR	Structure Model		
(255, 255, 255)	White	ARCH	Architectural Model		
(148,138,84)	Brown	ARCH-DW	Doors and Windows		
(255,0,0)	Red	FIRE/FP	Fire Protection Model		
(255,255,128)	Cream	AC EXHAUST	A/C Exhaust Duct		
(0,0,255)	Bright Blue	AC SUPPLY	A/C Supply Duct		
(255, 128, 255)	Pink	AC RETURN	A/C Return Duct		
(0,255,255)	Light Blue	AC DRAIN	A/C Pipe Drain Model		
(0,128,0)	Dark Green	COLD	Coldwater		
(255,128,0)	Orange	НОТ	Hotwater		
(0,64,128)	Dark Blue	SOIL	Soil Waste		
(128,64,0)	Brown	WASTE	Wastewater		
(150,99,196)	Violet	KWASTE	Kitchen Waste		
(255,255,0)	Bright Yellow	VENT	Ventilation		
(0,255,0)	Bright Green	RAIN	Rain Leaders		
(183,183,0)	Moss Green	POWER	Power		
(216,98,58)	Red Brick	COMM	Communication		
(232,75,0)	Orange Brick	ELEC	Lighting		



#### G2.4: Clash Matrix

Clash test is the selection of two Sets of elements to be analyzed whether they are overlapping one another. Selected sets to be analyzed according to the below table.

Details of roles and find item settings are in BIM Handbook - Section 3.2 Search Sets and Find Items

Table G2.4: Clash Matrix

AR = Architectural	FC				AR						N				ΑP			s					EE			AC			SN		F
ST = Structural	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
LN = Landscape								ııt									/all							   			٦ţ				
IN = Interior							2	bme									Shear Wall							Equipment			Equipment		Φ		
EE = Electrical							ij	qui	g		ě	_					hea							din			dink		ţ		
AC = Air Conditioning			wall				>	ty E	shir		/ind	ÆΡ	be				∞			ь		æ					& E		Ξ̈́	nt	
ME = Mechanical			ij.	ш		þ	a	icia	Fin	g	>   &	() e	sca	ing			ing	лп		dati		Ϋ́	ij	ē Ø			e.		più	ome	
FP = Fire Protection	*	00	ij	nlo	ţai	jii	ļŏ	pes	oor	illi	ŏ	xtur	lard	lant	=	lab	ram	ınlo	tair	onu	<u>i</u>	ncte	ouc	ixt	)uct	ipe	-ixtr	ipe	lum	qui	ipe
SN = Sanitary  AP = Automated arking	FC_AII*	AR_Floor	AR_Curtain	AR_Column	AR_Stair	AR_Ceiling	AR_Door and Window	AR_Speacialty Equipment	IN_Floor Finishing	IN_Ceiling	IN_Door & Window	IN_Fixture (MEP)	LN_Hardscape	LN_Planting	AP_AII	ST_Slab	ST_Framing	ST_Column	ST_Stair	ST_Foundation	ST_Site	EE_Duct&Tray	EE_Conduit	EE_Fixture	AC_Duct	AC_Pipe	ME_Fixture	SN_Pipe	SN_Plumbing Fixture	SN_Equipment	FP_Pipe
1 FC_All**	Ĭ.	⋖	⋖	⋖	⋖	⋖	⋖	۷	≤	≤	≤	<b>≤</b>	_		⋖	S	S	S	S	S	S	Ш	Ш	Ш	۷	∢	Σ	S	S	S	4
2 AR_Floor																															
3 AR_Curtain wall																															
4 AR_Column																															
5 AR_Stair																															
6 AR_Ceiling																															
7 AR_Door & Window																															
8 AR_Speacialty Equipment																															
9 IN_Floor Finishing																															
10 IN_Ceiling																															
11 IN_Door & Window							1																								
12 IN_Fixture (MEP)							10																								
13 LN_Hardscape	1		1																												
14 LN_Planting	1		1																												
15 AP_AII																															
16 ST Slab		0				10		1	1	10			1	1	1																
17 ST_Framing & Shear Wal	i		1			10		1					1	1	1																
18 ST_Column				0				1					1	1	1																
19 ST Stair					0			1					1	1	1																
20 ST_Foundation								1					1	1	1																
21 ST Site								1					1	1	1																
22 EE_Duct&Tray			1			5				5						1	1	1	1	1	1										
23 EE_Conduit			1			1				1						1	1	1	1	1	1										
24 EE_Fixture & Equipment	H					5				5						1	1	1	1	1	1										
25 AC_Duct			1			5	10			5	10				H	1	1	1	1	1	1										
			1			1	10			1	10				H	1	1	1	1	1	1										
						5	10			5	10					1	1	1	1	1	1										
27 ME_Fixture & Equipment			1							1	10		1	1			1	1	1	1	1										
28 SN_Pipe			1			1	10						T	1		1															
29 SN_Plumbing Fixture						5	10			5	10				$\vdash$	1	1	1	1	1	1										
30 SN_Equipment						5	10			5	10					1	1	1	1	1	1										
31 FP_Pipe			1			1	10			1	10					1	1	1	1	1	1										
32 FP_Fixture & Equipment							10			10	10					1	1	1	1	1	1										

Note – more details of the selection of two Sets of elements in model can be found in <a href="Appendix Q5.2">Appendix Q5.2</a>: Clash <a href="Search Sets">Search Sets</a> and <a href="Appendix Q5.3">Appendix Q5.3</a>: Clash <a href="Tests">Tests</a>

#### G2.5: Clash Management

#### G2.5.1 Clash Zone

Clash Zone is a clash model management with regards to zoning of the building, typical floor, and project's design milestone. This clash zone aims to avoid those kinds of an unnecessary clash number and use to facilitate clash management and issue tracking.

However, the criteria distinguishing each zone and the zone's naming convention need to be discussed and agreed in the BIM Kick-off meeting according to F3: Meeting Procedure – BIM Kick-off

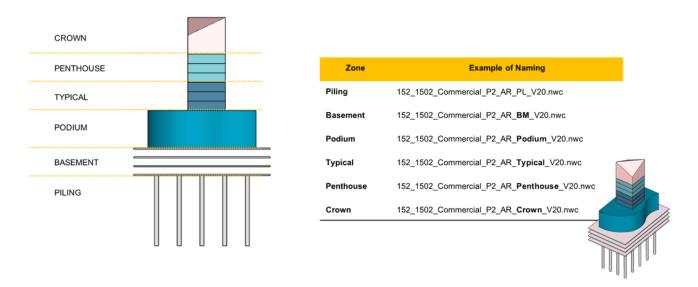


Figure G2.5.1: Example of Clash Zone and Naming

#### **G2.5.2 Clash Status**

Clash status uses to determine the hierarchical classification of clash issues which allows responsible teams to track the changes of each clash group and to quickly identify the issues that still need to be managed.

After managing clash group, it shall be issued in Saved Viewpoint window with regards to type of issues as follows;

- Regulation Issues that conflict with MQDC design compliance strategies on the statutory and regulatory requirement
- Major Issues that are considered critical to the project in accordance with MQDC Standard and Constructability. The major issues must be reviewed and approved a solution in the meeting to allocate a roles and responsibilities.
- **Minor** Issues that slightly affect design compliance and constructability or are about modelling techniques.

  In sense the responsible teams can be spontaneously assigned to the clear solutions.





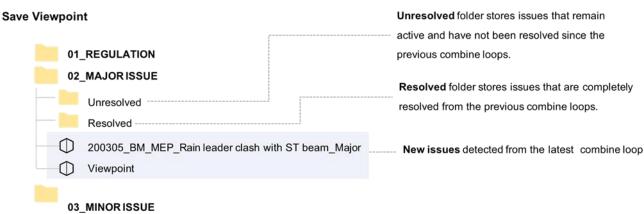


Figure 2.5.2: Clash Management Folder Structure

## **Saved Viewpoint Naming**

```
<Date>_<Location>_ <Responsible Party>_<Description>_<Type of Issue>
```

For Example

200305\_Podium\_MEP\_Rain leader clash with ST beam\_Major

Clash Status (Unresolve/ Resolved) requires to be update after each BIM meeting and issued as minutes of meeting's attachment in .nwd file format shown in Figure 2.5.2.

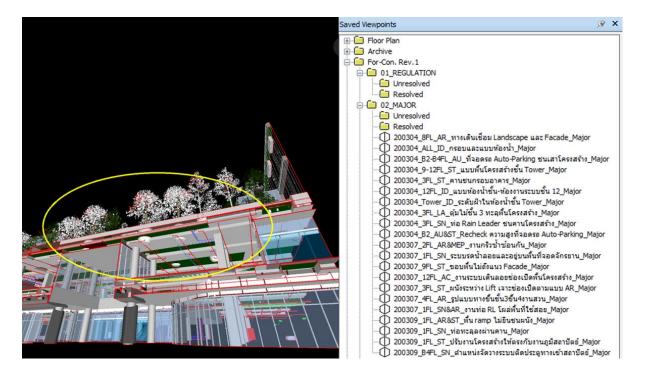


Figure 2.5.3 Example of Clash Issue

### G2.6: Clash Report

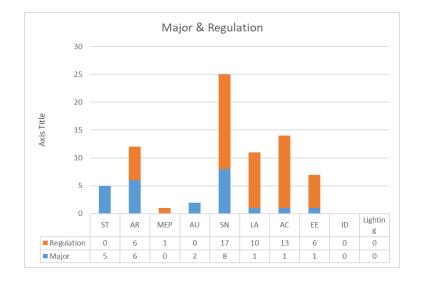
After the clash detection process and grouping are done, the clash report will be produced as a guideline for model revision or as an approval document when the model is clash free. The reports consist of

1. **DTGO Project Dashboard** (.xlsx) – a report in excel file format, which illustrate BIM coordination progress and issue to project owner (VDC) on date 15<sup>th</sup> and 30<sup>th</sup> each month or as agreed dates.

DTGO Dashboard Template can download from Appendix Q5.4: Clash Report Template

2. **Navisworks Document File** (.nwd) – a report in 3D model file format, which presents coordination issues in terms of 3D Save Viewpoints.

No.	Date Four €	Location	Issue Type	Discipline _	Discipline 🔻	Issue Description	Assign To-	Issue Statu	)ate Clo <mark>⊸</mark>	Note / Remark
1	20/03/04	8 FL	Major	AR	LA	ทางเดินเชื่อม Landscape และ Facade	AR	Resolved	20/05/07	
2	20/03/04	Zone Tower	Major	N		กรอบและแบบท้องน้ำ	IN	Resolved	20/05/07	
3	20/03/04	9 - 12 FL	Major	ST		แบบพื้นโครงสร้างชั้น Tower	ST	Resolved	20/05/07	
4	20/03/04	12 FL	Major	N		แบบห้องน้ำขั้น-ท้องงานระบบขั้น 12	IN	Resolved	20/05/07	
5	20/03/04	Zone Tower	Major	N	MEP	ระดับฝ้าในท้องน้ำชั้น Tower		Resolved	20/05/07	
6	20/03/07	1 FL	Major	SN	LA	ระบบ รดน้ำตอย และ อยู่บนพื้นที่จอดจักรยาน	SN	Resolved	20/05/07	
7	20/03/07	9 FL	Major	ST	LA	ขอบพื้นไม่ถึงแนว Facade	ST	Resolved	20/05/07	
8	20/03/07	12 FL	Major	AC		งานระบบเดินดอยช่องเปิดพื้นโครงสร้าง	AC	Resolved	20/05/07	
8	20/03/07	3 FL	Major	AR	ST	ผนังระหว่าง Lift เจาะช่องเปิดตามแบบ AR	ST	Resolved	20/05/07	



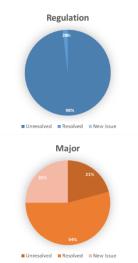


Figure G2.6.1 Example of Clash Tracking Report

Minor	Action	Quantity	Status
Unresolved	V	59	Minor
Resolved	V	28	32%
New Issue	V	0	68%
Minor Issue Summary	87 0		
Cost Saving (THB)			■ Unresolved ■ Resolved ■ New Issue

Figure G2.6.2 Example of Minor Issues report



# **DTGO Top 20 Issues**

DTGO Top20 issues are the most detected issues in according with DTGO design standard and constructability, as specified in table G2.6. Therefore, these issues also require solely recording as shown in figure G2.6.2.

Example of DTGO Top 20 Issues Report can be download from <a href="Appendix Q5.4">Appendix Q5.4</a>: Clash Report Template.

Table G2.6: DTGO Top 20 Issues

No.	Description						
Regul	ation issues						
1	The minimum clear height below MEP/ Structural works is 2.1 m.						
2	The minimum Corridor width is 1.5 m						
3	The minimum width of narrowest side of a bedroom is 2.5 m.						
4	The minimum helipad size is 10m.*10m.						
5	The minimum of street width surrounding site is 6 m.						
Major	Major issues						
6	Discrepancies between the orientation of architectural and structural columns						
7	Discrepancies between the orientation of architectural and interior partitions						
8	Discrepancies between the orientation of architectural, structural, and MEP shaft openings						
9	Ensure efficient space above ceiling for MEP work						
10	Combine the sizing of main riser and shaft opening						
11	Exhaust duct works clash with façade						
12	Rain lead pipework clashes with structural framings						
13	Clarify wall specification: low wall, double wall, etc.						
14	Necessary structural assembly details are required to model for combining						
15	MEP designers to identify and confirm the lift pit level with suppliers						
16	MEP designers to provide dimension of MEP room for architects						
Minor	issues						
17	Discrepancies between the orientation of architectural and MEP FHC						
18	Discrepancies between the orientation and dimension of architectural and MEP grill exhausts						
19	Discrepancies between the orientation of MEP and interior AC in unit rooms						
20	Discrepancies between the orientation of architectural and MEP outlets						

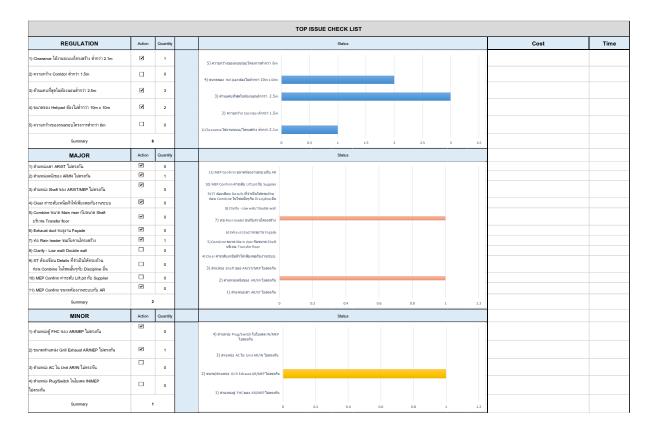


Figure G2.6.3 Example of Top 20 Issues Report



### G2.7: Return on Investment (ROI)

To allow evaluation the efficiency of an investment, ROI will be used as a rudimentary gauge of the investment's profitability. DTGO Top20, regulation, and major issues are account for ROI calculation by multiply each issue with its unit cost (including material, labor, and time). CM takes responsible for completing the ROI report and summarizing the total cost and total duration.



No.	Issue	Description	Issue Type	Cost/Unit	Unit	Total Cost	Duration
14		ค่าระศับใต้ Sprinkler ค่ำกว่า 2.1m	Regulation				
15		คำแหน่งเสาของ AR/ST ไม่ ครงกัน	Major				
16		ผนังของ AR/IN ไม่ครงกัน	Major				
17		คำแหน่ง Shaff ของ AR/ST ไม่ครงกัน	Major				

Figure 2.7 Example of ROI Calculation Diagram

#### G3: QA&QC Site Inspection

One way of controlling construction quality is utilizing BIM to support the inspection or verification of finished products.

The main contractors shall prepare BIM models, according to Section G1.4 QC Model Validation Check for Site Inspection, and submit to BIM360 Docs using for virtual reference navigating throughout site inspection processes.

BIM360 Docs helps providing single source, approachable and verificative information for site inspectors, i.e., CM/ PM and QSHE.

DTGO QA/QC standard for site inspection consists of 4 inspection processes;

- 1. Inspection Test is performed to ensure that the quality level of product is within acceptable design and construction standard, i.e., commissioning test. If the test results do not meet the expected criterias, inspectors (QHSE) will issue NCR (Non-Conformance Report) and inform responsible parties for amendment. The issues reported as NCR are account for the major effect for the project, e.g., pilling eccentric, walls/ columns plumb, pipe pressure, etc.
- 2. QC1 Above Ceiling is performed to inspect the orientation of pipe/ductwork, fixtures and devices such as lighting, sprinklers, fire alarms, etc., above ceiling and low wall areas.
- 3. QC2 Wet Work is performed to inspect shaft openings and blockouts as well as space dimension according to QSHE QA/QC Standard, e.g., door/window openings, switch/outlet blockouts, floor drain orientation, etc.
- 4. QC3 End Product is performed to verify quality of finished product such as paintwork, wall/floor finishes, built-in furniture, etc.

Contractors are assigned to record photos of the approved inspection's areas to futher used for As-built model inspection (refer to Section G3.1: Site Photo).

## G3.1: Site Photo

Site photos is essentially required as a part of As-built information recording. In order to allow stakeholders being on the same page as the photos are collected by many parties and passed on to others, guideline for photo taking is necessary.

The guideline indicates photo angle and position in order to facilitate smooth transition for the Asset Information Management process.

The photos taken by 360 Camera or recording gadgets regard to QSHE agreement, shall be considered the following points;

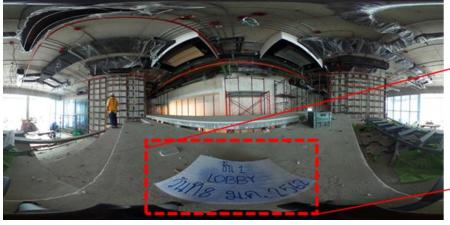
- Sufficient light in the areas
- Obstacles or unwanted stuffs in the areas
- Proper perspective and clear sight of the photos



Table G3.1 Site Photo Recording Protocol

Construction Process ช่วงเวลาในการ ก่อสร้าง	Objectives เป้าหมายการถ่ายภาพ	Participants ผู้รับผิดชอบ	Floors Require Photos ชั้นที่ต้องเก็บภาพ
1. QC1 Above Ceiling	Before installing ceiling : Observe pipework above ceiling	MEP Contractors	: Every Floor
2. QC2 Wet Work	Before plastering : Observe pipework in walls	MEP Contractors	: Every Floors
3. End Product	Final Approval : Complete work	Main Contractors	: Every Floor
Construction     Progress	: Observe construction progress	All Contractors	: As per construction progress report

To facilitate manageable documents, contractor shall define the location of recording area by specifying level, room/area name and recording date, as suggested in figure G3.1 below.



Floor 1 LOBBY Date 8 Jan 2019

Figure G3.1 Example of Site Photo (Location identified)

#### **G3.2: Photo Folder Structure**

Photo Folder Structure is necessary for organizing and accessing the recorded data. Regarding DTGO information management standard, the folders are provided as shown in figure G3.2.

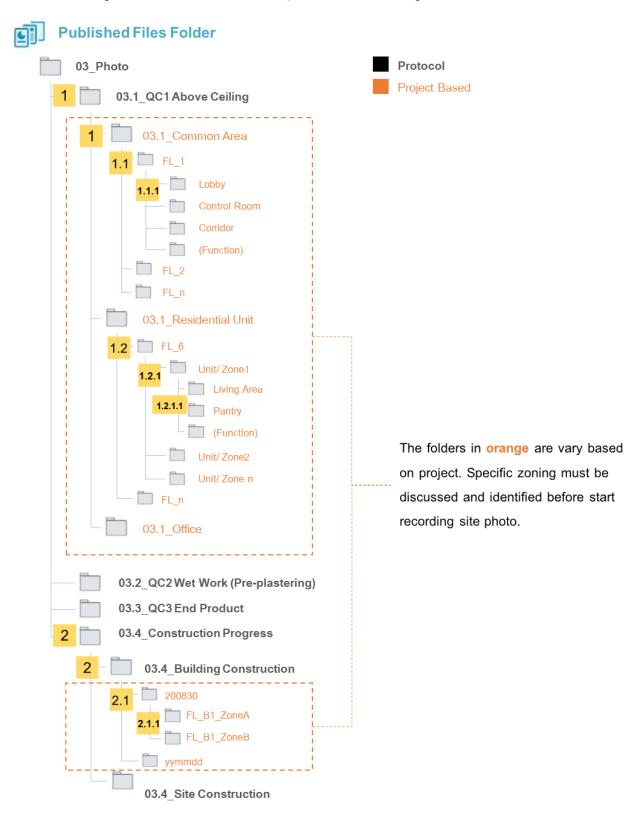


Figure G3.2 Site Photo Folder Structure



Table G3.2 Site Photo Folder structure

1.2

Level

Criteria		Description
Naming	Remark	Description
QC Photo Recording		Recorded photos regarding QC processes
		(QC1, QC2, QC3)
03.1_QC1 Above Ceiling	Protocol	
03.2_QC2 Wet Work		
03.3_QC3 End Product		
1 Common Area/ Facility	Project Base	Type of common areas/facilities
<area function=""/>		
Example		
03.1_Common Area		
03.1 Facility		
1.1 Level	Project Based	Floor level
<fl_no.></fl_no.>		
Example		
FL_B1		
FL_7		
1.1.1 Room/ Area Function	Project Based	Usage functions of rooms/areas
<room area="" function=""></room>		
Example		
Lobby		
Corridor		
NOC Room		
1 Residential/ Rental Unit and Office	Project Based	Unit types
<area function=""/>		
Example		
03.1 Residential Unit		
03.1 Rental Unit		

Project Based Floor level

Criteria		
	Remark	Description
<fl_level></fl_level>		
Example		
FL_B1		
FL_7		
<b>1.2.1</b> Unit/ Zone	Project Based	Unit/ Zone's name
<fl_level_unit name=""></fl_level_unit>		
Example		
FL_7_BA02		
FL_1_F305		
1.2.1.1 Room/ Area Function	Project Based	Rooms/ Areas' function
(if necessary)		
<room area="" function=""></room>		
Example		
Living Room		
Pantry		
Bedroom		
Construction Progress		Recorded photos of construction progress
03.4_Construction Progress	Protocol	
2 Construction Type		
03.4_Building Construction	Protocol	
03.4_Site Construction		
2.1 Record Date	Project Based	
<yymmdd></yymmdd>		
Example		
200826		
190910		
2.1.1 Zone (if necessary)		Name of construction area



Criteria		Description
Naming	Remark	Description
<fl_level_zone_zone< td=""><td></td><td></td></fl_level_zone_zone<>		
Name>		
or		
<site_construction type=""></site_construction>		
Example		
FL_B1_ZoneA		
Site_Excavation		
Site_Fence		



**Asset Information Management** 



# **Section H: Asset Information Management**

The goal of asset management primarily is to capitalize on BIM and its information, which capture and present in a structured manner and digitally accessed and managed more conveniently compared to hardcopry documents.

The asset information management aims to enhance effective operations and maintenance that are accurate and completely built into the BIM.

## H1: Asset Information Model (AIM) Input

A proper amount of information in terms of quality and quantity, according to facility manager requirement, is the key of effective BIM for asset management to understand the asset information requirements (AIR) which are critical for operations and maintenance (O&M) phase.

To achieve DTGO specific asset information requirements, Asset Information Model (AIM) can include structured, i.e., geometrical models, schedules and databases, and unstructured information, i.e., additional documentation.

The asset information would include the following;

- 1. Model Information Input
- 2. Specific Information Input

The asset information must conform to FM inventory format described in Section H1.1: FM Inventory format.

#### H1.1: FM Inventory Format

			L	ocation				1	Supplier Contact	
tem	Туре	System	Level	Space: Name	Quantity	Brand	Model	Manufacturer	(company)	Manual
CDU	CDU	Air Conditioner System		ระเบียง_R-1-7	1					-
CDU	CDU - For 12000 BTU FCU 2	Air Conditioner System	ระสับพินธ์นห์4	ระเบียง_R-2	1					
CDU	CDU - For 12000 BTU FCU 2			1810U4_R-2	1					
CDU	CDU - For 24000 BTU FCU	Air Conditioner System	ระสับพันธ์นที่4	ระเบียง_R-2	1					
Engine Firepump	Fire Pump	Fire Protection	ระดับพื้นขึ้นที่4	1	1				T T	
Fan Coil Unit	FCU - Exposed Wall-Mount - 12000	Air Conditioner System	ระสับพินธ์นที4	ห้องนอน_R-2	1		1		T T	
Fan Coil Unit	FCU - Exposed Wall-Mount - 12000	Air Conditioner System	ระสับพินธ์นหิ4	ห้องนอน_R-2	1		I	T	T I	
Fan Coil Unit	FCU - Exposed Wall-Mount - 24000	Air Conditioner System	ระสับพินธ์นที4	ห้องรับแยก_R-2	1					
Fan Coil Unit	FHC_02-B 2	Air Conditioner System	ระสับพันธ์นห์4	หางเห็น	1					
Fan Coil Unit	FHC_02-B 2	Air Conditioner System	ระสับทันยันที4	หางเต็น	1					
Fan Coil Unit	FHC 02-B 2	Air Conditioner System	ระดับพื้นชั้นที่4	หางเดิน	1					

<FM\_Mechanical Equipment Schedule>

		Warra	nty					Preventiv	e Maintenance		
Manufacturer	Contractor	Warranty ownership					Maintenar	ce Period			Next Maintenance
Warranty	Warranty	(company)	Warranty Date	Warranty Expire	Warranty Contact	Life time	Period	Unit	Maintenance Cost	Maintenance Date	Date
									1		
Ø				1							
	<u></u>	-					-				-
	Н	1		<u> </u>			-		-		I.
Ø				1							
<u>N</u>		ļ		ļ			-				
H		-		1			-				I.

Figure H1.1 Example of FM Revit Schedule Template

The FM Inventory format facilitates contractors to manage Asset Information Model (AIM), which captured and represented in a structured manner and can be digitally accessed and managed more convenient compare to hardcopy document.

Regarding DTGO Asset Information Requirement (AIR) and facility manager's demand, required asset information consists of the following;

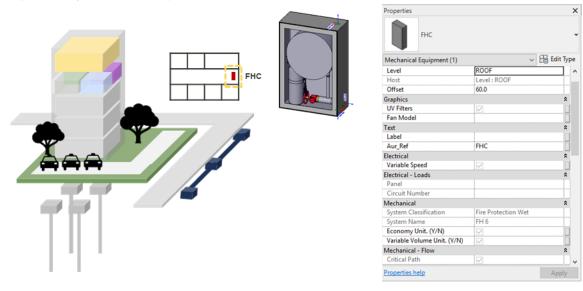
- General Information is structured information inherently related the model, i.e., physical asset data, embodying name description, technical characteristic of the asset, as well as location and spatial data.
- Specification and Warranty are details contributing asset identities and its guarantee include brand, model, manufacturer, supplier contact, and warranty details.
- Preventive Maintenance is information refers to routine operation and maintenance of asset,
   embodying life expectancy, maintenance period, maintenance cost and maintenance schedule.

FM Revit Template, i.e., FM Inventory Format template, can be downloaded from Appendix Q6.1: FM Inventory Format.



### H1.2: Model Information Input

The Project Information Model (PIM) supports the delivery of the project and contributes to the Asset Information Model (AIM). The PIM contains details of project geometry, location and primary performance requirements in terms of model parameters, which require quality control to ensure both geometric and non-geometric data are well-qualified. Model Validation checklist (refer to <a href="Section G1.1 Model Validation">Section G1.1 Model Validation</a>
Checklist) and providing Revit Template help guiding inspectors to easily verify the model information (figure H1.2) according to DTGO quality control standard.



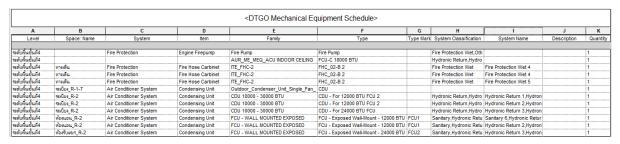


Figure H1.2 Example Model Validation Schedule template

# H1.3: Specific Information Input

The specific information of asset reflecting the information requirements for operation and maintenance embodies;

- 1. Specification
- 2. Warranty
- 3. Preventive Maintenance

as described in table H1.3.

Table H1.3 Description of Asset Information Input

Asset Inform	mation	Description	Remark	Responsibility
1. Spe	ecific Infor	rmation		
1.1. Bra	ınd	Equipment/ product's brand		Contractors
1.2. Mod	del	Equipment/ Product's model		
1.3. Mar	nufacturer	Manufacture/ Supplier		
1.4. Sup	oplier	Supplier's contract, i.e. phone		
Con	ntact	number and email address (required		
		company's contact)		
1.5. Mar	nual	URL for access to manual and	URL has to be the link of	
		related document	the document storage folder	
			according to BEP Section	
			H2.3 Deliverable Package	
			Management	
2. Wai	rranty			
2.1. Wai	rranty		Company Name	Contractors
Owi	nership	· Manufacturer Warranty		
		· Contractor Warranty		
2.2. Wai	rranty			
Date	te			
2.3. Wai	rranty			
Ехр	oire			
2.4. Wai	rranty			
Con	ntact			



Asset	Information	Description	Remark	Responsibility
3.	Preventive M	laintenance		
3.	1. Lifetime	Usage's lifetime of	Data provided/suggested by	Contractors
		product/equipment	supplier/ contractor	
3	2. Maintenance	Maintenance schedule e.g. daily,	Data provided/suggested by	FM
	Period	weekly, yearly, etc. suggested by	supplier/ contractor	
		supplier or contractor		
	• Period	A number of maintenance period	Data provided/suggested by	
		per schedule	supplier/ contractor	
	• Unit	A unit of maintenance period per		
		schedule such as day(s),		
		week(s), month(s), year(s), etc.		
3.	3. Maintenance	Maintenance cost per	Data provided/suggested by	Contractors
	Cost	maintenance turn regarding	supplier/ contractor	
		required materials and labor cost.		
3.	4. Maintenance	Recorded lastest maintenance	Data provided by FM	FM
	Date	date		
3.	5. Next	Next maintenance schedule	Data provided by FM	
	Maintenance			
	Date			

# **H2: Asset Information Deliverables**

The key purpose of identifying asset information procedure is to avoid over-specifying and enhance asset operation and maintenance.

It is important to have a process to ensure the collection and management of good quality, well-organized, and accurate data.

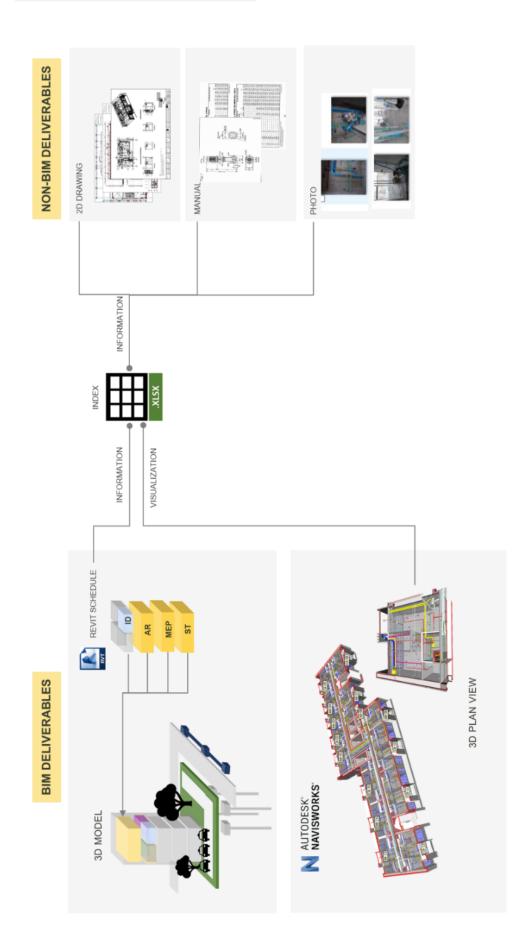


Figure H2: Asset Information Deliverables Diagram



#### **H2.1: BIM Deliverables**

BIM Deliverables represents the models (e.g., structural, architectural, landscape, interior, and MEP model, etc.), which consists of the geometric elements and non-geometric data, i.e., attributes to be tagged as parameter in the geometric elements.

Although it is possible to model all asset but not all facility information has to be captured within BIM model. The more detail an object means the bigger file size to be organized that might effects the future utilization. Hence, it is important to identify the particular asset requirements and their level of details (LOD), in order to scope the curtain objects that facility manager actually need to manage.

In accordance with DTGO Asset Information protocol, contractors take responsible for preparing asset information as identified in Section H1: Asset Information Model (AIM) Input.

#### **Asset Information Management**

The accuracy of Asset Information Model (AIM) is essential for facility manager, as well as the asset model management for further operation and maintenance.

Asset model views enables user and/or inspectors to jump directly to the preset views without having to navigate each time to reach an item. The main contractor is assigned to provide asset models' Save Viewpointed (Navisworks) according to area usage as following;

- Common Area
- · Retail/ Residential Unit
- · Office

In order to enhances efficiently utilizing BIM, label links are required for all approved As-built models. A label link provides accessibility to non-BIM deliverables via an asset information index.

Details of asset model management, Saved Viewpoint and Label Link, are described in <u>Handbook Section</u>
4.1 Asset Model Management.

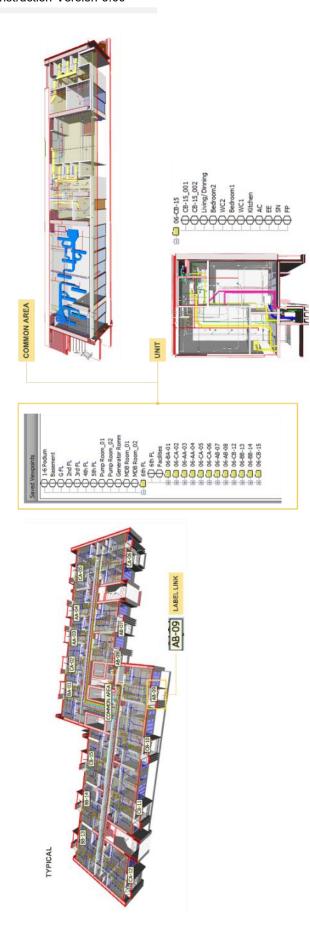


Figure H2.1: Example of Asset Model Management



### **Model Inspection with Photo**

Model Inspection with Photos demonstrates the comparative feature between As-built construction (represent in photos) and building model used for revision and verification of As-built Model.

The comparison between model and photo should verify position, completeness, top and/or bottom constrain and geometry of model elements according to Section G1.4 QC Model Validation Checklist of Site Photos.

Guideline for site photo recording can be found in Section G3.1 Site Photo.

#### H2.2: Non-BIM Deliverable

Non-BIM deliverables is additional asset information such as documents and databases to be handed over with asset information deliverables, e.g., manual book, site photo, As-built drawing, etc. These information are not part of BIM model but essential for facility managers, which can be accessed through an asset information index in terms of particular links. Non-BIM deliverables according to DTGO Asset Information Requirement (AIR) embody;

- 1. As-built Drawing
- 2. Manual
- 3. Site Photo

#### **Warranty Folder Organization**

Warranty Organization allows project owners and/or facility managers to ensure assurance from responsible parties to the asset. The warrantor shall repair of compensated by any defects or losses during the warranty period.

Warranty documents are required to be scanned into Soft-copy and gathered in provided folders separated by discipline and area usage as follow;

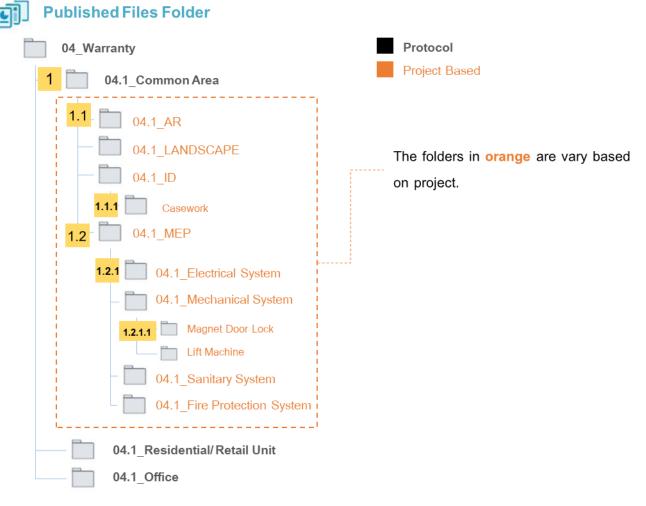


Figure H2.2.1 Warranty Folder Structure

Table H2.2.1 Warranty Folder Structure

Criteria		Description
Naming	Remark	Description
1 Zone		
04.1_Common Area	Protocol	Usage function of area/ zone
04.1_Residential Unit		
04.1_Retail Unit		
04.1_Office		



Criteria		Description
Naming	Remark	Description
1.1 Discipline	Project	
	based	
04.1_AR		
04.1_LANDSCAPE		
04.1_ID		
04.1_MEP		
1.1.1 Item	Project	Asset categories
	based	
<asset name=""></asset>		
Example		
Casework		
Cutain Panel		
1.2 MEP System	Project	
	based	
04.1_Electrical system		
04.1_Mechanical System		
04.1_Sanitary System		
04.1_Fire Protection system		
1.2.1 Item	Project	Asset categories under MEP subdisciplines
	based	
<asset name=""></asset>		
Example		
Magnet Door Lock		
Lift Machine		

## **Manual Organization**

For the ease of accessing information, contractors shall collect material or equipment manuals which they are purchasing in soft file format. Organization of manual in digital formal should be the same as the organization of paper-based manual, separated by discipline as follow;



Figure H2.2.2 Manual Folder Structure



Table H2.2.2 Manual Folder Structure

		Criteria		Description
			Damank	
		laming	Remark	Description
1 Coi	mmon Area/ Facil	ity		
	02.1_Common A	ırea	Protocol	Types of common areas/facilities
1.1	l Discipline		Protocol	
	02.1_AR			
	02.1_LANDSCAI	PE		
	02.1_ID			
	02.1_MEP			
	1.1.1 AR Sub-dis	scipline	Protocol	
		02.1_Ceiling		
		02.1_Floor		
		02.1_Wall		
		02.1_Door		
		02.1_Window		
	1.1.2 MEP Syste	m	D4I	
	,		Protocol	
		02.1_Electrical system	Protocol	
	<b>.</b>		Protocol	
	<b>.</b>	02.1_Electrical system	Protocol	
	<b>.</b>	02.1_Electrical system 02.1_Mechanical System	Protocol	
		02.1_Electrical system 02.1_Mechanical System 02.1_Sanitary System	Protocol	
		02.1_Electrical system 02.1_Mechanical System 02.1_Sanitary System 02.1_Fire Protection	Protocol	
		02.1_Electrical system 02.1_Mechanical System 02.1_Sanitary System 02.1_Fire Protection system		Electrical power distribution's equipment/
		02.1_Electrical system 02.1_Mechanical System 02.1_Sanitary System 02.1_Fire Protection system 1.1.2.1 Electrical System		Electrical power distribution's equipment/
		02.1_Electrical system 02.1_Mechanical System 02.1_Sanitary System 02.1_Fire Protection system 1.1.2.1 Electrical System		fixtures - RMU
		02.1_Electrical system 02.1_Mechanical System 02.1_Sanitary System 02.1_Fire Protection system 1.1.2.1 Electrical System		fixtures - RMU - Transformer
		02.1_Electrical system 02.1_Mechanical System 02.1_Sanitary System 02.1_Fire Protection system 1.1.2.1 Electrical System		fixtures  - RMU  - Transformer  - Generator
		02.1_Electrical system 02.1_Mechanical System 02.1_Sanitary System 02.1_Fire Protection system 1.1.2.1 Electrical System		fixtures  - RMU  - Transformer  - Generator  - Busduct
		02.1_Electrical system 02.1_Mechanical System 02.1_Sanitary System 02.1_Fire Protection system 1.1.2.1 Electrical System		fixtures  - RMU  - Transformer  - Generator

Criteria	Description
Naming	Remark Description
	<ul> <li>Panel Board e.g. Load Center,</li> <li>Auto Transfer System, Manual</li> <li>Transfer System, etc.</li> <li>Others</li> </ul>
02_CCTV System	CCTV system's equipment/ fixtures  - CCTV camera  - Digital Video Recorder  - Monitor  - System Control Panel e.g.  Workstation Computer, Graphic  Annunciator, UPS, etc.
03_PABX System	Private Automatic Branch Exchange
04_MATV System	Master Antenna Television
05_Communication System	Networks
06_Fire Alarm System	Fire alarm equipment/ fixtures  - Smoke Detector  - Heat Detector  - Pull Manual Station  - Bell/ Horn Alarm  - Panel Board e.g. Workstation  Computer, Graphic Annunciator,  Control Panel, etc.
07_Access Control System	Access control's equipment/ fixtures  - Card Reader  - Exist Button  - Magnet Door Lock  - Gate Barrier  - Control Panel



Criteria	Description
laming Remark	Description
08_Common Area	Common area lighting fixtures
Lighting	- Lighting
	- Switch
	- System Control Panel e.g.
	Workstation Computer, Relay
	Control Panel, etc.
09_Conduit, Cable Tray, Wireway	Conduits and wireways, excluding
	busducts
1.1.2.2 Mechanical System Protocol	
01_Air Conditioner System	A/C equipment/ fixtures
	- Air Terminal e.g. AHU, FCU, Air
	Split Type
	- CDU
	- Control Panel
02_Ventilation System	Ventilation equipment/ fixtures
	- Fan e.g. Exhaust, Fresh Air,
	Make-ip, etc.
	- Control Panel
03_Vertical Transport, Lift	Vertical transport equipment/machine
	- Lift e, g, Fire Man Lift, Passenge
	Lift, Glass Lift
	- Escalator
	- Control Panel
04_Piping and Duct	Pipe, Duct, Flexduct)
05_Grille and Damper	
1.1.2.3 Sanitary System Protocol	
01_Cool Water System	Cold water system's equipment/fixtures
01_Cool Water System	- Pump e.g. Transfer Pump,
01_Cool Water System	

Criteria		Description
Naming	Remark	Description
		- Control Panel
02_Wastewater Treatment		Wastewater treatment equipment/fixtures
		- Tank e.g. Septic Tank, Grease
		Trap Tank, Equalizer Tank,
		Aeration Tank, Sludge Tank,
		Sludge Return, Effluent Tank, etc.
		- Control Panel
03_Swimming Pool		Swimming pool system's equipment/
		fixtures
		- Pump e.g. Pool Pump, Spa
		Pump, Noise Pump, etc.
		- Tank e.g. Filter Tank, Surge Tank,
		etc.
		- Electrolysis
		- Control Panel
04_Landscape, Pond		Landscape's water feature
Pool, Waterfall, Fountain		- Pump e.g. Circular Pump,
		Fountain Pump, etc.
		- Control Panel
05_Drainage		Drainage fixtures
06_Piping		Sanitary pipes
1.1.2.4 Fire Protection	Protocol	กลุ่มอุปกรณ์หมวดงานระบบป้องกันไฟไฟม้
System		' '
01_Fire Protection		Fire protection system's equipment
		- Pump e.g. Engie Firepump,
		Jockey Pump, etc
		- FHC
		- Pressurized Fan
		- Control Panel



Crite	eria		Description
Naming		Remark	Description
			- others
02_Spri	nkler Floor Plan		Fire protection's sprinkler
			- Sprinkler
			- Valve
03_Fire	Exist, Fire Barrier		
04_Pipi	ng		Fire protection system's pipes
2 Residential/ Rental Unit and C	Office		
<area fund<="" th=""/> <th>tion&gt;</th> <th>Project</th> <th></th>	tion>	Project	
Example		Based	
02.2 Residential Unit			
02.3 Rental Unit			
2.1 Discipline		Protocol	
02.1_AR			
02.1_LANDSCAPE			
02.1_ID			
02.1_MEP			
03.4_Site Construction			
2.1.1 MEP System		Protocol	
02.1_El	ectrical system		
02.1_M	echanical System		
02.1_Sa	nitary System		
02.1_Fi	re Protection		
system			
2.1.1.1	Zone (if necessary)	Project	Construction areas/zones
		Based	
<	Zone Name>		

Criteria		Description
Naming	Remark	Description
Example		
Typical		
Penthouse		
Zone A		

#### **H2.3: Deliverable Package Management**

Deliverable Package shall be submitted at the end of the As-built stage consists of;

- 3D Model: As-built Revit and Navisworks Models which are approved follow up the actual construction.
- 2. **2D Drawing**: As-built CAD and PDF drawing followed up the actual construction.
- 3. **Manual**: Manual documents collected as Hard-copied are required to be scanned into Soft-copy and gathered in provided Folder.
- 4. **Site Photos**: Actual construction photos such as piping taken as an As-built inspection tool. The Photos are allocated by room and functional usage e.g. unit room and corridor.
- Warranty: Warranty documents, which ensure quality assurance from warrantor, are required to be scanned into Soft-copy and gathered in provided Folder.

This information shall be submitted in the following folder structure.



## **Project Files Folder**

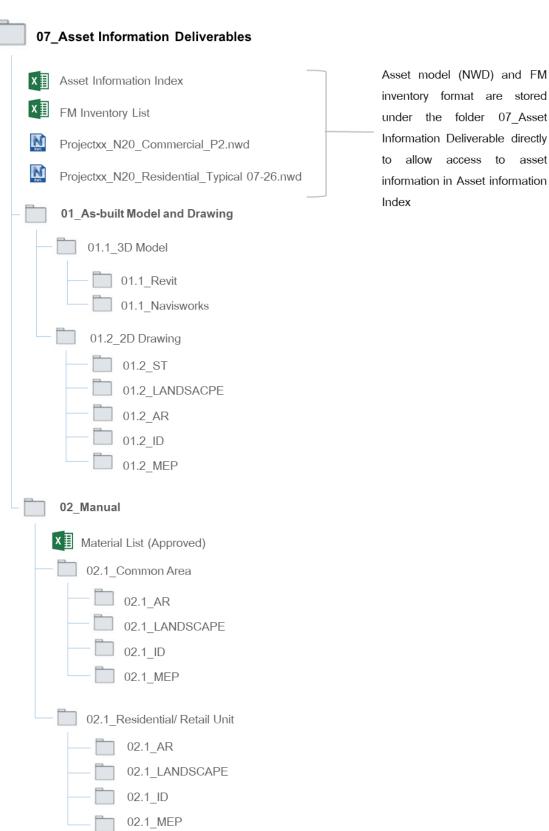


Figure 4.2.3. Asset Information Deliverables Folder Structure

Table H4.2.3 Asset Information Deliverables Folder Structure

Folder Name	Sub-Folder	Sub-Folder	Description	Responsible
				Party
07_Asset Inform	nation Deliverabl	les		
01_As-built Model and Drawing			As-built models and drawings	Contractors
	01.1_3D Model	01_Revit	As-built Revit models	
		02_Navisworks	As-built Navisworks models	
	01.2_2D Drawin	ng	As-built drawings	
		01.2_ST		
		01.2_AR		
		01.2_LANSCAPE		
		01.2_ID		
		01.2_MEP		
02_Manual			Manual and Specification	Contractors
	02.1_Zone			
		02.1_AR		
		02.1_LANDSCAPE		
		02.1_ID		
		02.1_MEP		
03_Photo			Recorded site photos	Contractors
-	03.1_QC1 Abov	re Ceiling		
		03.1_Common		
		Areas		
		03.1_Unit Rooms		
03.2_QC2 Wet Work (Pre-plastering			g)	
		01_Common Areas		
		02_Unit Rooms		



Folder Name	Sub-Folder	Sub-Folder	Description	Responsible
				Party
07_Asset Information Deliverables				

### 03.3\_QC3 End Product

01\_Common Areas

02\_Unit Rooms

### 03.4\_Construction Progress

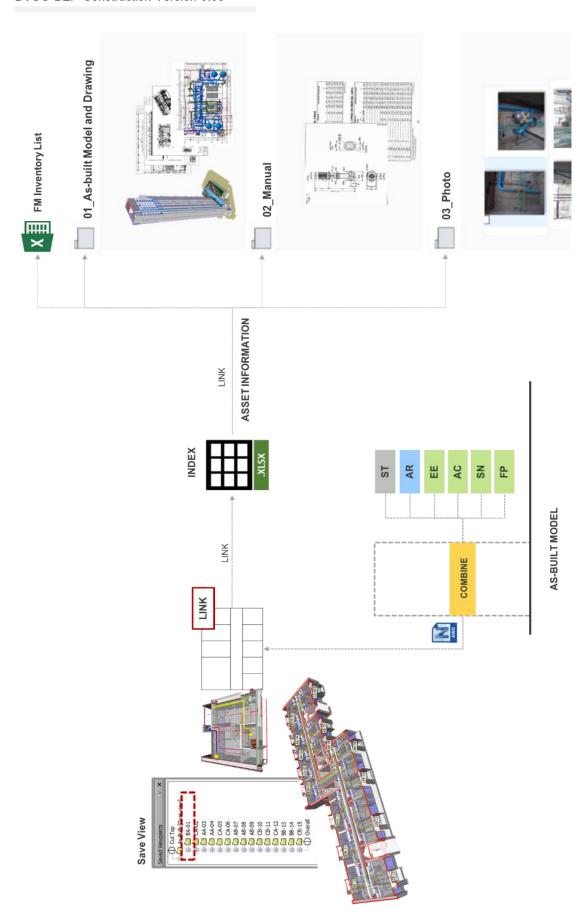


Figure H2.3.2: Asset Infomation Exchage



The integration of asset information deliverables is necessary to the overall success of BIM utilization. It is important to contribute an asset information exchange system, which significantly improves efficiency and saves the facility manager time and resources.

The Asset information exchange system consists of three types of information;

- **BIM Models** are Navisworks As-built models with preset viewpoints and label links of asset information index.
- Asset Information Index is an index providing accesses to non-BIM deliverables, i.e., various asset documents.
- Asset Documents are additional asset document or databases include As-built drawings, manual, and site photo.

The Asset Information Index, a vital tool synchronizing BIM to non-BIM deliverables (figure H2.3), can be downloaded from Appendix Q6.2: FM Revit Template.

# **SECTION**

**Project Closed-out** 



#### **Section I: Project Closed-Out**

#### **I1: Project Lessons Learned**

In order to achieve DTGO Organizational Information Requirement (OIR), Improving governance processes to enhance effectively manage information, the project manager shall capture lessons learned throughout the entire project life cycle with record them in a suitable knowledge store.

In accordance with the PDCA model (Plan-Do-Act-Check), the four-stage method that enables project's owner to continually improve people and processes and prevent recurring mistakes for future projects.

#### I1.1: Project Top 5 Issues

Each particular project encounters different working conditions and obstacles, which possibly indicate to various numbers of issues regarding individual project execution. The diversity of project-based data helps to broaden organizational database.

The more amount of case studies, the more chances to interpret and work out lessen learned as well as develop appropriate strategies to optimize BIM utilization.

Therefore, BIM consultant takes responsible for identifying top 5 issues detected each operation phase, design phase and construction phase. The top 5 issues are not account for DTGO Top 20 Issues identified in BEP Section G2.6 Clash Report.

#### **I2: Evaluation and Impact Assessment**

Evaluation is a part of results-based project BIM management, which assesses how well planning and managing for future outputs into outcomes.

The aim is to determine the relevance and level of achievement of project goals and objectives, development effectiveness, efficiency, impact and sustainability. Evaluations also feed lessons learned into the decision-making process of the project stakeholders.

Impact assessments determine the effectiveness of a project activities and judge the significant of changes contributing to longer-term impact by those activities. The Impact should be seen as the contribution of the intervention to the overall goal.

The Evaluation and Impact Assessment Template can be downloaded from Appendix Q7.1: Evaluation and Impact Assessment.

#### I2.1: Project Return on Investment (ROI)

ROI (Return on Investment) is a performance measure used to evaluate the efficiency of an investment in BIM implementation, in order to assess the value of BIM to the organization, DTGO.

ROI value reflects the cost that is anticipated wasting on construction activities to meet the requirement according to quality and safety standard. ROI value is considered as cost representing amount of money and time to deliver the project according to <a href="BEP Section G2.7">BEP Section G2.7</a>: Return on Investment.

BIM consultant is assigned for delivering ROI report to project owner when the project closes out.



# **SECTION Q**

## **Appendices and Attachment**

### Section Q: Appendices and Attachment

No.	Title	File Location on BIM 360 DOCs	File Type
Q1	Project Standard		
Q1.1	DTGO OIR Template	00_Project Standard > 03_Templates	
Q1.2	Information Management Responsibility Matrix	00_Project Standard > 03_Templates	
Q1.3	BIM Handbook	00_Project Standard > 02_Handbook	.pdf
Q1.4	Asset Information Deliverable	00_Project Standard > 03_Template	.zip
Q2	BIM Project Process		
Q2.1	BIM Master Workflow	00_Project Standard > 01_BEP	
Q3	Model Management		
Q3.1	Model Management Report	00_Project Standard > 01_BEP	
Q3.2	Workset Management	00_Project Standard > 01_BEP	
Q3.3	DTGO Model LOD-LOI	00_Project Standard > 01_BEP	
Q4	Quality Control		
Q4.1	BQC 4 Checklist	00_Project Standard > 06_Quality Control Checklist	
Q4.2	BQC 5 Checklist	00_Project Standard > 06_Quality Control Checklist	
Q4.3	BQC 6 Checklist	00_Project Standard > 06_Quality Control Checklist	
Q5	Clash Detection		
Q5.1	Color Appearance	00_Project Standard > 03_Templates	
Q5.2	Clash Search Sets	00_Project Standard > 03_Templates	
Q5.3	Clash Tests	00_Project Standard > 03_Templates	
Q5.4	Clash Report	00_Project Standard > 03_Templates	
Q5.5	ROI Report	00_Project Standard > 03_Templates	
Q6	Asset Information Manageme	ent	
Q6.1	FM Inventory Format	00_Project Standard > 03_Templates	
Q6.2	FM Revit Template	00_Project Standard > 03_Templates	
Q7	Project Closed-out		
Q7.1	Evaluation and Impact Assessment	00_Project Standard > 03_Templates	

