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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 Appendix Q1.1:
DTGO OIR Template, 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" "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 Section 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 Appendix Q1.3: 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 Section F2.1: 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 Appendix Q1.3: BEP Construction

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	Estimated Completion Date	Designer	Deliverables
Design Phase				
Schematic Design	(Date: mm/yyyy)	(Date: mm/yyyy)	(Company Name)	(2D Drawing)
Drawing Package for EIA	(Date: mm/yyyy)	(Date: mm/yyyy)	(Company Name)	(2D Drawing)
Drawing Package for Permission	(Date: mm/yyyy)	(Date: mm/yyyy)	(Company Name)	(2D Drawing)
Drawing Package for Tender	(Date: mm/yyyy)	(Date: mm/yyyy)	(Company Name)	(2D + 3D)
Drawing Package for For-Con.	(Date: mm/yyyy)	(Date: mm/yyyy)	(Company Name)	(2D + 3D)

Note - The schedule would be updated and confirmed by owner and architect

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)

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.)

Architecture Designer

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

Structure Engineer

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



MEP Engineer

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

Landscape Designer

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

Interior Designer

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

Automated Parking 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.)

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
Plan Phase	1. Programming	
	2. Site Analysis	
	3. Phase Planning (4D Modeling)	
	4. Cost Estimation	
Design Phase	1. Design and Coordination	
	1.1 Design Authoring	
	2. Design Review	
	2.1 Building Code Validation	
	2.2 Structural Analysis	
	2.3 Mechanical Analysis	
	2.4 Lighting Analysis	
	2.5 Other Engineering Analysis	Ш
	3. 3D Coordination	
	3.1 Clash Detection	
	4. Phase Planning (4D Modeling)	
	4.1 Construction Planning and Monitoring	
	5. Cost Estimation	
	5.1 Quantity Take-Off	
	6. Sustainability (6D)	
	6.1 Sustainability Evaluation	
	6.2 Energy Analysis	
	7. Return on Investment	

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



Software Agreement



Section D: Software Agreement

D1: BIM Platform

Table D1: 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.

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 subscription)	Contractors	project member
Document Management/	BIM360 Design	BIM Consultant	Equal to accessing
Project Admin	(Bring one's own subscription)		project member

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.

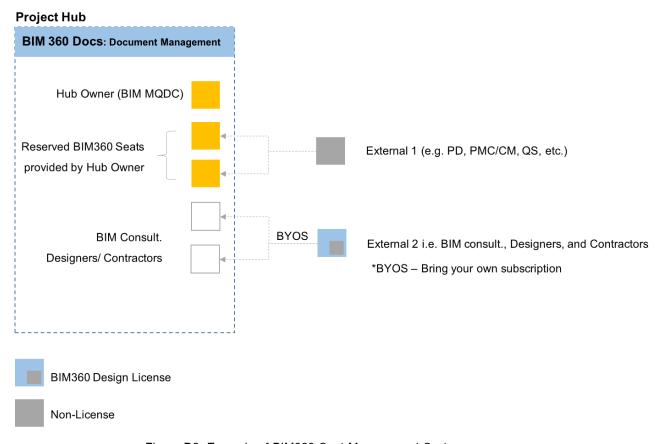


Figure D2: Example of BIM360 Seat Management System



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

Type - ปริมาณ	Unit - หน่วยวัด	Example
Length	m	1.23 m
	mm	1235 mm
Area	m ²	1235.00 m ²
Volume	m ³	1235.00 m ³
Angle	٥	12.35°
Slope	٥	12.35°
Mass Density	kg/m ³	1234.57 kg/m ³

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:

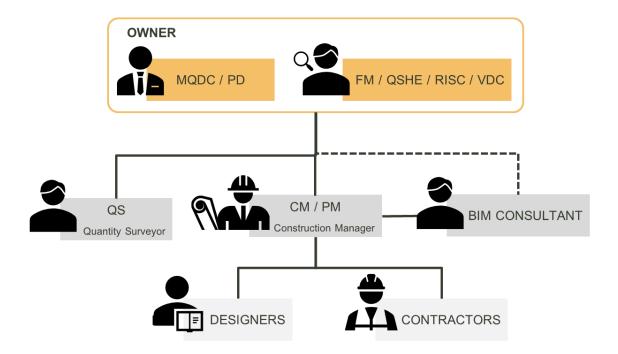


Figure E1.1: Organization Chart

Note – For dash line = - - , CM shall revise organization chart depending on project's contracts and agreements.

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

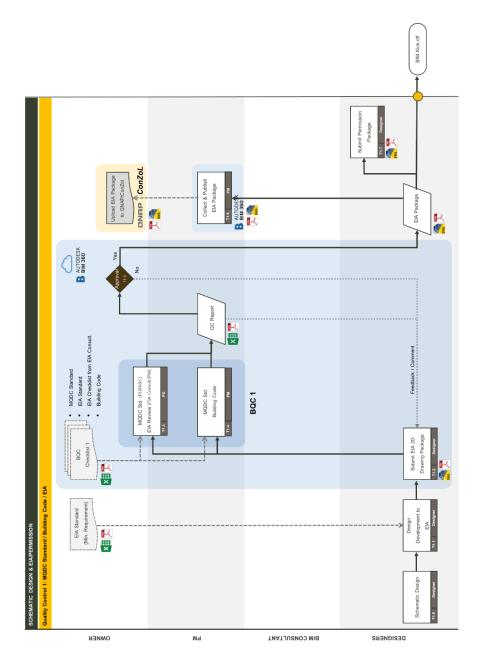


Figure F1.1: BIM Workflow from Schematic to EIA/Permission



Table F1.1: BIM Workflow from Schematic to EIA/Permission

Task No.	Activities	Description	Action By	Output			
Design Ph	Design Phase						
T1: Schen	T1: Schematic Design – EIA / Permission						
T1.0	Schematic Design	Schematic design development to confirm Area Ratio (CFA/ GFA/ NFA/	Designers	Schematic Design			
		Green Area) and Plan/Section/Elevation and Building Height		Package			
T1.1	Design Development to	Design Development to EIA/Permission stage. Designers shall review	Designers	-			
	EIA/Permission	design intent with EIA Standard before submitting a package					
T1.2	Submit 2D EIA Package	Submit 2D drawing for review and approval process.	Designers	EIA 2D Drawing			
			(AR, ST, MEP)				
T1.3	MQDC Standard and EIA	Review design with regards to MQDC Standard, EIA Standard and EIA	PD, RISC, EIA	QC1 Report			
	Review	Checklist from EIA Consult.	Consult.				
T1.4	MQDC Standard and Building	Review design with regards to MQDC Standard and Building Code	CM/ PM	QC1 Report			
	Code Review	mentioned in Appendix Q4.1: BQC Checklist 1 and then create QC					
		Report used for T1.5 approval process.					
T1.5	Approval 2D EIA Package	Review and approve EIA Package. If the package is rejected, a responsible	PD/RISC	-			
		person must revise and resubmit the package again.					

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ctivities	Description	Action By	Output		
Design Phase					
EIA / Permission					
lish 2D EIA	Collect and upload EIA Package and QC Report to Published Files Folder	CM/ PM, PD	EIA Package		
	on BIM360 Docs and QNAP/ConZol.				
ssion Package	Submit Permission Package	Designers	Permission		
			Package		
)		EIA / Permission Dish 2D EIA Collect and upload EIA Package and QC Report to Published Files Folder on BIM360 Docs and QNAP/ConZol.	EIA / Permission Diish 2D EIA Collect and upload EIA Package and QC Report to Published Files Folder on BIM360 Docs and QNAP/ConZol. CM/ PM, PD		



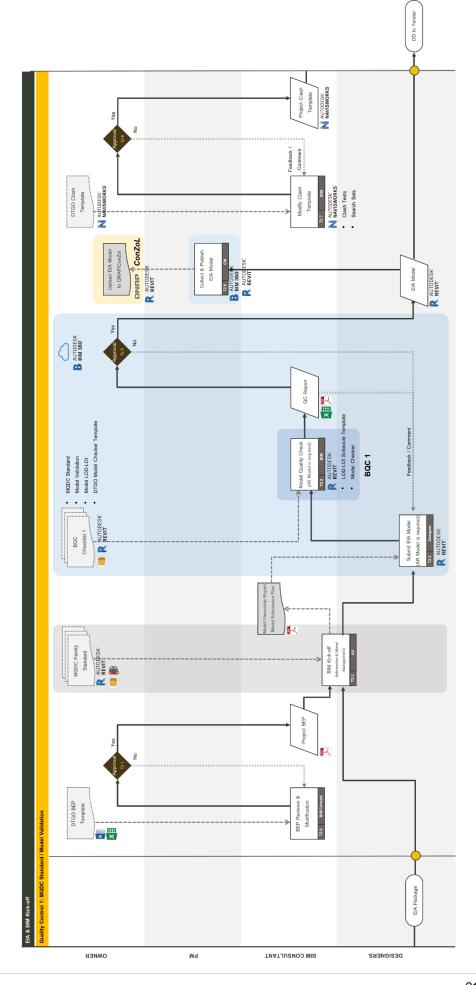


Figure F1.2: BIM Workflow from EIA to BIM Kick-off

Table F1.2: BIM Workflow From EIA to BIM Kick-off

Task No.	Activities	Description	Action By	Output			
Design Ph	Design Phase						
T2: EIA - E	BIM Kick-off						
T2.0	BEP Revision & Modification	Modify DTGO BEP Template to create new Project BEP.	BIM Consult.	-			
T2.1	Approval Project BEP	Review and approve Project BEP	PD	Project BEP			
T2.2	BIM Kick-off	Arrange a meeting for BIM Kick-off to announce the BIM execution plan and MQDC Family Standard	BIM Consult.	Model Ownership Report Model Submission Plan			
T2.3	Submit EIA Model	Submit 3D Model for review and approval process.	Designers (AR Model is required)	EIA Model			
T2.4	Model Quality Check	Review AR model according to Model LOD-LOI, Model Validation Checklist and DTGO Model Checker Template mentioned in Appendix Q4.1: BQC Checklist 1 and then create QC Report used for T2.5 approval process.	BIM Consult.	QC1 Report			



Task No.	Activities	Description	Action By	Output
Design Ph	nase			
T2: EIA - I	BIM Kick-off			
T2.5	Approval EIA Model	Review and approve EIA Model. If the package is rejected, a responsible	PD	-
		person must revise and resubmit the package again.		
T2.6	Collect & Publish EIA Model	Collect and upload EIA Package and QC Report to Published Files Folder	CM/ PM, PD	EIA Package
		on BIM360 Docs and QNAP/ConZol		
T2.7	Modify Clash Template	Modify DTGO Clash Template to create Project Clash Tests.	BIM Consult.	-
T2.8	Approval Project Clash	Review and approve the Project Clash Template.	PD	Project Clash
	Template			Template

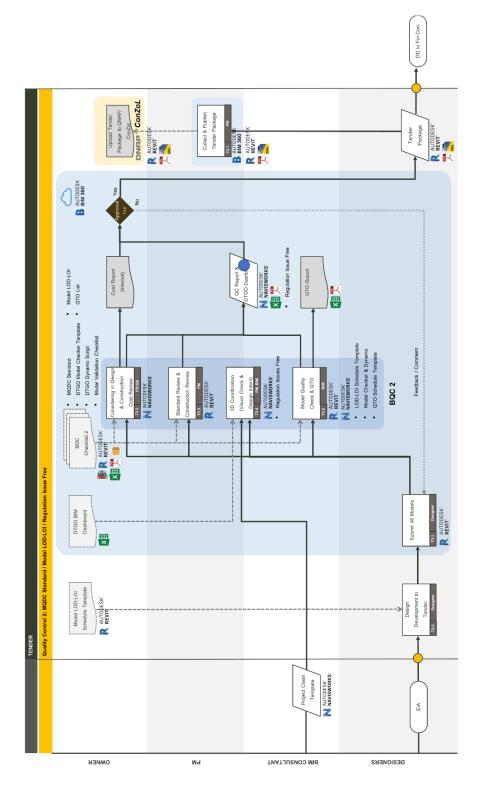


Figure F1.3: BIM Workflow for Tender



Table F1.3: BIM Workflow for Tender

Task No.	Activities	Description	Action By	Output			
Design Ph	Design Phase						
T3: Tende	T3: Tender						
T3.0	Design Development to Tender	Develop design for Tender. Designers shall review their model with regards	All Designers	-			
		to DTGO Model LOD-LOI Schedule Template mentioned in Section G:					
		Quality Control					
T3.1	Submit All Models	Submit model for review and approval process	All Designers	All Models			
T3.2	Considering in Design &	Considering in design and construction together with review and approve	PD, QS	Cost Report			
	Construction and Cost Review	construction cost estimation from QS					
				QC2 Report			
T3.3	Standard & Construction Review	Review design standard and construction detail with regards to BQC 2	CM/ PM	QC2 Report			
		details mentioned in Appendix Q4.2: BQC Checklist 2 and then create QC					
		Report used for T3.6 approval process.					
T3.4	3D Coordination (Visual Check &	Combine model for visual check and review design intent with regards to	CM/ PM,	Clash Report			
	Design Intent)	building code and regulation issues from Top 20	,	3.3.3			
	Doolgi. Intolly	Samuring source and regulation located from rep 20	BIM Consult.				

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Task No.	Activities	Description	Action By	Output				
Design Ph	Design Phase							
T3: Tende	T3: Tender							
T3.5	Model Quality Check & QTO	Review models according to Model LOD-LOI, Model Validation Checklist and DTGO Model Checker Template mentioned in Appendix Q4.2: BQC Checklist 2 and then create QC Report used for T2.6 approval process. Additionally, a responsible person shall take quantities from the model and create the QTO report, more details in Section H: Quantity Take-off Protocol	BIM Consult.	QC2 Report				
T3.6	Approval Tender Package	Review and approve Tender Package. If the package is rejected, responsible person must revise and resubmit the package again.	PD					
T3.7	Collect & Publish Tender Package	Collect and upload Tender Package and QC Report to Published Files Folder on BIM360 Docs and QNAP/ConZol	CM/ PM, PD	Tender Package				



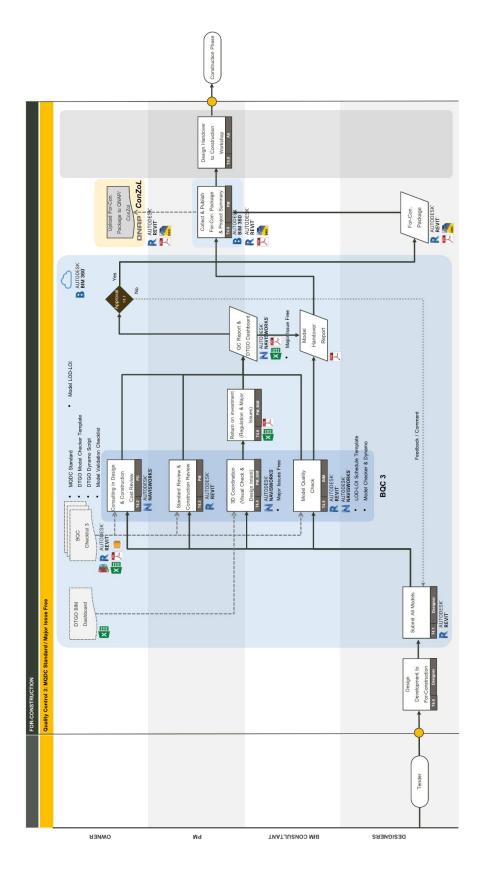


Figure F1.4: BIM Workflow for For-Construction

Table F1.4: BIM Workflow for For-Construction

Task No.	Activities	Description	Action By	Output			
Design Phase							
T4 For-Co	T4 For-Construction						
T4.0	Design Development to For-Construction	All Designers	-				
T4.1	Submit All Models	Submit models for review and approval review and approval process	All Designers	All Models			
T4.2	Considering in Design & Construction and Cost Review	Considering in design and construction with regards to construction cost estimating.	PD	QC3 Report			
T4.3	Standard & Construction Review	Review design standard and construction detail with regards to BQC 3 details mentioned in Appendix Q4.3: BQC Checklist 3 and then create QC Report used for T4.7 approval process.	CM, PM	QC3 Report			
T4.4	3D Coordination	Combine model for visual check and review design intent with regards to major issues.	CM/ PM, BIM Consult.	Clash Report			

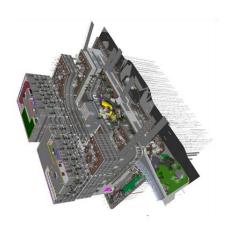


Task No.	Activities	Description	Action By	Output		
Design Phase						
T4 For-Co	onstruction					
T4.5	Model Quality Check Review models according to Model LOD-LOI, Model Validation Checklist and DTGO Model Checker Template mentioned in Appendix Q4.3: BQC Checklist 3 and then create QC Report used for T2.6 approval process. Additionally, a responsible person shall create a model handover report at this stage.		BIM Consult.	QC3 Report		
T4.6	Return on investment (ROI)	Collect all regulation and major issues from the 3D Coordination process to create ROI Report	CM/ PM, BIM Consult.	ROI Report		
T4.7	Approval For-Con. Package	Review and approve For-Con. package. If the package is rejected, a responsible person must revise and resubmit the package again.	PD	-		
T4.8	Collect & Publish For-Con. Package	Collect and upload For-Con. package and QC Report to Published Files Folder on BIM360 Docs and QNAP/ConZol	CM/ PM	For-Con. Package		
T4.9	Design Handover to Construction Workshop	Handover For-Con. package and BIM report to contractor for construction phase.	CM/ PM, BIM Consult.	-		

Note – The overview of BIM Master Work can be found in Appendix Q2: BIM Project Process

F2: Design Milestone

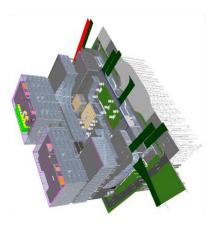
Design Milestone represents the operating procedures of BIM between preliminary design and pre-construction by combining all relevant disciplines consisting of architecture, structure, building services, landscape, and interior design. This intends to reduce time spent on communication by gathering significant information from all relevant factors required for pursuing work. These result in the sequential submission as follows.



detail and accuracy in response to The model information shall have the All designers shall submit model with MAJOR CLASH FREE Project Information Requirement (PIR).

MAJOR ISSUE FREE

FOR-CONSTRUCTION



detail and accuracy in response to the All designers excluding IN & LN shall The model information shall have the REGULATION basis of cost estimation. with submit model CLASH FREE

design review and design coordination

with regards to MQDC standard.

AR MODEL SUBMISSION

BIM Model shall be main tool used for

proceeding the design development.

needed

information

relevant

Project plan layout shall be confirmed at this stage. This shall include all

REGULATION ISSUE FREE

AR MODEL SUBMISSION

SCHEMATIC DESIGN &

EIA/PERMISSION

TENDER

Figure F2.1: Example of Design Milestone



F2.1: Project Deliverables

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

Table F2.2: Project Deliverables

		Design Phase			
	Schematic - EIA		Tender	For-Construction	Design Handover
		BIM Kick-off	BQC2	BQC3	Design Handover to
	Activities	BQC1 - Design Review - MQDC Standard Review - Building Code - EIA Check - Model Validation	- Design and Cost Review - MQDC Standard Review - Model Validation Check - 3D Coordination focus on Regulation Issue - Quantity Take-off	- Design and Construction Review - MQDC Standard Review - Model Validation Check - 3D Coordination focus on Major Issue - Return on Investment	Construction Phase
Model		- AR Model Submission	- All models with Regulation Clash Free	- All models with Major Clash Free	- For-Construction Model Package
Drawing	Deliverables	- EIA Drawing Package	- Tender Drawing Package	- For-Con. Drawing Package	- For-Con. Drawing Package
Document		- QC Report 1 - Project Boundaries and Area	- QC Report 2 - Cost Report - QTO Report - Specification Book	- QC Report 3 - ROI Report - Specification Book	- Model Handover 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		.IVU.IIWC	
Interior Model				
Landscape Model	For-Con.		.rvt/.nwc	
Façade Model	For-Con.			
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 Beneft	Tender –	Every month	ndf	
Clash Detection Report	For-Con.		.pdf	
QTO Report	Tender	End of Tender	.pdf	
POI Poport	For-Con.	End of Pre-	ndf	
ROI Report	FOI-COII.	Construction	.pdf	



F2.2: Model Submission

After the approval process, all approved BIM deliverables package shall be combined into one single file by linking model for all typical floors into the main model before publishing and archive the package at each state. Additionally, for the For-Construction package, all designers 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 the Design Phase, as shown in Figure F2.3

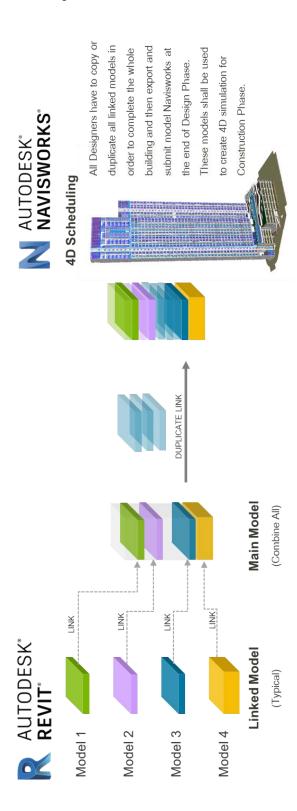


Figure F2.3 Model Submission

F3: Meeting Procedure

Table F3.1: Meeting Procedure

Meeting Type –		Project Stage	
ประเภทการประชุม	Schematic – EIA	Tender	For-Con.
BIM Kick-off			
Frequency	Once before creating a	-	-
	model		
Objective	BEP announcement and	-	-
	BIM model agreement		
Participant	Owner, Designers, CM,	-	-
	BIM Consult.		
Project Meeting			
Frequency	As per project agreement	As per project agreement	As per project agreement
Objective	QC1: Review Design,	QC2: Review Design &	QC3: Review
	Building Code, and EIA	Construction, Regulation	Construction, Major Issue
	Check	Issue, and Construction	
		Cost	
Participant	Owner, Designers, CM/	Owner, Designers, CM/	Owner, Designers, CM/
	PM, BIM Consult.	PM, BIM Consult.	PM, BIM Consult.
BIM Monthly Meeting			
Frequency	Monthly	Monthly	Monthly
Objective	Track and report project	Track and report project	Track and report project
	progress	progress	progress
Participant	VDC, BIM Consult., Etc.	VDC, BIM Consult., Etc.	VDC, BIM Consult., Etc.



Meeting Type –		Project Stage	
ประเภทการประชุม	Schematic – EIA	Tender	For-Con.
Design Handover			
Meeting			
Frequency	-	-	Once at the end of the
			design phase
Objective	-	-	Handover For-Con.
			Package and BIM
			summary report to the
			contractor.
Participant	-	-	Owner, Designers, CM/
			PM, BIM Consult.,
			Contractor

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

F3.1: BIM Kick-off

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

Agenda	Description	BEP reference	Key Person
1. BIM Kick-off (Design Pl	ase)		
1.1. BIM Goals and Objectives	BIM Goals and Objectives BIM Uses	Section C: Project Goals and BIM Uses	BIM Consultant
1.2. Organization Chart	Roles and Responsibilities	Section E: Organizational Structure	All
1.3. BIM Software Agreement	 BIM Platform and Software Version BIM360 Seat Policy 	Section D: software Agreement	All
1.4. Project Timeline & Deliverables	Project DeliverablesModel Submission	Section F2: Design Milestone	All
1.5. BIM Master Workflow	 Schemetic - EIA Tender For-Con. Design Handover 	Section F1: BIM Master Workflow	BIM Consultant
1.6. Information Management	 Information Exchange Protocol BIM360 Docs Folder Structure BIM360 Design Collaboration BIM360 Review and Approval process 	Section F4: Information Management	BIM Consultant
1.7. Model Management	 DTGO Naming Convention Model Structure Project Coordinates Model Responsibilities MQDC Family Standard DTGO Schedule/Quantity Template 	Section F5: Model Management	All



Age	enda	Description		BEP reference	Key Person
1. BIM Kick-	off (Design Pha	se)			
1.8. Qual	lity Control	•	BIM Quality Control	Section G1: Quality	BIM Consultant
Chec	ck		Checklist	Control and Section G2:	and PMC/CM
		•	MQDC Standard	Clash Detection Protocol	
		•	EIA Standard		
		•	Model Validation		
		•	MQDC Model Checker		
		•	Clash Detection Protocol		

F4: Information Management

F4.1: Information Exchange

The above diagram 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.
- 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.
- 4. Goodwill is the internal database used to collect BIM issues and ROI report after the project closed-out.

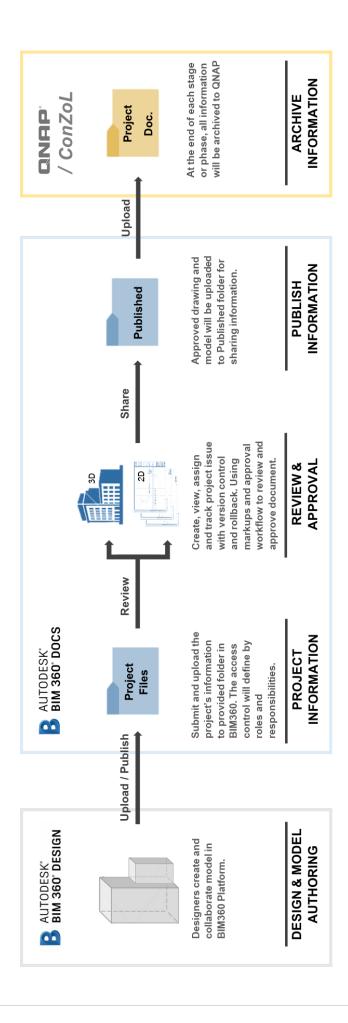


Figure F4.1: Information Exchange

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:

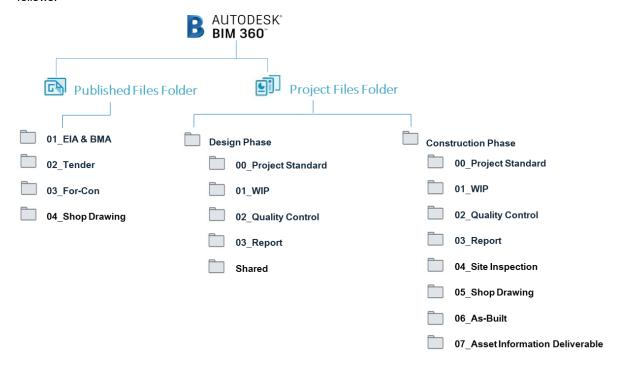


Figure F4.2.1: BIM 360 Docs Folder Structure

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

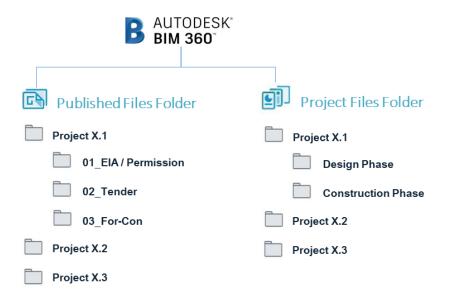


Figure F4.2.2: Folder Structure for the Large Project



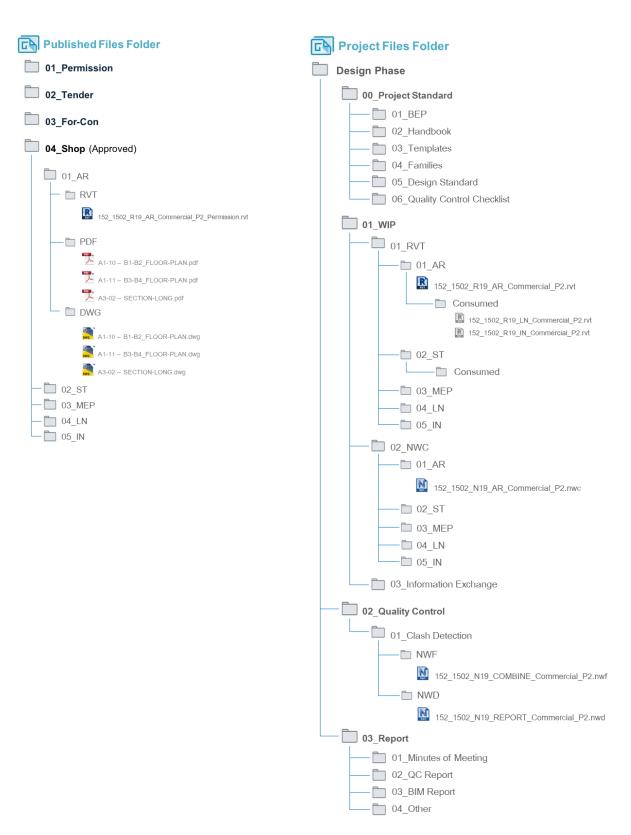


Figure F4.2.3: BIM360 Docs Information Management

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 File	s Folder			
01_EIA / Permi	ission		Published and shared document of EIA	PM
			Package	
	01_AR	BIM Summary	BIM Summary Report	BIM Consult.
		01_RVT	3D Revit Model Package	PM
		02_PDF	2D Drawing Package	PM
		03_DWG	2D AutoCAD Files Drawing	PM
		Other	Other relevant information e.g. Design Spec.	PM
	02_ST			
	03_MEP			
02_Tender			Published and shared document of Tender	PM
			Package	
	01_AR			
	02_ST			
	03_MEP			
	04_LN			
	05_IN			
03_For-Con			Published and shared document of For-Con.	PM
			Package	
04_Shop			Published and shared document of Shop	PM
			Drawing & Model Package	
05_As-Built			Published and shared document of As-Built	PM
			Package	



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 Name	Sub-Folder	Sub-Folder	Description	Resp. Party	
Project Files F	older				
00_Project Sta	ndard				
	01_BEP		Project BEP and Appendix	All	
	02_Handbo	ok	DTGO BIM Handbook	All	
	03_Templat	te	DTGO Standard Template	Designers, BIM Consult.	
	04_Family		MQDC Family Standard	Designers	
	05_Design	Standard	MQDC Design Standard	PD, CM/ PM, Designers	
	06_Quality Control Checklist		BQC Checklist		
01_WIP			Work in Process files folder for designers		
	01_RVT	01_AR	Revit Model	Designers	
		02_ST			
		03_MEP			
		04_LN			
		05_IN			
	02_NWC	01_AR	NWC Navisworks Model	Designers	
		02_ST			
		03_MEP			
		04_LN			
		05_IN			
	03_Informa	tion	Shared and exchanged information for design	Designers	
	Exchange		collaboration	<u>, </u>	

Folder Name	Sub-Folder Sub-Folder	Description	Resp. Party			
02_Quality Co	ntrol	Clash Detection model and report				
	01_NWF	NWF Navisworks Model used for Clash	BIM Consult.			
	02_NWD	NWD Navisworks Model Report				
04_Report		Project Report				
	01_Minutes of Meeting	Minutes of Meeting	CM/ PM, BIM			
			Consult.			
	02_QC Report	Quality Control Report	Designers, CM/			
			PM, BIM			
			Consult.			
	03_BIM Report	BIM Report	BIM Consult.			
	04_Others	Other relevant information	BIM Consult.			

F4.3: Design Collaboration

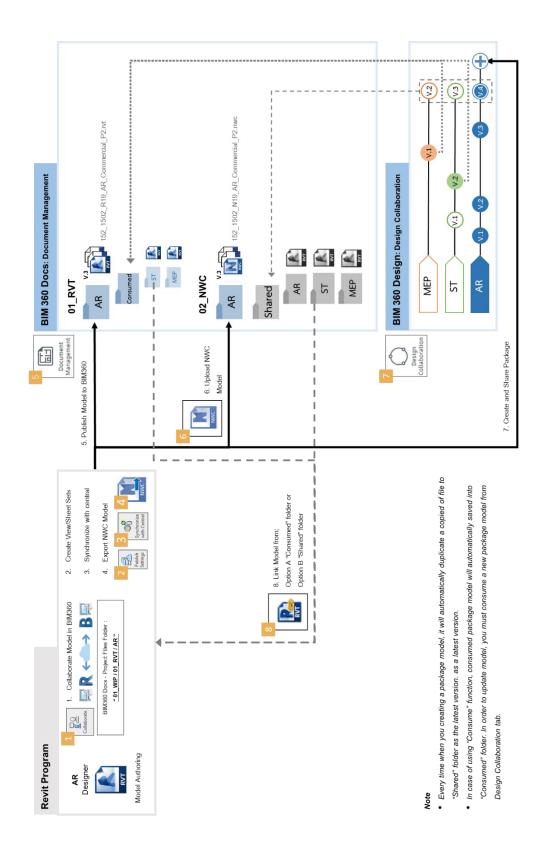


Figure F4.3: Model Collaboration

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
O	LITIK WIOGEI	Link Live – selecting live model from folder "Shared"
		Link Non-Live – selecting model package from folder
		"Consumed".
		Consumed .

F4.4: 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 F4.4 and more details can be found in BIM Handbook – Section: BIM360



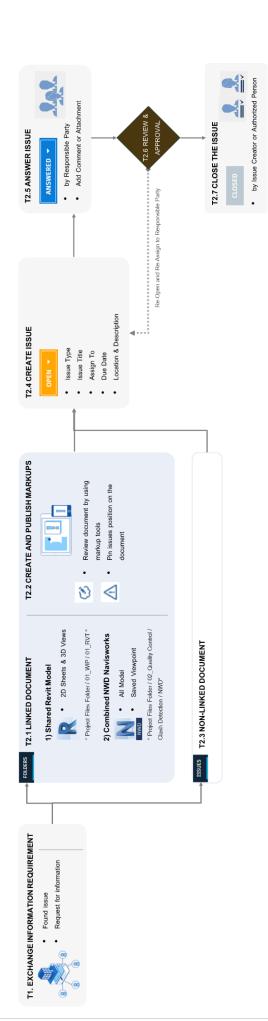


Figure F4.4: BIM360 Issues Workflow

F4.5: 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.

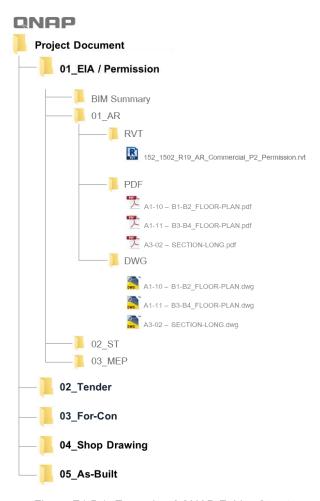


Figure F4.5.1: Example of QNAP Folder Structure

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



Figure F4.5.2: 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

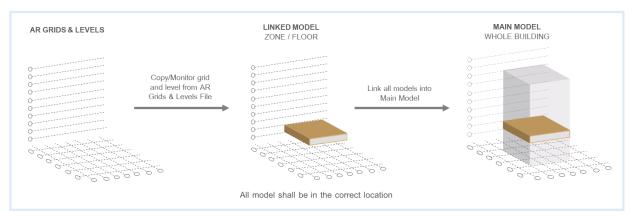


Figure F5.2: Project Coordinates

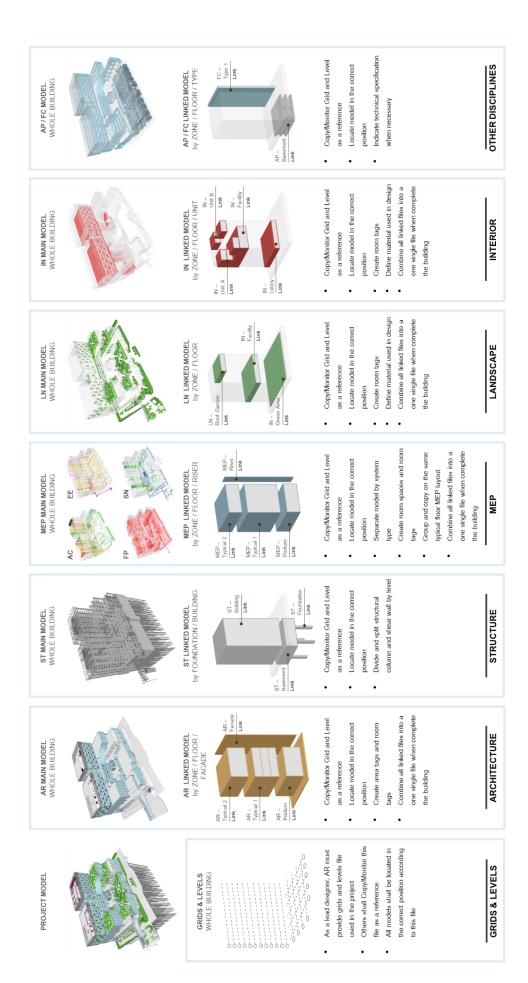


Figure F5.2: Example of Model Structure Concept

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 design phase, the architect 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 model.

Example of the project coordination report can be found in Appendix Q3.1: 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	N/S E/W		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	าุ่มอาคาร					
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.

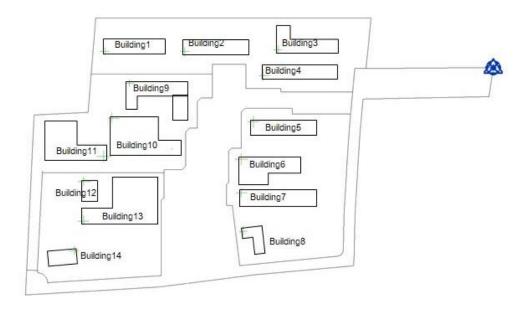


Figure 5.2.1.1: Example of Project's Master Layout

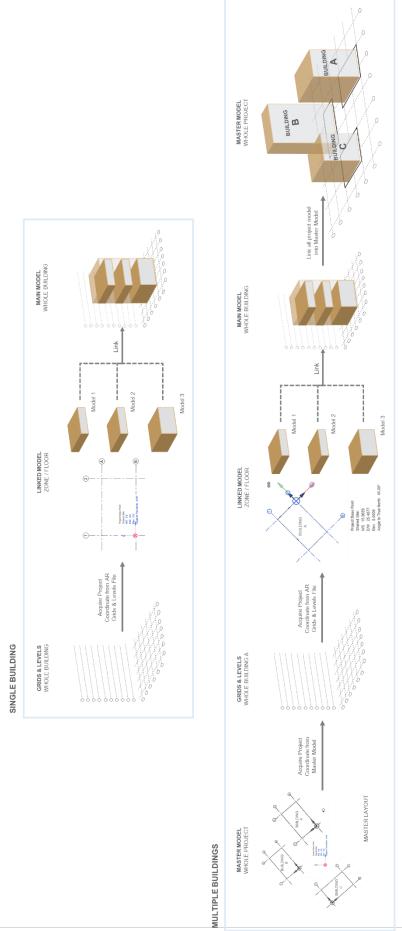


Figure5.2.1.2: Example of Survey Point and Project Base Point Setup



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.

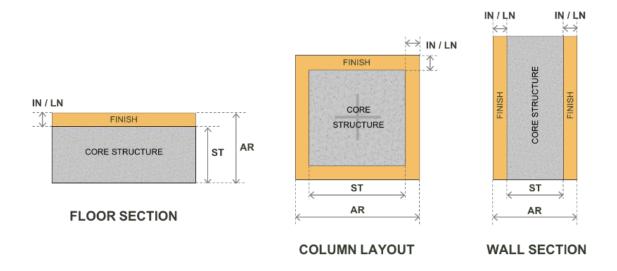


Figure F5.3.1: Example of Model Responsibility



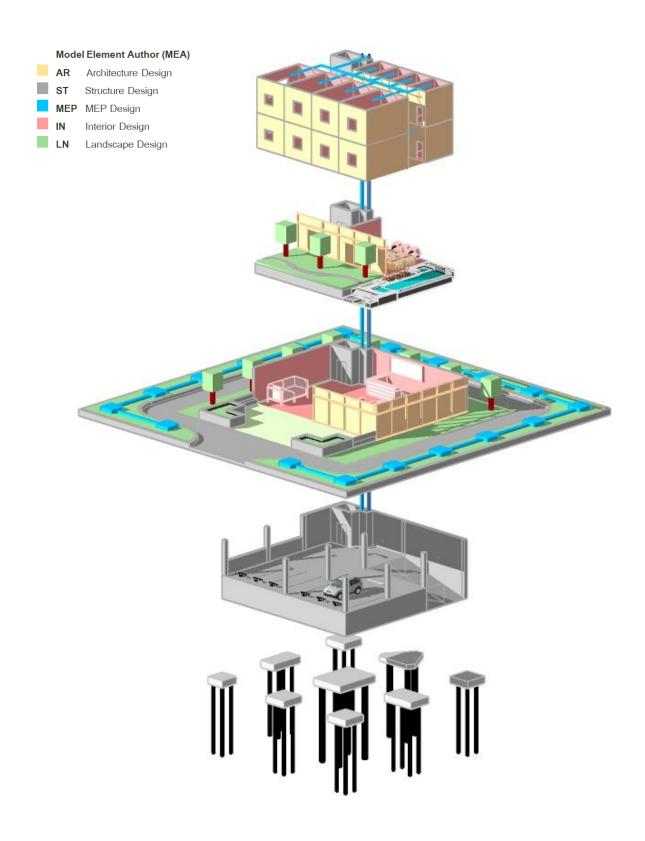


Figure F5.3.2: Example of Model Element Author

Table F5.3: Model Ownership

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

							Info.	: Information	ผู้ให้ข้อมูลสนับ	สนุน
	۵					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	-	-	-	-	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	-	-	-



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>

Project Files Folder Design Phase 00_Project Standard 01_BEP 02_Handbook 03_Templates 04_Families DTGO_Door_SS_Single-Swing_R20.rfa 05_Design Standard 01_WIP 02_Quality Control 03_Report

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 Description>_<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

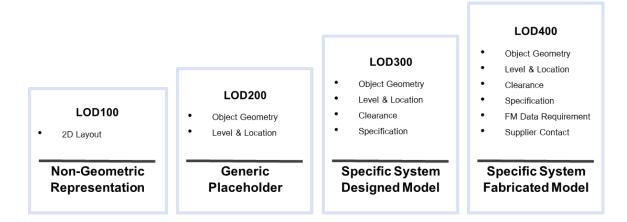
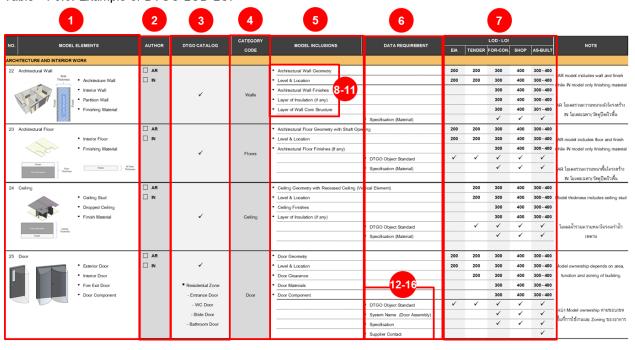


Figure F5.6: Model LOD Definition



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, S		
		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

	Design Phase				
	Schematic - EIA	Tender	For-Construction		
Checklist	BQC1	BQC2	BQC3		
	- MQDC Standard	- MQDC Standard	- MQDC Standard		
	- Building Code	- Model Validation	- Model Validation		
	- EIA Standard	- Model LOD-LOI	- Model LOD-LOI		
	- EIA Checklist from EIA Consult.	- QTO List			
	- Model Validation				
	- Model LOD-LOI				

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

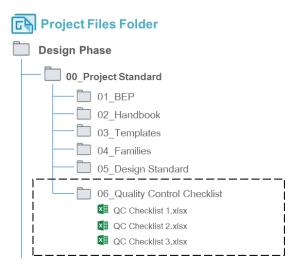


Figure G1: QC Checklist File Folder



G1.1: MQDC Standard

This design review aims to ensure the basic information of the project at the initial design stage with regards to MQDC Standard Checklist. Quality check procedure shall use Design Checklist in Appendix Q4: Quality Control

G1.2: 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

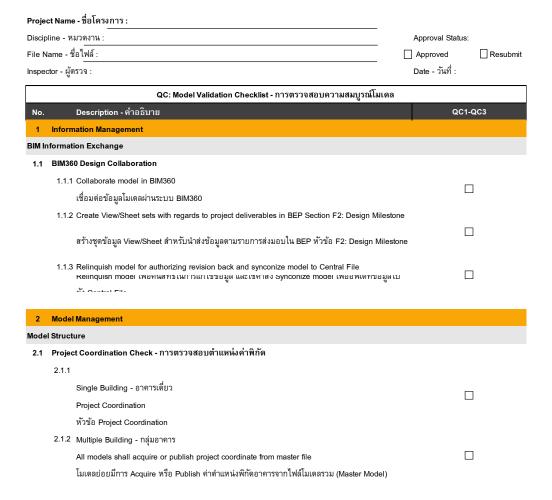


Figure G1.2: Example of Model Validation Checklist

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.

G1.3: 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

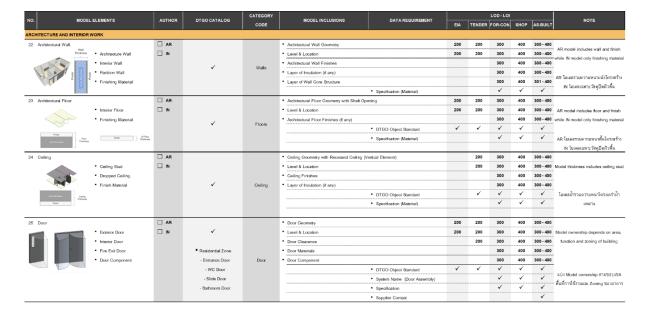


Figure G1.3: Example of Model LOD-LOI Checklist

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.

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

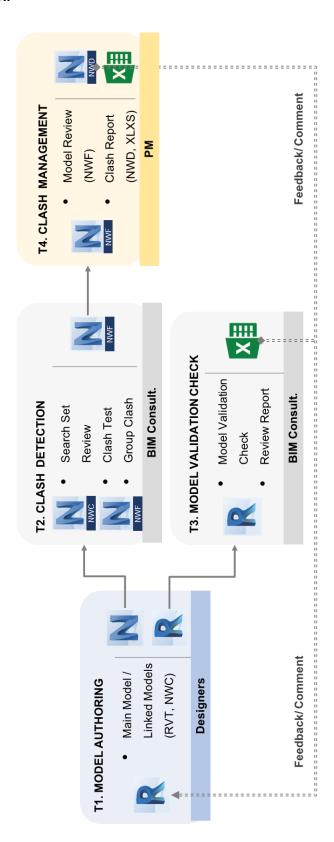


Figure G2.2.1: Clash Workflow

Table G2.2: Clash Responsibility

Task No.	Activities	Description	Action By
T1	Model Authoring	 Create Model Internal Clash Detection Provide NWC Model for Clash Detection Revise model as per clash issues or design changes 	Designers / Contractors
T2	Clash Detection ตรวจสอบ Clash	 Recheck NWC Model, Search Sets and update Clash Tests Prepare NWF Model for grouping and running clash . 	BIM Consult.
ТЗ	Model Validation Check ตรวจสอบความ สมบูรณ์โมเดล	 Review RVT Model in accordance with DTGO Model LOD-LOI and Model Validation Checklist Create Model QC report 	BIM Consult.
Т4	Clash Management จัดการ Clash	 Review design standard and constructability Manage group clash with regards to the DTGO Standard and Top 20 Issues. Create Clash Report and prepare relevant document needed for project meeting Summarize the meeting outcomes and create Clash Tracking 	CM



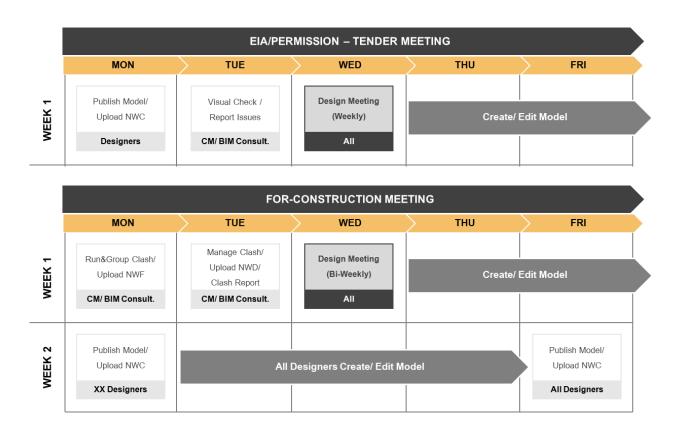


Figure G2.2.2: Example of Loop Modeling

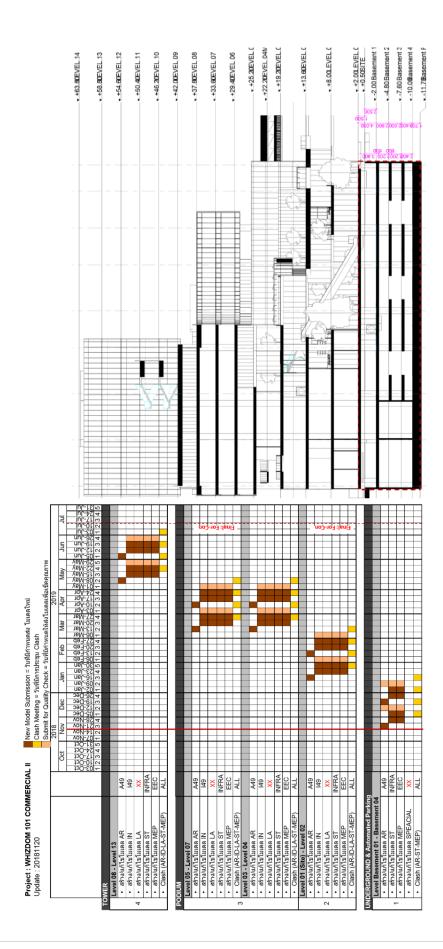


Figure G2.2.3: Example of Clash Detection Plan



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>, 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					11	_		L		ΑP			s					ΕE			AC			SN		F
ST = Structural	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15			18	19	20	21	22	23	24	25	26	27	28	29	30	31
LN = Landscape								aut									۱a							ιt			nt				
IN = Interior							ð	Equipment									Shear Wall							Equipment			Equipment		e.		
EE = Electrical			_				/ind	<u>E</u> du	ē		yok	<u></u>					She							quip			quip		xtr		
AC = Air Conditioning			wal				> 2	lfy	ishi		Ninc	ME	abe				∞ಶ			lion		ay.		8 E					P P	ent	
ME = Mechanical FP = Fire Protection		_	ä.	m	١.	ng	rar	acia	ᇤ	g	8	_ 	lsca	ting			nin	mn	.	ndat		:&Tr	duit	ıre	.	_	are	_	de High	ibi	
SN = Sanitary	*	<u>8</u>	Curt	Solu	Stail	Ceilli	8	Spe	loor	jii	oor	ixtri	Harc	Jan	₹	Slab	-ran	Solu	Stair	-our	Site	Juc	Son	Fixtı	Dnc	Pipe	Fixt	Pipe	Plu	Equ	Pipe
AP = Automated arking	FC_All**	AR_Floor	AR_Curtain wal	AR_Column	AR_Stair	AR_Ceiling	AR_Door and Window	AR_Speacialty	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**	Ë		1					_	_	_		_			1	0)	0)	0)	0)	0)	0)	ш		ш	1	1	_	0)	0)	0)	Ë
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 Wall	l		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						5				5						1	1	1	1	1	1										
25 AC_Duct			1			5	10			5	10				T	1	1	1	1	1	1										
26 AC Pipe			1			1	10			1	10				1	1	1	1	1	1	1										
27 ME_Fixture & Equipment						5	10			5	10				_	1	1	1	1	1	1										
28 SN_Pipe			1			1	10			1	10		1	1	1	1	1	1	1	1	1										
29 SN Plumbing Fixture						5	10			5	10				+	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				\dashv	1	1	1	1	1	1										
						-	10			10	10				-	1	1	1	1	1	1										
32 FP_Fixture & Equipment							10			10	10					1		1	1		1										

Note – more details of the selection of two Sets of elements in model can be found in Appendix Q5.2: Clash
Search Sets and Appendix Q5.3: Clash Tests



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

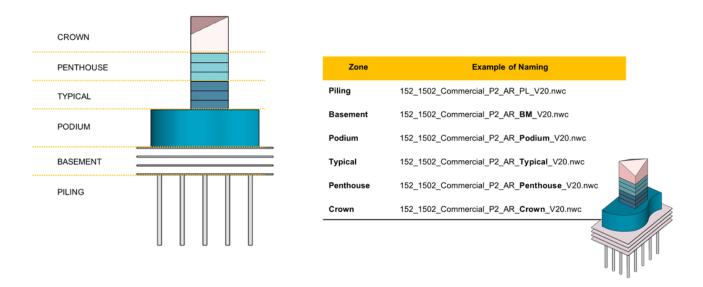


Figure G2.5.1: Example of Clash Zone and Naming

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.

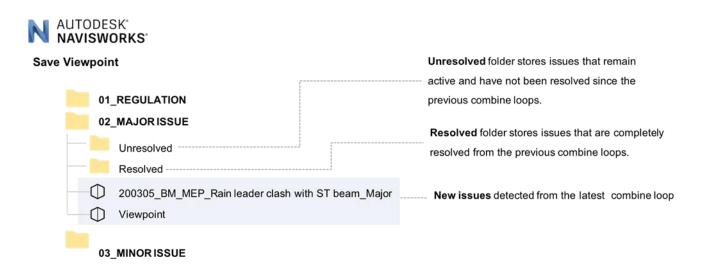


Figure 2.5.2: Clash Management Folder Structure

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.

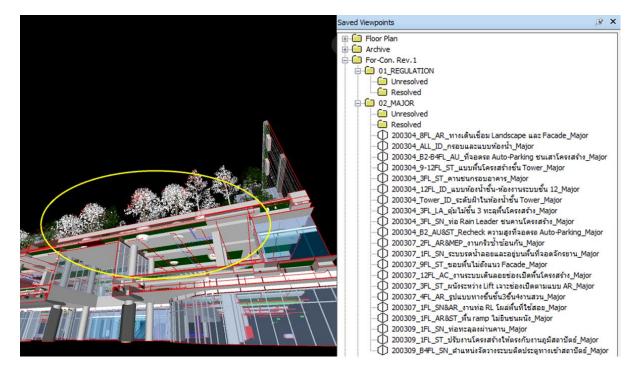


Figure 2.5.3 Example of Clash Issue



G2.6: Clash Report

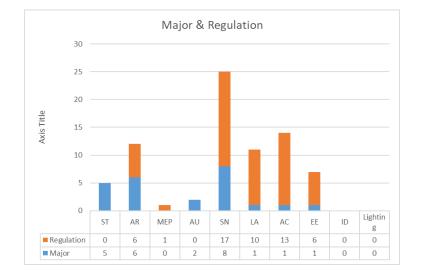
After the clash detection process and grouping are done, the clash report will be produced as a guideline for model revision or as an approval document when the model is clash free. The reports consist of

1. **DTGO Project Dashboard** (.xlsx) – a report in excel file format, which illustrate BIM coordination progress and issue to project owner (VDC) on date 15th and 30th 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 <mark>↓r</mark>)ate Clo	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	IN		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	IN		แบบท้องน้ำชั้น-ท้องงานระบบชั้น 12	IN	Resolved	20/05/07	
5	20/03/04	Zone Tower	Major	IN	MEP	ระดับฝ้าในห้องน้ำชั้น Tower		Resolved	20/05/07	
6	20/03/07	1 FL	Major	SN	LA	ระบบ รคน้ำลอย และ อยู่บนพื้นที่จอคจักรยาน	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		งานระบบเดินลอยช่องเปิดพื้นโครงสร้าง	AC	Resolved	20/05/07	
9	20/03/07	3 FL	Major	AR	ST	ผนังระหว่าง Lift เจาะช่องเปิดตามแบบ AR	ST	Resolved	20/05/07	



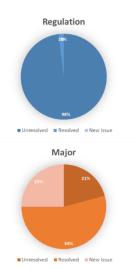


Figure G2.6.1 Example of Clash Tracking Report

Minor	Action	Quantity	Status
Unresolved	V	59	Minor
Resolved	V	28	32%
New Issue	V	0	68%
Minor Issue Summary	87	7	
Cost Saving (THB)	0		■ 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 Appendix Q5.4: Clash Report Template.

Table G2.6: DTGO Top 20 Issues

No.	Description								
Regul	Regulation 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	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								



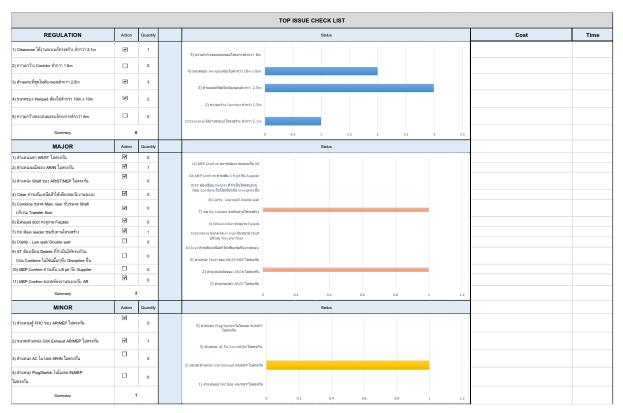


Figure G2.6.3 Example of Top 20 Issues Report

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.



Figure 2.7 Example of ROI Calculation Diagram



SECTION H

Quantity Take-Off

Section H: Quantity Take-Off Protocol

H1: Quantity Take-Off

One of the benefits in which BIM can be used is quantity take-off (QTO) by using DTGO Schedule Template. Indeed, the QTO list cloud be review and revised specifically by project. In consequence, this aims to use BIM (5D) to conduct a cost feedback back to the team. In this project, Revit software will be used for cost estimating. DTGO Schedule Template can be found in Appendix Q1.5: DTGO Schedule/Quantity Template.



H2: QTO Workflow

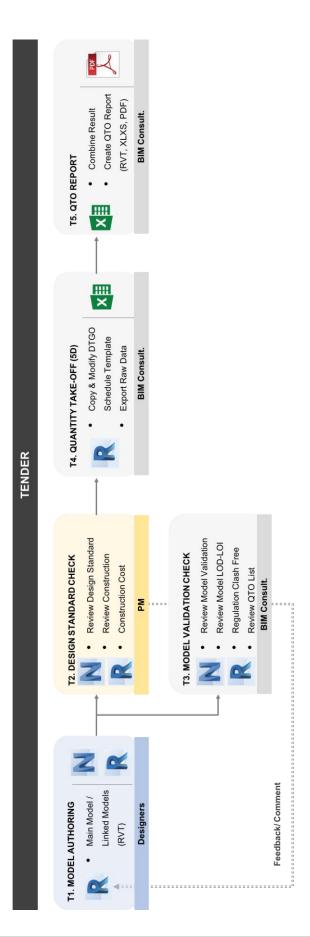


Figure H2.1: QTO Workflow

Table H2.1: QTO Roles and Responsibility – ตารางแสดงหน้าที่ความรับผิดชอบ

Task No.	Activities	Description	Action By
T1	Model Authoring	All designers develop the design for Tender and	Designers
		shall review their design and model with regards	
		to Section G: Quality Control	
T2	Design Standard Check	Consulting and review design and construction	CM/ PM
		with regards to MQDC Standard and construction	
		cost estimating for BQC2 Process.	
Т3	Model Validation Check	Review model validation, model LOD-LOI, and	BIM Consult.
		QTO list with regards to BQC2 process	
T4	Copy and Modify Schedule	Modify DTGO Schedule/Quantity Template as	BIM Consult.
	Template	appropriated.	
T5	Export Schedule and	Export Schedule and combine result to create	BIM Consult.
	Combine Raw Data	QTO Report	



H3: QTO List - Schedule/Quantity Templates

Schedule/Quantities shows selected information and quantities of elements in the model. For more information please see Appendix Q1.5: DTGO Schedule/Quantity Templates

Table H3.1.1: Model Elements and Materials Take-off: Architecture and Interior

QTO List	Unit	Example
Architecture and Interior		
Area / Room	Area	CFA / GFA / NFA Area (AR)
		Room Function (AR / IN)
Wall Partition / Wall Type / Wall Finish	Area	Brick Wall ,Precast Wall ,CMU ,Curtain Wall
Floor Type / Floor Finish	Area	F8_EPOXY 1mm_50mm
Ceiling / Ceiling Finish	Area	AR-CT3-50mm Gypsum Plaster and Paint
Door & Window	Set	Elevator Door ,Wood door
Aluminum Glazing		
Sanitary Ware	Set	Water Closet ,Urinal ,Lavatory
Louver, Grille	Set	
Railing	Length	
Roof Type / Roof Finish	Area	Roof Tile
Staircase Finish	Area	Riser and Tread Finishing

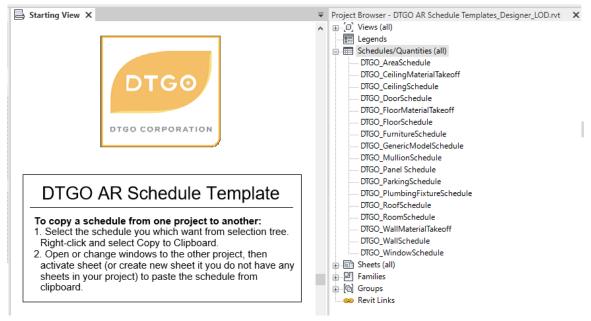


Figure H3.1.1: DTGO Schedule Template for Architecture and Interior

Table H3.1.2: Model Elements and Materials Take-off: Landscape

QTO List	Unit	Example
Landscape		
Floor Type / Floor Finish	Area	Walkway , Paving
Planter Finishes	Area	
Plaster	Area	
Swimming Pool Finishes	Area	Swimming Pool Tiles
Staircase Finishing	Area	

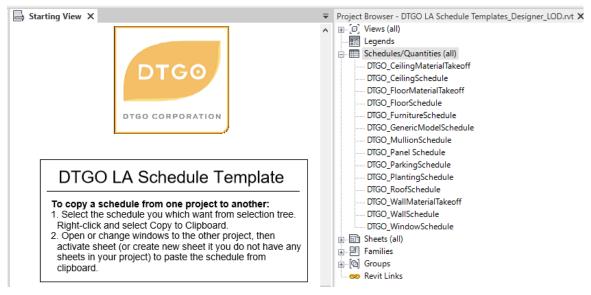


Figure H3.1.2: DTGO Schedule Template for Landscape

Table H3.1.3: Model Elements and Materials Take-off: Structure

QTO List	Unit	Example
Structure		
Foundation	Volume	
Structural Wall	Volume	Shear Wall ,D Wall ,Retaining Wall Water Tank
		Precast Wall
Structural Concrete Column	Volume	
Structural Concrete Beam	Volume	
Structural Floor	Area	Slab on Ground ,Post Tension ,Structural Road
		,RC Slab
Structural Stair	Volume	
Structural Ramp	Volume	
Steel Structure	Length	Steel Column Steel Beam



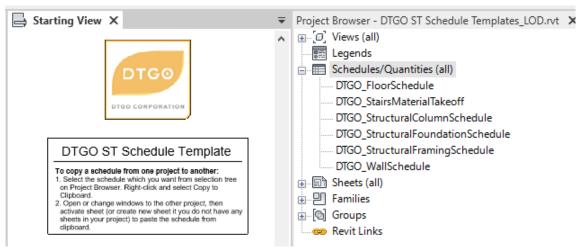


Figure H3.1.3: DTGO Schedule Template for Structure

Table H3.1.4: Model Elements and Materials Take-off: Sanitary Systems

QTO List	Unit	Example
Sanitary Systems		
Main Equipment	Set	Fire Pump ,Jockey Pump ,Oil Tank
Fire Alarm System	Set	Heat Detector ,Smoke Detector ,Fire Alarm Horn
		,Surface Loudspeaker ,Manual Pull Station ,
		Remote Indicator
Fire Hose Cabinet & Portable Fire	Set	Recess Type Cabinet ,Stand Type Cabinet , Dry
Extinguisher		Chemical ,CO2
Fireman Telephone Outlet	Set	
Piping Work	Length	PP-R ,HDPE ,GSP ,BP , PVC ,RCP
Pipe Accessories & Fitting	Set	Swing Check Valve ,Control Valve ,Gate Valve
		,Butterfly Valve

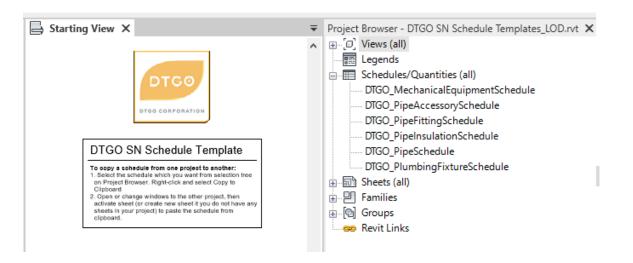


Figure H3.1.4: DTGO Schedule Template for Sanitary Systems

Table H3.1.5: Model Elements and Materials Take-off: Fire Protection Systems

QTO List	Unit	Example
Fire Protection Systems		
Main Equipment	Set	Fire Pump ,Jockey Pump ,Oil Tank
Fire Alarm System	Set	Heat Detector ,Smoke Detector ,Fire Alarm Horn
		,Surface Loudspeaker ,Manual Pull Station ,
		Remote Indicator
Fire Hose Cabinet & Portable Fire	Set	Recess Type Cabinet ,Stand Type Cabinet , Dry
Extinguisher		Chemical ,CO2
Fireman Telephone Outlet	Set	
Piping Work	Length	PP-R ,HDPE ,GSP ,BP , PVC ,RCP
Valve & Pipe Accessories	Set	Swing Check Valve ,Control Valve ,Gate Valve
		,Butterfly Valve
Sprinkler Head	Set	

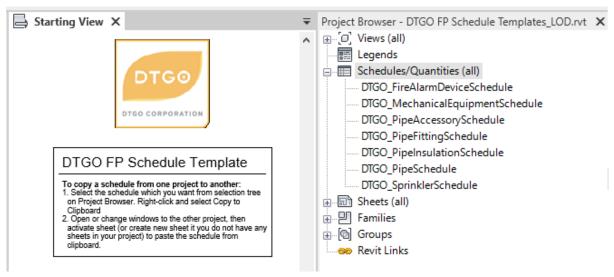


Figure H3.1.5: DTGO Schedule Template for Fire Protection Systems



Table H3.1.6: Model Elements and Materials Take-off: HVAC systems

QTO List	Unit	Example	
Air Conditioning Systems			
Main Equipment	Set	Water Chiller , Cooling Tower , Water Filter	
conditioner condensing unit (CDU)	Set		
Air Handing Unit (AHU)	Set		
Fan Coil Unit (FCU)	Set	Ceiling Cassette ,Ceiling Conceal ,ERV, Ceiling	
		Mount ,Wall Type	
Ventilating Fan	Set		
Air Terminal	Set	Air Louver ,Air Grille ,Air Diffuser ,Air Register	
Piping Work	Length	' Chilled Water Pipe ,Condenser Water Pipe	
		,Condensate Drain	
Valve & Pipe Accessories	Set		
Duct Work	Surface	Round Duct ,Rectangular Duct	

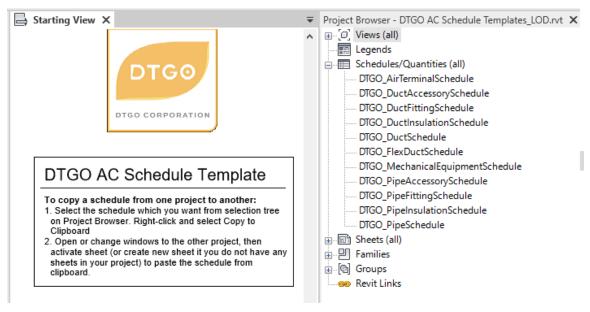


Figure H3.1.6: DTGO Schedule Template for HVAC systems

Table H3.1.7: Model Elements and Materials Take-off: Electrical system

QTO List	Unit	Example		
Electrical System				
Main Equipment	Set	Transformer ,Ring Main Unit ,Distribution Board		
		, Panel board ,Control Panel , RTU (Remote		
		Terminal Unit)		
Cable & Wire	Length	conduit ,EMT Conduit		
Raceway	Length	Cable Tray, Wire Way , Busduct		
Switch & Outlet	Set	Power Outlet ,Communication Outlet ,single pole		
		switch ,double pole switch		
Lighting Fixture	Set	Downlight ,Emergency Exit Sign		
Security and Access Control System	Set	ссту		
Lightning Protection System & Grounding	Set	Ground Bars ,Ground Test Box		
System				
Closed Circuit TV System	Set	Data Rack , Master Antenna Television (MATV)		
Main Equipment	Set	Transformer ,Ring Main Unit ,Distribution Board		
		, Panel board ,Control Panel , RTU (Remote		
		Terminal Unit)		

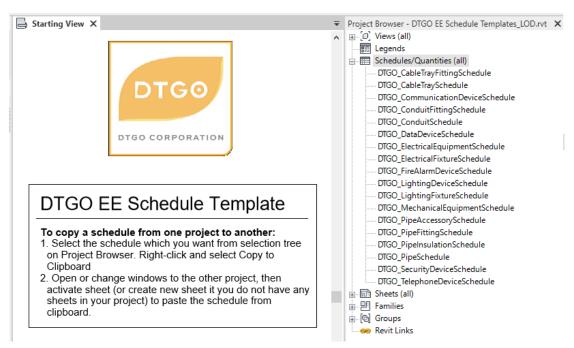


Figure H3.1.7: DTGO Schedule Template for Electrical system



SECTION

Construction Sequencing

Section I: Construction Sequencing

I1: 4D Scheduling

4D scheduling implementation in field operation plays an instrumental role in linking construction sequencing, according to master schedule, with the visual geometry of BIM model. More details are in BIM Handbook – Section: 4D Scheduling

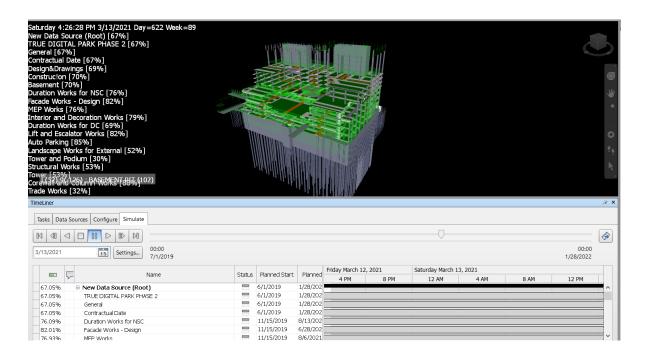


Figure I1: Example of Navisworks 4D Timelier



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	00_Project Standard > 03_Templates	
	Responsibility Matrix	00_FT0Ject Standard > 05_Templates	
Q1.3	BEP Construction	00_Project Standard > 01_BEP	.pdf
Q1.4	BIM Handbook	00_Project Standard > 02_Handbook	.pdf
Q1.5	DTGO Schedule/Quantity	00_Project Standard > 03_Templates	
	Template		
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 1 Checklist	00_Project Standard > 06_Quality Control Checklist	
Q4.2	BQC 2 Checklist	00_Project Standard > 06_Quality Control Checklist	
Q4.3	BQC 3 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	

