MARU 360

BIM EXECUTION PLAN

PRE-CONSTRUCTION

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VERSION3.0

Standard BIM Execution Plan

Pre-Construction Phase

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1.0 START UP

1.1 Introduction

Ananda Development realizes the benefits of Building Information Modelling (BIM) Process in design throughout to the construction process of the building. BIM Process allows all parties to efficiently collaborate throughout the project lifecycle, in turn conveys the highest quality products to the clients.

BIM Execution Plan is a necessity in this process as it provides a guideline for all parties to proceed through the project together. This plan is to be agreed upon the beginning of the project, while maybe adjust to best fit the nature of each party in order to effectively serve the project goals

1.1.1 Document Overview

The goal of this document is to provide the framework for all project team members to execute Building Information Modelling (BIM) Process to achieve the organisational goals indicate in Section 1.2 Model Use. BIM Execution Plan (BEP) is created to ensure that.

- BIM Goals for the organisation is accomplished.
- All project team members understand their role and responsibilities in BIM Process.
- All project team members utilize consistent standards and guideline.

BIM Execution Plan (BEP) laid out critical information such as modelling procedure and model management, collaboration techniques, information exchange procedures and deliverables requirements.

1.1.2 Document Control

A. Document Development

The information contained in this document has been prepared with the understanding that this is a live document and may require periodic updates throughout the duration of the project to reflect the progress of the project and incorporate newly agreed procedures and workflows. Initial authorship by Dwp City Space Co., Ltd. in June 2017, revised by Lumpini Wisdom and Solution Co., Ltd. in August 2018.

B. Version Definition

Rev. 1.0: This is the first major release of the document. All other major releases will be 2.0, 3.0 etc.

Rev. 0.1: The first iteration of the document. For each minor change to the document, use the decimal revision numbers to indicate the status of the current update process (0.2, 0.3, 1.1, 2.1 etc.).

Revisions starting with 0 (e.g. 0.1, 0.2) are draft issues for comment. Documents with a 0 revision number have not formally been issued.

C. Confidential Information

This document is made available to the Maru 360 Group on the express understanding that the information obtained in it will be regarded and treated by the Maru 360 Group, their contractors and their sub-contractors on their BIM projects as strictly confidential. The contents of this document are intended only for the sole purpose and use of Maru 360 Group, their contractors and their sub-contractors on their BIM projects and not to be distributed to any other person outside the scope of this document.

D. Disclaimer

The materials in this document are provided for the fitness of particular project purposes. The document is intended to be guidance, there is no guarantee of completeness of information, text, graphics links or other items contained in this document. There is no warranty and assurance of success for implementation of this materials.

1.2 Model Use

This section defines the objectives of using BIM in this project. As BIM is the mixture of the virtual model and information within, there are many applications of the process. The BIM Execution Plan and model requirements should be designed with achieving the BIM objectives in mind. The BIM goals identified in this project during Design phase are:

Table 1.1 Model Use

Goals	Objectives
Quality	Visualisation and Coordination; Design Coordination through 3D model allows project members to have proficient decision making as the model provides more clarity than drawings and all the information in all disciplines are collaborated. This method allows users to realise design and construction the issue in virtual model rather than on the construction site, improving quality of the overall process and the building. Documentation; Models will be used to ensure coordinated documentation which will be used on site.
Quantity and Cost	Quantity Extraction; The Model provides allows automatic extraction of quantity, improve speed and accuracy of quantity take-off. This is due to the integrated information in the model.

1.3 Organisational Chart

This section explains roles involve in BIM process. This organisation chart demonstrates the hierarchy and stakeholders in a particular project.

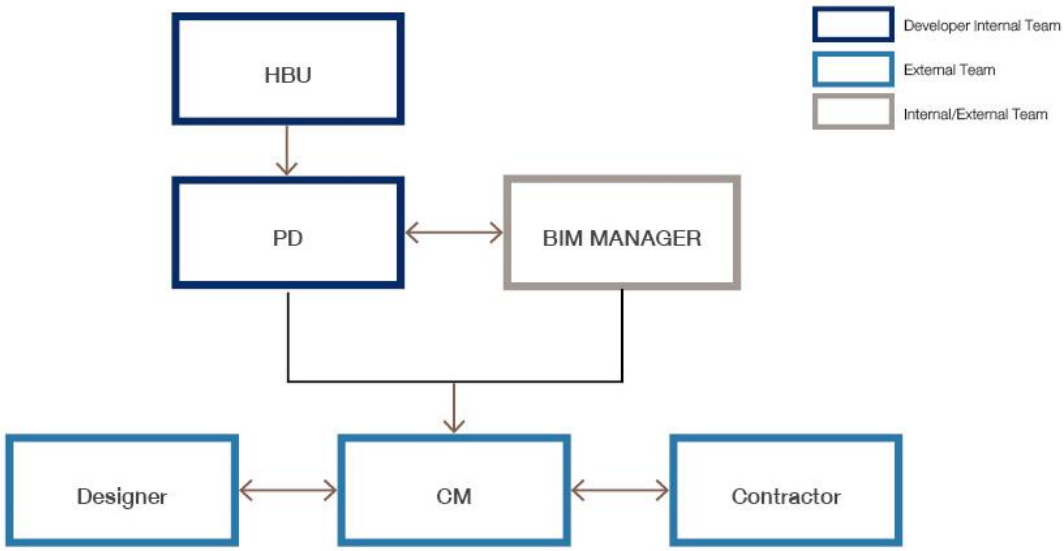


Figure 1.1 Organisational Chart

The personal shall have appropriate skills, attitudes and understanding of BIM process in order to perform the tasks. All parties shall have responsible person assign for the role indicate in this chapter.

Table 1.2 Organisational Role and Position

	Team	Role	Position
Owner/Developer	Head Business Unit (HBU)	Make decisions regarding design concept and design directions.	
	Product Design (PD)	Consult for major design changes and approve product at phase end.	
	BIM Manager	Studies, plans and monitor to develop most effective and efficient BIM process for achieve project goals in both design and construction phase.	• Manager • Coordinator • Technical Specialist
	Quantity Surveyor	Provide unit price for quantity extract from the model and take off quantity for non-model elements.	• Quantity Surveyor • Quantity Validator

Table 1.2 Organisational Role and Position

Team	Role	Position
Designers	Create BIM Model for design phase and collaborate with other parties. Produce For-Construction Drawings from model to be used on site.	• Manager • Coordinator • Modeller
Contractors	Create BIM Model for construction phase and revise design for constructability as well as collaborate with other parties to update construction plan and pass on information to BIM Manager Team BIM Team and Construction Manager (CM). Produce Shop Drawings from model to be used on site.	• Manager • Coordinator • Modeller
Construction Manager (CM)	Coordinate information from designers/contractors to update construction plan and pass on information to BIM Manager Team. BIM Team as well as assist in model management and control to track BIM Uses outcome.	• Manager • Coordinator - AR & ST • Coordinator - MEP Coordinator - LA • Coordinator - IN •

It is suggested that each party have all of the positions indicate above, however, if the one person is capable of more than one positions as elaborate below, the party may have less staff.

1.3.1 Role Description

Each position has the following responsibility

Table 1.3 Role Description

Position	Responsibility
Manager	Controls and plan the process of his/her team according to standard and agreed plan for effective progress to achieve project goals. Manager may include but not limited to; Project Manager, BIM Manager, Project Architect, Project Engineer and Cost Estimator.

Position	Responsibility
Coordinator	Ensures effective progress through communication within his/her own party and with associate parties.
Modeller	Creates and modifies and controls models of his/her own discipline according to requirements, ensuring that the models can serve project goals or allow next designated parties to utilize model to achieve project goals.
Technical Specialist	Consult and experiment on process which involve the technical aspect of the program in order to ensure the most effective BIM process.

1.4 Modelling Agreement

1.4.1 Software

The software which is used throughout the project is obligated to be the same software version as the beginning of the project.

Table 1.3 BIM Software

Usage	Software	Version*	Native File Format
Model Authoring (All Discipline)	Autodesk Revit	2018	RVT
Model Federation and Review	Autodesk Navisworks Manage	2018	NWC, NWF, NWD
Clash Detection	Autodesk Navisworks Manage	2018	NWC, NWF, NWD
Construction Sequence Animation	Autodesk Navisworks Manage	2018	NWC, NWF, NWD
Cost Estimation	Autodesk Revit	2018	RVT
	Autodesk Navisworks Manage	2018	NWC, NWF, NWD
	Excel		

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

1.4.2 Revit Project Template

All model disciplines shall be created from Revit Project Template which contains Standard Family elements provided by BIM Manager (Owner) unless discussed otherwise. The current project template contains standard system family and can be download from ***Family Catalogue and Project Template*** in Maru 360 Standard page.

1.4.3 Starting View

All Revit files are required to have a "Starting View", the first page visible when open the model, to ensure team members are working in the correct file. The minimum information required to be included on this page are;

- Company name (Final Ownership)
- Project name
- File name
- Discipline
- Model contents in the file
- Project Coordination
- Software Version
- Linked file organisation/structure diagram

1.4.4 Model Coordination System

A common building grid shall be established and used by all members of the design teams. When the teams in project want to refer to system that is using in the model, or which coordinates are defined on point.

A. Shared coordinates

Coordinates in a file will only be shared, or the files will have shared coordinates after a process of transferring the coordinate system used in a file into another. It does not matter if in two files the location is exactly the same. They will be not sharing coordinates unless the sharing coordinates process has been carried out.

How to: Link model/sheet using Shared coordinates

1. Click Insert tab >> Link panel, select Link or Import file.
2. In the Import/Link dialog, select the model, required to link in the project, from the current project location.
3. For Positioning, select “Auto – By Shared Coordinates”.

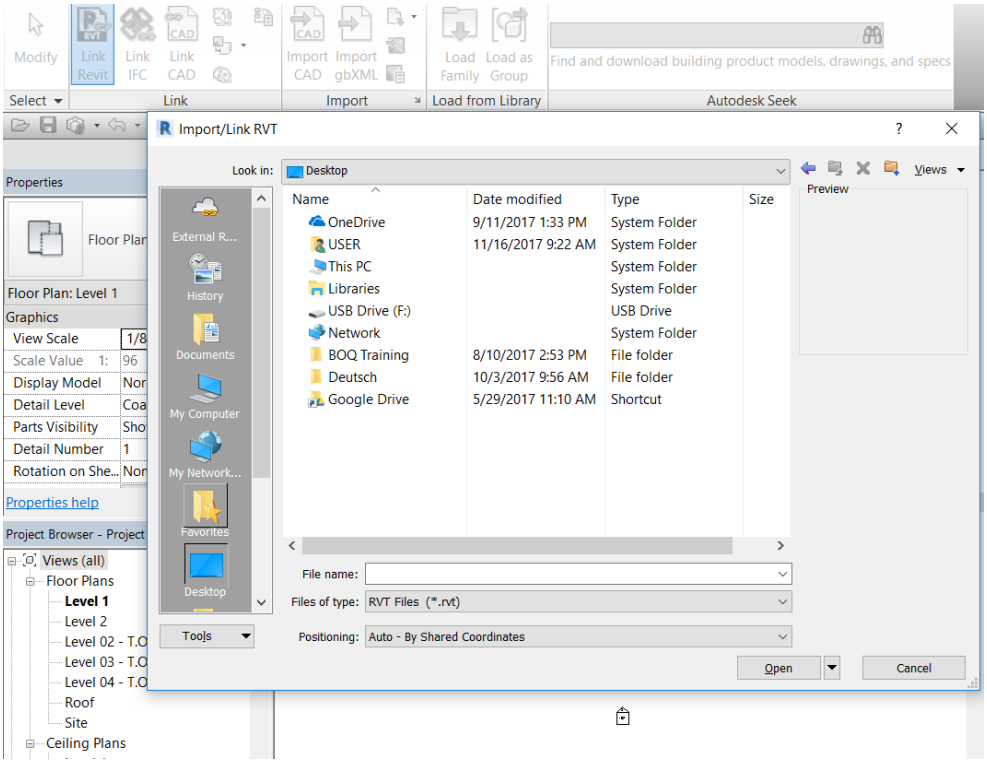


Figure 1.2 How to: Link model/sheet using Shared coordinates

Normally there is one file, and only one, that is the source for sharing coordinates. From this file the location of different models is transferred to them, and after that all files will be sharing coordinates, and be able to be linked with the “Shared Coordinates option”.

For ANANDA, this file is the AR_Grid.rvt file which all disciplines shall use as a reference and copy monitor both gridlines and levels from this file.

B. Origin points in Revit

First thing to understand in Revit is how many coordinates systems we have in a project, that is also how many coordinates origin points we can find in a model:

- The Survey Point (SP)  This is the point that stores the universal coordinate system, or a defined global system of the project to which all the project structures will be referred. The Survey Point must be set to the actual site survey point before the DD100 model submission.
- The Project Base Point (PBP)  The position of this point is unique for each model, and this information is not shared between different models. Project Base point could be placed in the same location as the Survey Point, but it is not usual to work in that way.

All models in the same project shall share the coordinate system from AR_Grid.rvt file or any referent architectural model within project provided by architectural modeller. The Survey Point coordinate and Project Base Point coordinate are set as agree at the beginning of the project and shall be consistent throughout all the Revit files.

1.4.5 Unit Measurement

Models shall use consistent units and measurement across the project. Default project units for design shall be millimetres in order to employ a sufficient level of accuracy.

- Switching between Imperial/Metric units shall be avoided where possible in order to maintain proper or conventional measurements.
- CAD data shall be scaled to the appropriate units prior to linking into BIM environment.

2.0 BIM PROCESS

2.1 Project Phase Description

This section provides the overview and expectation for each phase, including the consequence of the output require for the phase submission. The detail in of deliverables in each phase will be elaborated in Section 2.2.2 BIM Objective and Deliverable.

The following Project Phase Diagram shows the concept of model development from the beginning of the project to the hand-over to customers. Full-size diagram can be found in *Appendix A1 – Project Phase*.

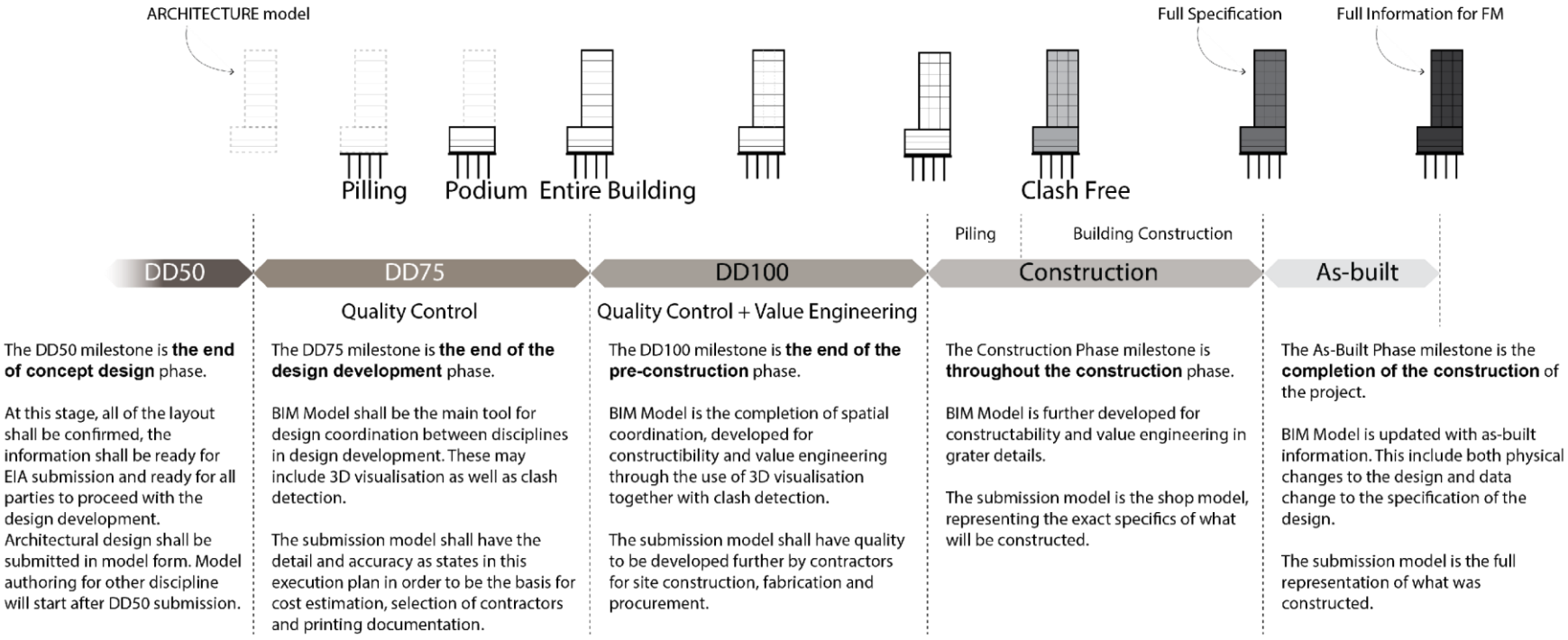


Figure 2.1 Project Phase

2.2 BIM Plan

2.2.1 Master Workflow

The master workflow in the following page illustrates how BIM process is implemented throughout the project stages. The workflow is explained below, however the details process of each step will be further explained in the own chapter indicated. Full size diagram can be found in *Appendix A2 - Master Workflow.*

BIM process could be implemented from the very start of the project as a design tool, helping to analyse feasibility of the space. The model then shall be developed to be more accurate and contain more information. Submitting DD50 stage, architects shall have their models ready for other discipline to work on.

All models producing in DD75 stage shall be checked to ensure that the quality of model is capable to achieve BIM goals. These processes may vary in different project stages, it includes checking the design, modelling technique as well as clash detection, the detail can be found in Section 4.0 Quality Control. The models as well as tender package are submitted at the end of this stage. This model will also be used for quantity take off to give a cost feed back to the team. This process is explained in Section 5.0 Quantity Take-off.

DD100 stage allow details and the design to be developed further using BIM models as a tool. The models go through quality control check again, focusing on constructability of the design. The models submit in this stage are used as a For-Con package and will also be used for a cost feedback for the changes in design which may happen.

During Piling stage, the model will be edited to ensure that even the smaller details is constructible, using clash detection as a tool. The model shall be “Clash Free” before submitting the final package for contractors to develop further into fabrication/installation detail.

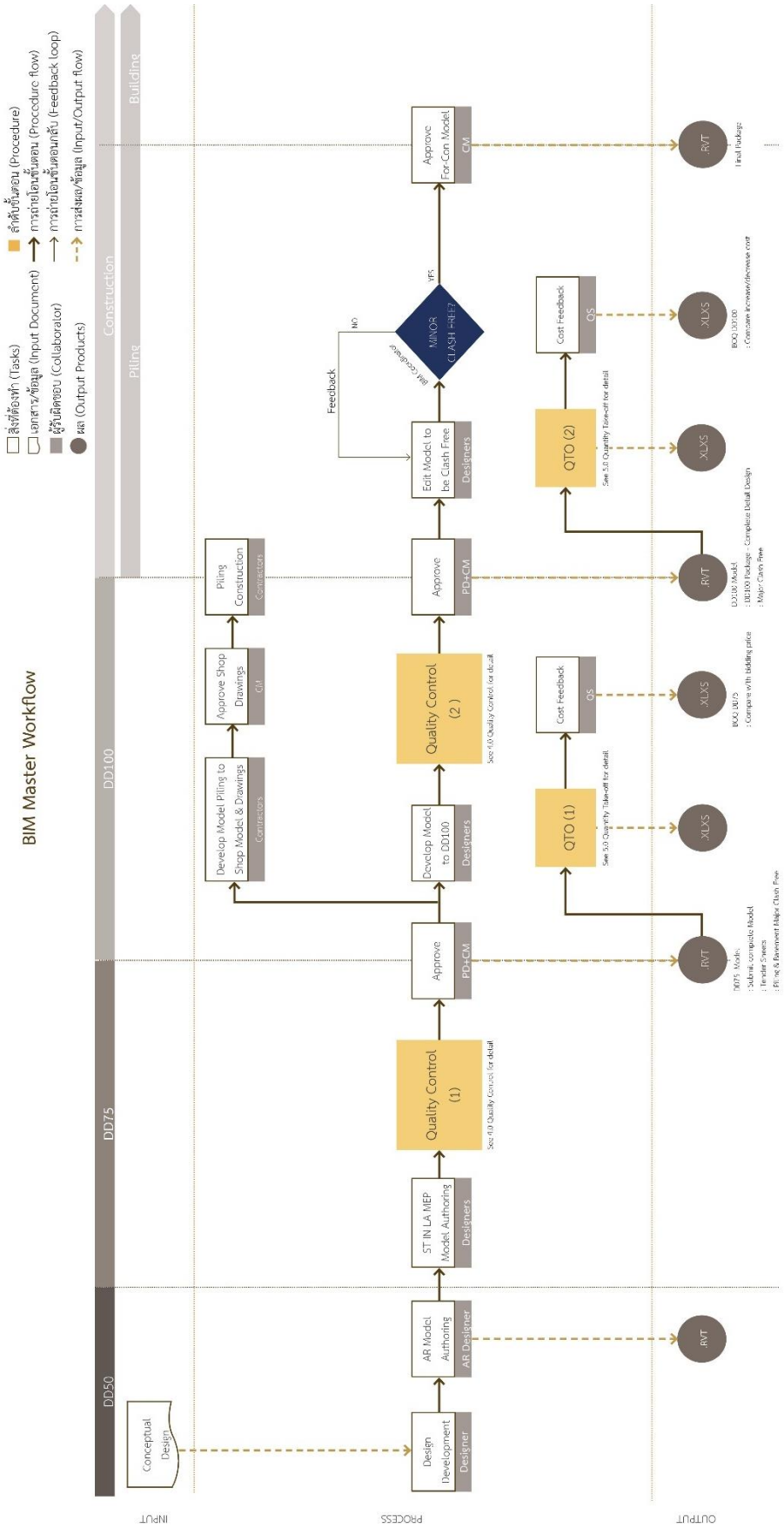


Figure 2.2 Master Workflow

2.2.2 BIM Objective and Deliverable

This chapter identify deliverable and activities need to be completed for each stage of the project. Details of milestone submission and Model Ownership indicating model elements require for each submission can be found in Section 6.0 Project information.

Table 2.1 BIM Objective and Deliverable

		Pre-Construction			Construction		Handover
		DD50	**DD75**	**DD100**	**Piling**	**Building Construction**	**As-Built**
	Activities	• Design Review • Construction Review • Property Management Review	• Design Review • Construction Review • Model Review • Clash Detection • Property Management Review	• Design Review • Construction Review • Model Review • Clash Detection • Detailed design for construction • Property Management Review	• Design Review • Construction Review • Model Review • Clash Detection	• Design Review • Construction Review • Model Review • Clash Detection	• As-built Review • Model Review
		• ATQPM Gate 1		• ATQPM Gate 2		• ATQPM Gate 3	
			• Cost Estimate I	• Cost Estimate II			
Model	Deliverables	• Architectural Model • Site Model	• Entire Model • (Underground Zero MAJOR Clash)	• DD100 Model • (Entire building Zero MAJOR Clash)	• Final Model (zero Clash) • Shop Model (Piling)	• Shop Model	• As-built Model
Drawings		• DD50 Drawing	• DD75 Drawings from model (Tender drawing)	• DD100 Drawings from model • (For con drawings)	• Shop Drawings from model (Piling)	• Shop Drawings from model	• As-built Drawing from model
Documents			• QTO I	• QTO II			
		• Outline Specification	• Detailed Specification	• Final Specification		• Update Specification	• Handover Specification
		• EIA Submission	• BMA Submission				
		• CFA, NFA, GFA					
		• Sale Kit • 3D Perspective					

2.3 Roles and Responsibilities

This role and responsibility diagram shows Stakeholders' required role and duty through project lifecycle. The full-size diagram can be found in ***Appendix A3 - Roles & Responsibilities.*** The detail of responsibility in each steps can be found in ***Appendix A4 - Roles & Responsibilities Matrix.***

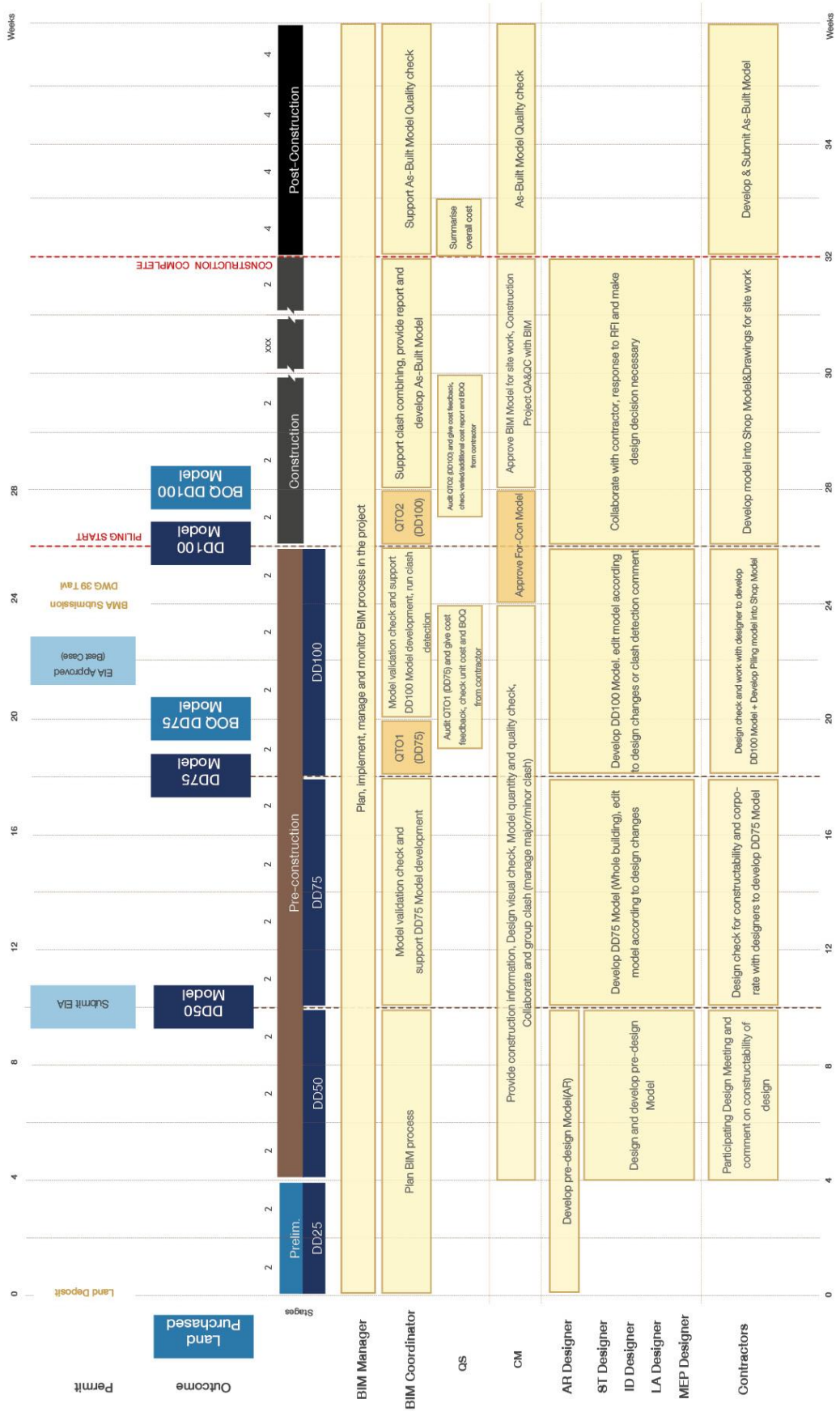


Figure 2.3 Roles and Responsibilities

3.0 DATA AND MODEL MANAGEMENT

3.1 Collaboration

3.1.1 Data Sharing Process

The project teams should be willing to share information throughout the duration of the project. This mean all parties should have access to the BIM models, Reports, Facility Data, and Other necessary information in real time. Central Workspace is suggested as a data sharing centre. This Central Workspace allows all stakeholders getting access to shared data which is necessary for project achievement.

The Central Workspace could be one of the following - Cloud Collaboration or Central Server Collaboration. Either way, these workspaces shall be made accessible to all parties. The full-size diagram can be found in *Appendix B1 - Data Sharing.*

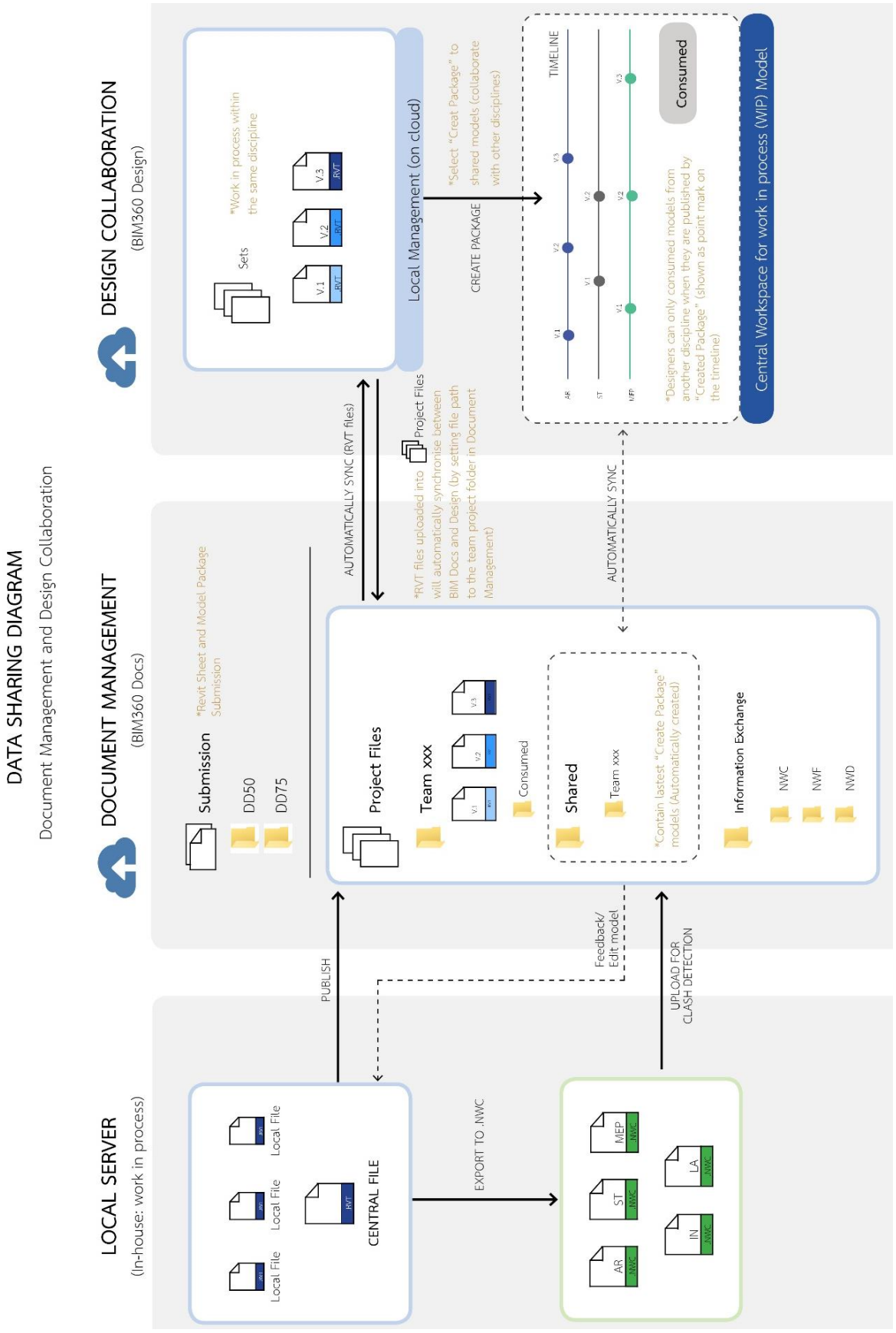


Figure 3.1 Data Sharing

3.1.2 Folder Structure

Record files will be submitted to Central Workspace within a clearly designated set of folders. All record files in Central Workspace shall be held within the standard project folder structure which is created as below; The full-size diagram can be found in *Appendix B2 - Folder Structure.*

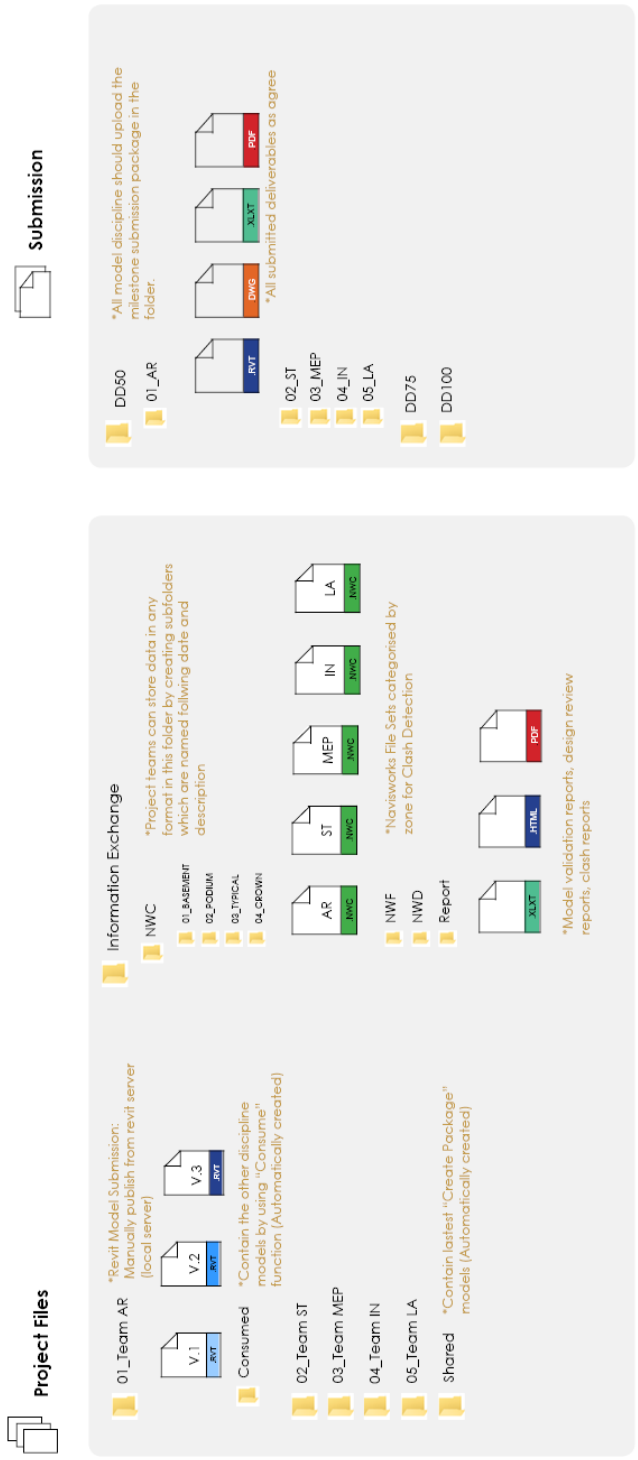


Figure 3.2 Folder Structure

3.1.3 Meeting

There are 2 main meetings relate to delivery of BIM on the project as following:

- BIM Kick-Off Meeting
- Combine Meeting
- BIM Technical Meeting (If require)

A. BIM Kick-Off Meeting

The purpose of the BIM kick-off meeting is to clarify BIM Execution Plan to all parties. The meeting demonstrates the process and BIM technical requirements which all parties shall agree in order to archive project goals.

The BIM Kick-Off Meeting is not a regular meeting but shall be organised once before the project start.

B. Combine Meeting

There are two levels of Combine meeting

- Model Clash Resolution is held to assign responsibilities to resolve model clashes that model authors could resolve the clashes without design implications. Design defects are also picked up for Design Review Meeting.
- Visual Review is held to discuss design defects picked up from the model. During the meeting the attendees, who are designers and engineers in the project will review the clashes and identify ownership for resolution. If decision and consensus could not be made, the project manager and/or PD will take arbitrary decision on the design issues which are required a design result.

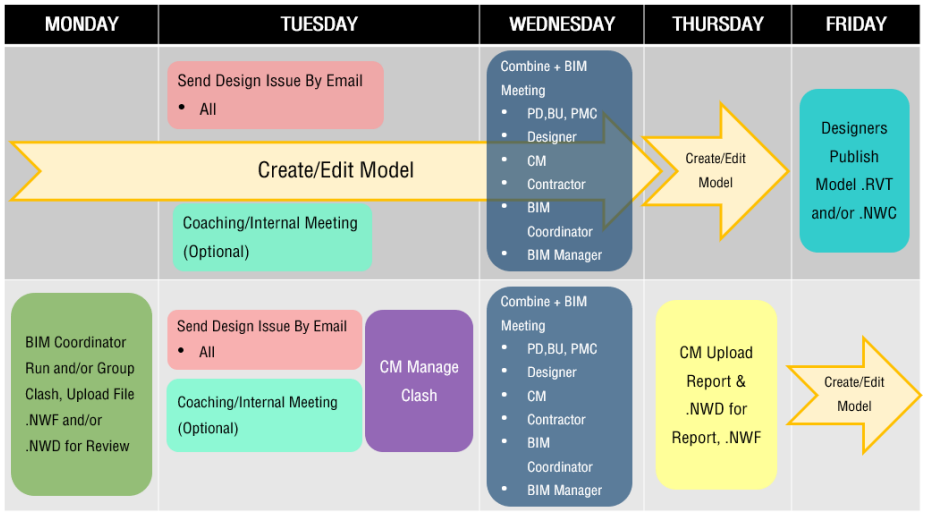


Figure 3.3 Example of Combine Meeting Loop

C. BIM Technical Meeting

It is for technical problems for all teams in the project. The meeting is not a regular meeting, it will occur only when a conflicted or new technical issue raised and cannot be resolved through other means of communication. The meeting may be held together with combine meeting. BIM technical problems on the project which may include following item;

- Cloud / Non-Cloud Collaboration
- Clash Detection Process
- Model Creation for QTO
- Quantity Take Off

3.2 Model Management

This section explains how the models from each discipline come together. Apart from satisfy model elements requirement in ***Model Ownership and LOD Definition*** in Maru 360 Standard page, it is critical to ensure that the models are created in certain ways in order to use the model according to the goals. To achieve the goals, following requirement are to be met;

- Create a separate Grid & Level file to be reference for all modellers.
- Create model in the correct level, using Grid & Level file as the reference
- Divide model into different parts to be complied in a separate file. However, try to avoid links within links.

There are two tools to synchronized shared coordinates between linked projects which are Acquire and Publish Coordinate. More detail will be provided in ***Appendix B3 - How to: Acquire/Publish Coordinate***

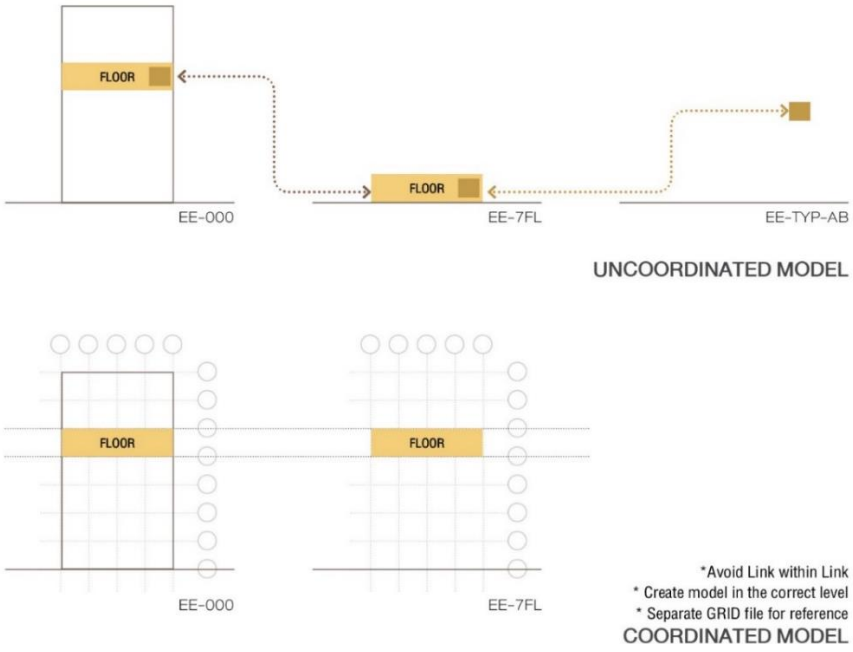
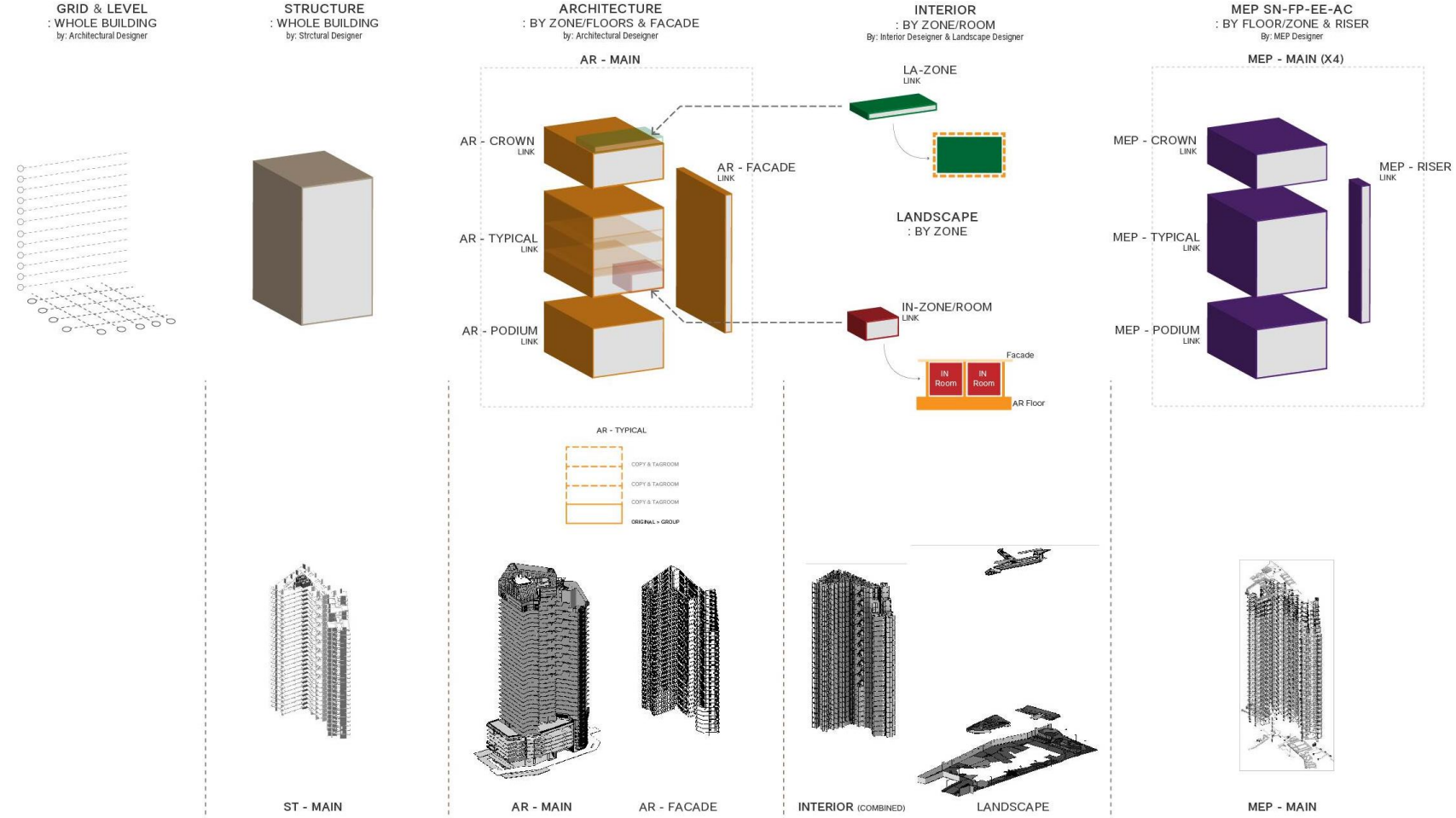


Figure 3.4 Coordinated Model

The requirement for model creation for each discipline in order to achieve the goals is illustrated in the following diagram. The full-size diagram can be found in *Appendix B4 - Model Management.*



- Use this file as a reference for location on the site, as well as location of the floor.
- Copy monitor grid and level from this file.
- All files shall be drawn on the correct levels.

- Divide column by floor.
- Ensure that column does not sink or penetrate into floor plate.

- Draw each zone at the correct level.
- Draw all floors and create room tags.
- Provide one combine file to complete the building.

- Draw in the correct position.
- Responsible for 'internal' materials.
- Provide one combine file to complete the building.

- Draw each zone at the correct level.
- Draw all floors and create room tags.
- Do not group and copy typical floors.
- Provide one combine file to complete the building.

Figure 3.5 Model Procedure

3.2.1 File Type Management

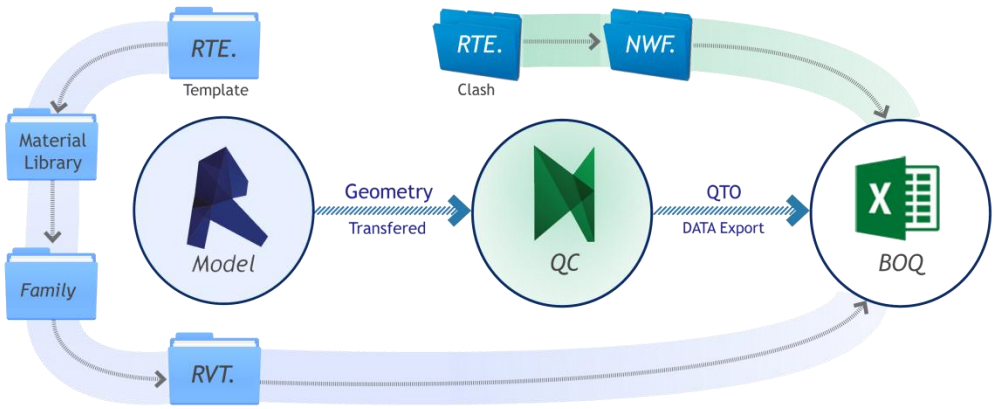


Figure 3.6 File Type Management

Table 3.1 File Type Description

File Types	Description
Model Procedure	
.rte	Revit Template
.adsklib	Material List and Specified Data
.rfa	Loadable Family Elements
.rvt	Revit File
Quantity & Quality Check	
.nwc	Navisworks Cache File: Raw data from BIM Model
.nwf	Navisworks File Set: Working file of Navisworks
.nwd	Navisworks Document: Viewing file, cannot be modified
Quantity Take Off – BOQ Template	
.xltx	Microsoft Excel Template File: BOQ template, coordinate between raw data and BOQ
*.xlsx	Microsoft Excel File: Take-off model quantity

3.2.2 Management of Linked Files

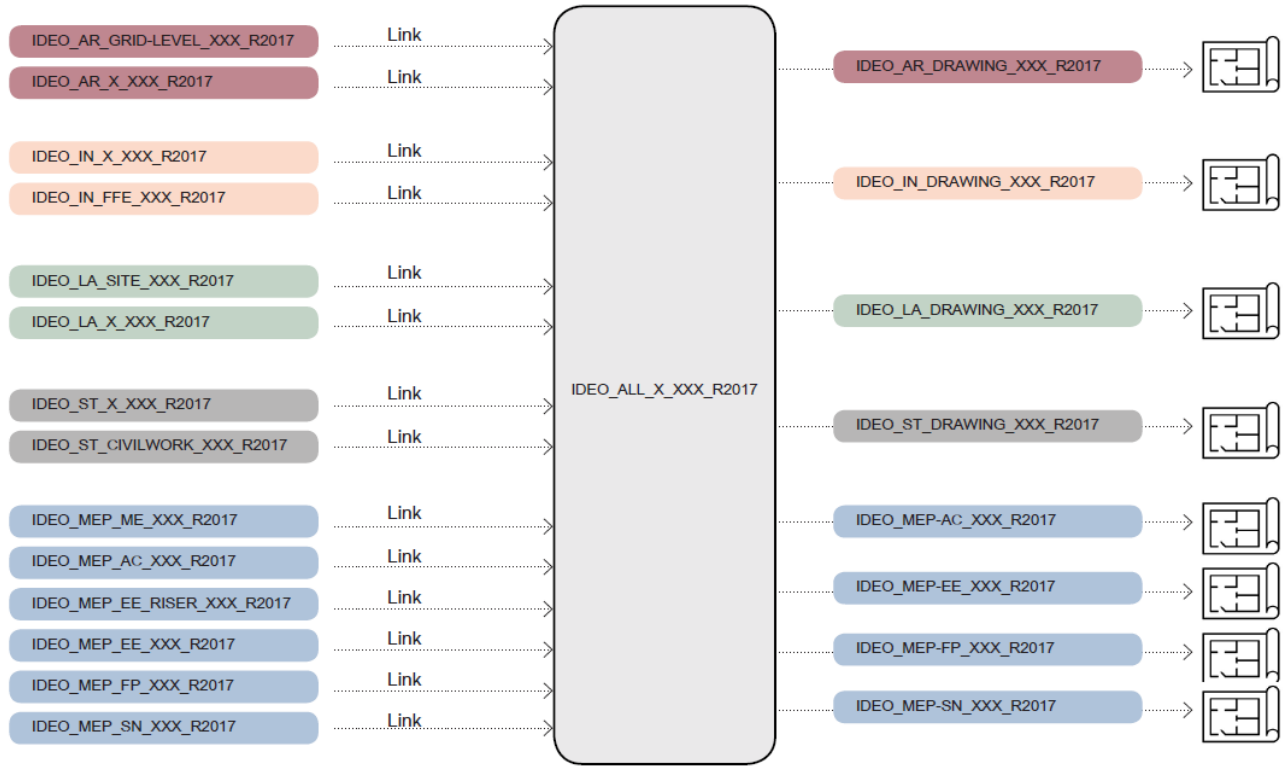


Figure 3.7 Management of Linked Files

Some projects may require that models of a single building are sliced into multiple files and linked back together in order to maintain manageable model file size. For Managing Linked File is recommended as following;

- Revit model must be kept separate by discipline, e.g. architecture, structure, mechanical, electrical, piping and plumbing. Each discipline in a Revit model shall be in its own unique worksets.
- Ensure that all .RVT and .DWG or any other required files are linked and not imported into the Revit file.
- All linked files must be supplied as a part of the record file deliverables.
- Remove all links to irrelevant or extraneous files that are not recognised as record file deliverables.
- All .DWG links in the submitted model must be hidden.
- All linked project files must be generated with the same Revit Software Version.

Link can be nested into one another. How a link responds when the host project is linked into another project depends on the option in Reference Type column. While the option in the Path Type column controls how the location of the link is remembered.

Table 3.2 Linked Model Management

Reference Type: control how a link responds when the host project is linked into another project	
Overlay	The nested linked model is not referenced in the new host project. Overlay is used to link the models which are different discipline used as referent framing for model authoring i.e. linking AR model into MEP model template to use architectural walls as a reference for piping line.
Attach	The nested linked model displays in the new host project. Attach is used to link the models which are same discipline divided into sub-files i.e. AR typical zone file contains AR sub-link file such as AR typical corridor file and AR typical unit room files.
Path Type: controls how the location of the link is remembered	
Relative	• Searches the root folder of the current project. • If the file is moved, the software still searches for it.
Absolute	• Searches only the folder where the file was originally saved. • If the original file is moved, the software is not able to find it.
Note* To manage path type, using absolute path helps files easier to manage and prevent moving submitted files from central workspace. However, an effective allocated folder structure is necessary.	

How to: Link Files (Attach/Overlay)

In Revit, files are linked into the host file via the Link panel on the Insert tab of the ribbon (Insert tab >> Link panel >> Link Revit). When files are initially linked into the host file.

1. From the Insert tab, select Manage Links. The Manage Links dialog box will show up.
2. In the Manage Links dialog box, go to Revit tab and the desired linked file and change the Reference Type (Drop-down).

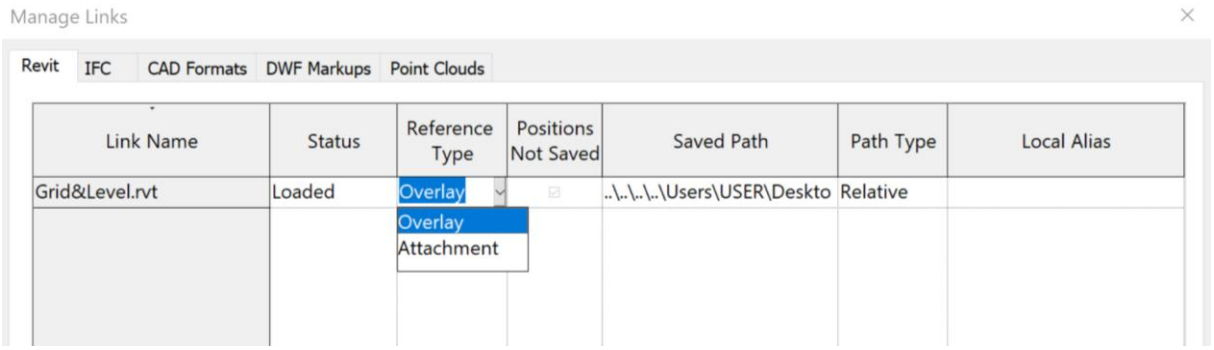
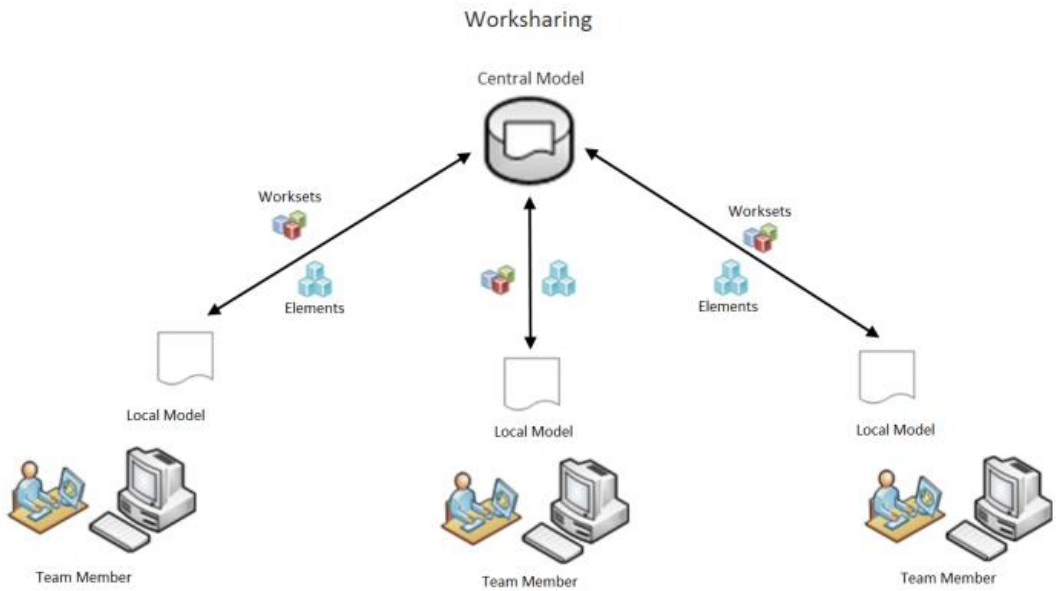


Figure 3.8 How to: Link Files (Attach/ Overlay)

3.2.3 Managing Worksharing and Worksets



Source: https://knowledge.autodesk.com

Figure 3.9 Worksharing

Worksharing refers to the use of Worksets to divide a model for the purpose of sharing project work among multiple teams. A workset is a customizable collection of building elements that can be used to manage project responsibilities. By associating various elements with worksets, the design team has additional control over visibility and element ownership, and several teams can collaborate and work within the same file.

When worksets are established in a project, there is on Central File and as many Local File as required for each team on the project to have a file. All Local Files are saved back to the Central File, and updates to the Central File are sent out to the Local Files. With this way all changes remain in one file, while the project, model, views, and sheets are automatically updated.

Workset management largely benefits the following procedure;

- Facilitates visibility control of component and any further model revisions.
- Controls edibility in each workset, subject to the management.

The intend of using worksets is to encourage efficient collaboration within a team. Worksets are recommend creating upon model disciplines as follow;

Table 3.3 Model Disciplines

Code	Discipline
AR	Architecture
IN	Interior Design
LA	Landscape
ST	Structural Engineering
MEP-AC	HVAC Engineering
MEP-EE	Electrical Engineering
MEP-SN	Sanitary Engineering
MEP-FP	Fire Protection Engineering

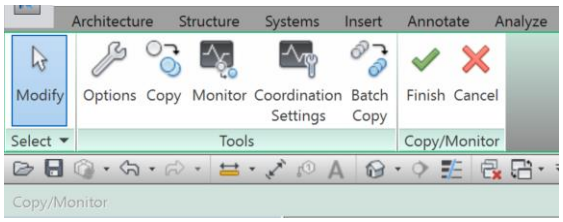
After worksets are launched in a project model, the project must be saved as a Central file to enable others to collaborate on the model. The file will collect all work done by project teams/members and allow them to receive regular updates of changes being made to the model and documentation. The Data Sharing processes can be found in *Appendix B5 – How to - Data Sharing*

3.2.4 Copy/Monitor Management

The Copy/Monitor allows creating copies of linked elements for better graphic control of the elements while maintaining a bond to linked elements. If the linked element changes in a subsequent iteration of the project file, the changes are detected in the Coordination Review tool. The linked element suggested to use Copy/Monitor command is Grid and Level from AR_Grid.rvt file.

How to: Copy Element for Mornitoring

1. With the preceded linked model in the project, switch to the Collaborate tab and select Copy/Monitor >> Select Link.
2. Pick the linked model, the ribbon will change to the Copy/Monitor. Click the option item to open the Copy/Monitor Options dialog box.



3. For each element tab, there is a list called Categories And Types To Copy. The left column lists represent the available model element types in the linked model and the right column lists are the host model element types.

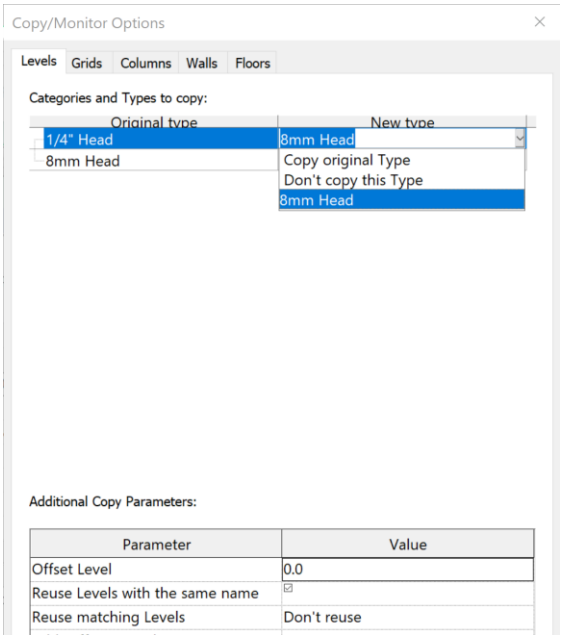


Figure 3.10 How to: Copy Element for Monitoring

3.2.5 Group Management

Using Groups are great at maintaining repetition within the project. Grouping elements is useful when creating entities that represent repeating layouts or are common to many building projects.

There must be regulations for grouping model elements to prevent mistakes which affect to model interference and model quantity take off. Model elements grouping could be done by following:

- Assigned group is grouping for typical room types to make elements in the grouped room easy to edit. For instance, editing elements in a grouped room such as materials and dimensions will affect the same editing elements in every same type of grouped rooms.
- Tasked group is the temporary grouping for making a convenience to data allocation and/or to group elements for copying or duplicating. After the tasks have been done, the tasked group is suggested to be detached.

3.2.6 Model Exclusion

Besides elements which are not mentioned in the model ownership lists referred to *Model Ownership* in Maru 360 Standard page, the model may exclude;

- Any detail lesser than 50mm thick or too small to be seen when printed at 1:100 scale shall not be modelled in 3D.
- 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.

3.2.7 Revit Sheet

Set of drawings produced by contractors is obligation to create within the project's files as Revit sheets. Dimensions, manufacturing conventions, and special fabrication instructions should be included on the shop drawing. Most jobsite dimensions need to be verified. Revit sheet could be created by following the suggestion referring to *Appendix B6 - How To: Revit Sheet Guideline*

3.3 Naming Convention

Naming Conventions aim to create understanding between parties through naming and data management. A Naming Convention is required to ensure that all files and model elements created on a project can be identify quickly, accurately and without ambiguity. Ownership, location, type of file and a unique number are all of paramount importance when identifying the content of a BIM file.

3.3.1 File Naming

File Naming Conventions: could be concluded as follow;

PROJECT NAME_DISCIPLINE_SUB CATEGORY_ZONE_SOFTWARE VERSION

Example:

IDEO_AR_GRID_XXX_R2017

IDEO_AR_FACADE_XXX_R2017

IDEO_IN_FFE_XXX_R2017

IDEO_ST_SUPERSTRUCTURE_XXX_R2017

IDEO_MEP-SN_FIXTURE_XXX_R2017

IDEO_MEP-FP_X_XXX_R2017

To avoid disoriented file naming in the project, designers must name the files used to collaborate within the project after file naming provided by BIM manager in ***Appendix B7 - File Naming.*** The designers can name files besides the file naming list as appropriate. All added file names aside the given names needed to notify the BIM manager to update on File Naming List.

3.3.2 Workset Naming

The worksets should be named in a consistent and logical manner to aid navigation through the project

DISCIPLINE_DESCRIPTION

Example:

AR_Facade

IN_Furniture

SN_ColdWater

EE_Lighting

3.3.3 View Naming

View naming shall be consistent across all references to that view. Renaming of views shall be carried out with care as any changes will be automatically reflected across all documentation. The View Naming could be concluded as follow;

Table 3.4 Example of View Naming

Name	Description
L01-Plan	First floor plan
L01-Ceiling Plan	First floor reflected ceiling plan
Level3-Detail Plan Elevator1	Third floor detail plan at elevator1
AA	Section A-A along gridline xx
BB	Section B-B along gridline yy
NS-Building Section	North-South full building section
Edge Section	Typical edge section showing slab, beam and wall
South Elevation	South Elevation

For a more accessible and simpler naming convention, all fields are optional. To maintain compliance, any variations should be clearly stated in the Project BIM Execution Plan.

3.3.4 Family and Type Naming

Element Naming consist of 2 levels related to family's parameters that are Family Name and Type Name.

FAMILY NAME: TYPE NAME

Example:

Basic Wall: W1_Fullbrick_20cm

Compound Ceiling: C1_Concrete_Paint

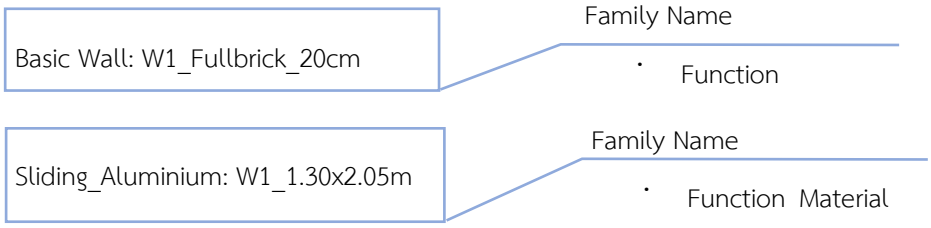
Rectangular Footing: F1_800x1000mm

Sliding_Aluminium: W1_1.30x2.05m

- Family Name is a parameter name describing materials and function of the element which shall be named as followed concept;

FUNCTION_MATERIAL (Optional)_DESCRIPTION (if necessary)

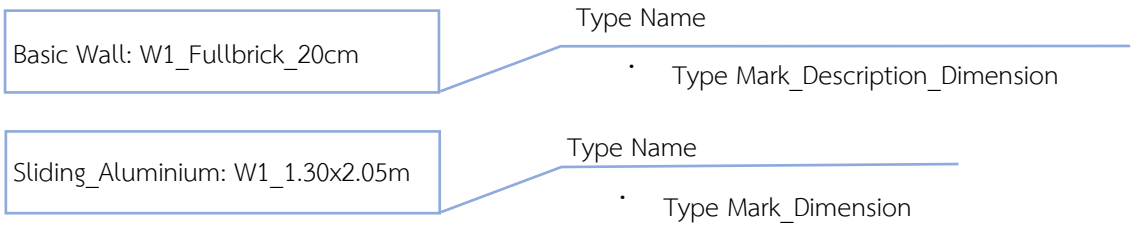
Example:



- Type Name is a parameter name describing specific details such as dimension which shall be name as followed concept;

TYPE MARK_DESCRIPTION_DIMENSION

Example:



- Type Mark is one of the parameters in Revit that is attached to element "Type". In this case Type Mark is use to indicate design specification according to a particular project. Input procedure for Type Mark is explained in ***Appendix C9 - How to - Insert Type Mark.***

Family Name and Type Name might vary upon family disciplines (AR, ST, MEP). However the concept of naming remains the same. Full example of naming convention can be found in ***Appendix C2 – Family Naming Convention.***

3.4 Family Management

3.4.1 Family Category

All elements added to Revit projects are created with families. Revit Family Category are categorised into 3 mains categories;

A. System Family

System families contain family types used to create basic building elements such as walls, floors, ceilings, and stairs in your building models. System families also include project and system settings, which affect the project environment and include types for elements such as levels, grids, sheets, and viewports.

B. Loadable Family

Unlike system families, loadable families are created in external RFA files and imported in the projects. Loadable families are families used to create the following:

- Building components that would usually be purchased, delivered, and installed in and around a building, such as windows, doors, casework, fixtures, furniture, and planting
- System components that would usually be purchased, delivered, and installed in and around a building, such as boilers, water heaters, air handlers, and plumbing fixtures
- Some annotation elements that are routinely customized, such as symbols and title blocks

C. In-place Element

In-place elements are custom elements created in the context of a project which can be created multiple in-place elements in the projects, and can be placed copies of the same in-place element in the projects. However, the in-place elements cannot be duplicated in-place family types to create multiple types.

3.4.2 Family Catalogue Management

Designers and contractors are encouraged to use the families from Ananda Development's Family Catalogue as families provided have correct naming system, clearance set up and, in the future, necessary information for cost estimation.

The catalogue can be downloaded from *Family Catalogue and Project Template* in Maru 360 Standard page. While the System family cannot be extracted and saved as a separate file, they are collected in Revit Template. Loadable families in the catalogue are organised in the folder structure explained below.

Table 3.5 Family Catalogue Folder Structure

Folder Level	Description	Example
Level 0	Ananda Brand	IDEO, MOBI and ASTON
Level 1	Discipline	Architectural, Structural, Plumbing and Piping, HVAC, Mechanical Equipment and Electrical
Level 2	Model Elements	Piling, Footing, Doors and Windows
Level 3	Function or uses of the elements	Sliding, Open Swing and Tempered

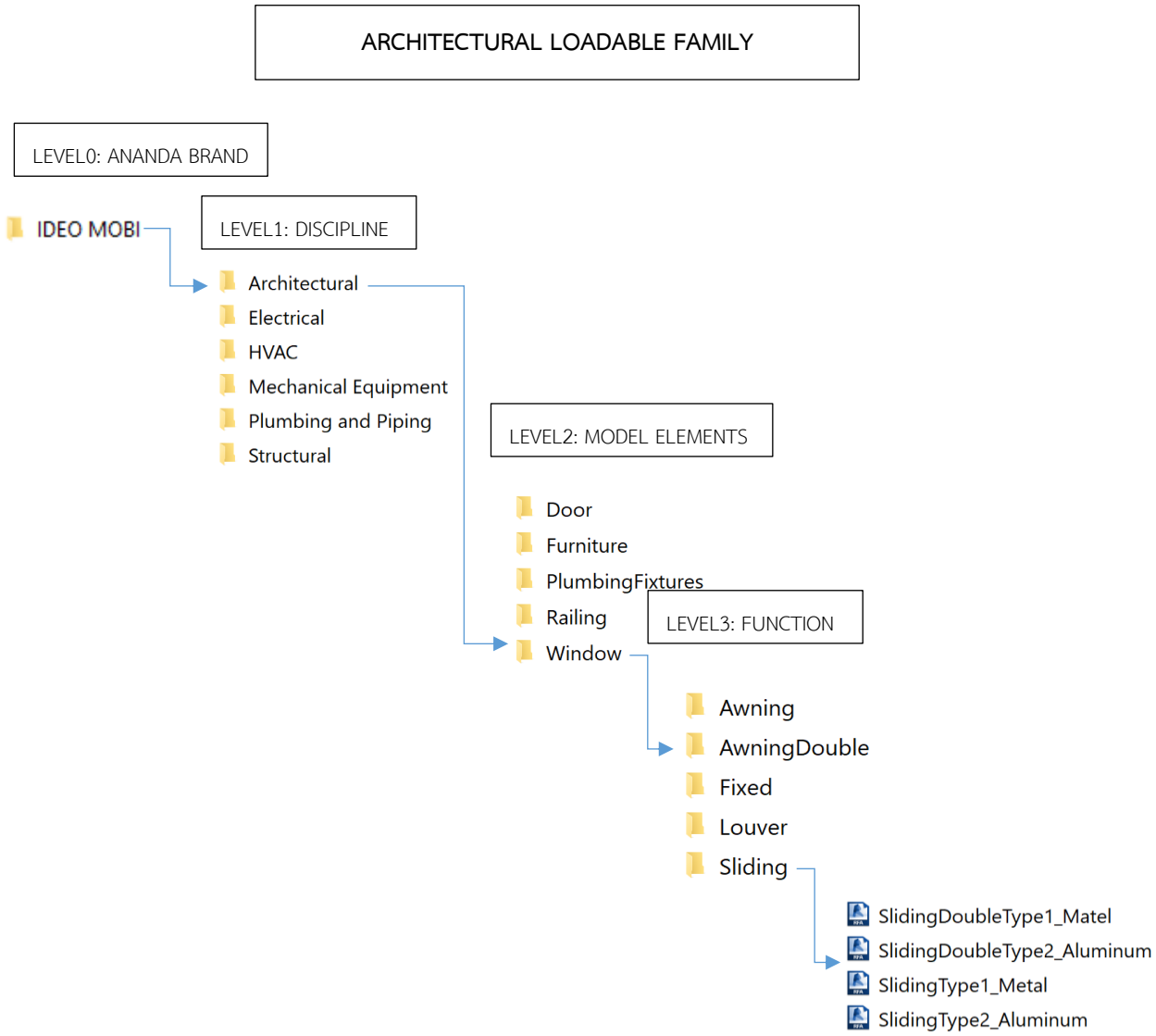


Figure 3.11 Example of Architectural Family Catalogue Folder Structure

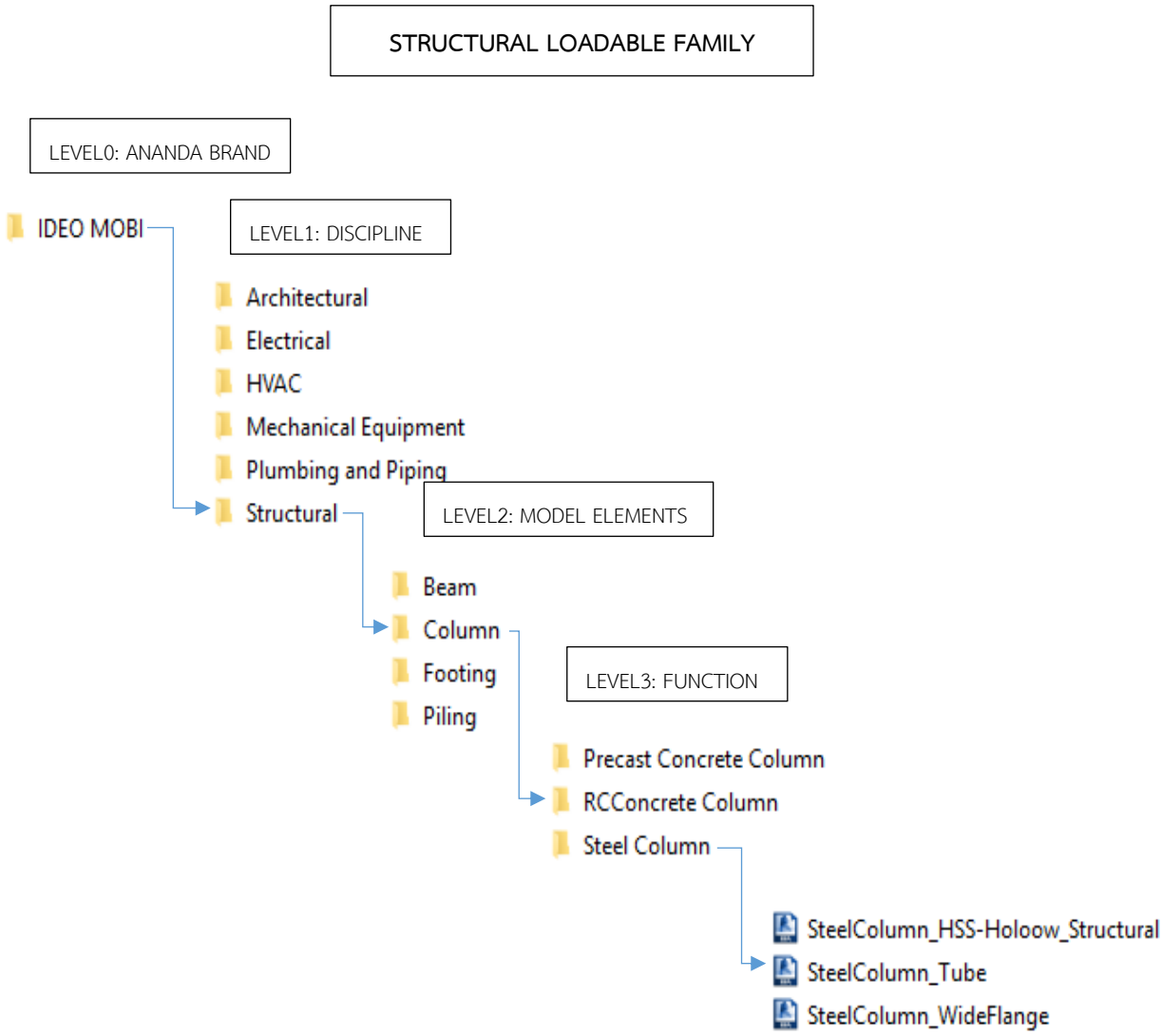


Figure 3.12 Example of Structural Family Catalogue Folder Structure

3.4.3 Family Creation Convention

In the case that families in the catalogue do not satisfy the use in projects, designers and contractors can create their own family with the procedure below. This is to ensure that the model element newly created is compatible with quantity take-off process. The full-size diagram can be found in *Appendix C4 - Family Creation Workflow.*

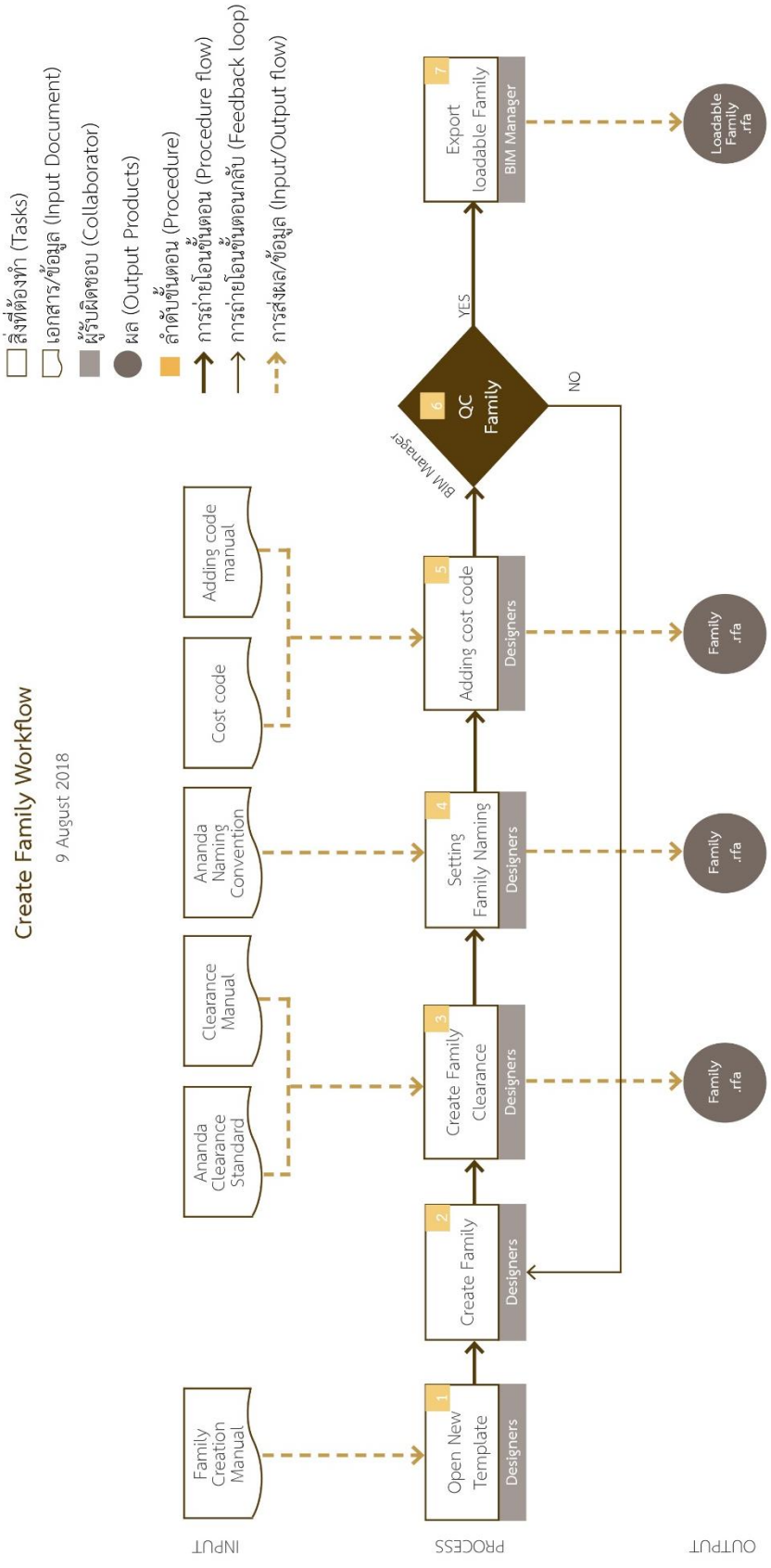


Figure 3.13 Family Creation Workflow

Table 3.6 Family Creation Workflow Description

Activity	Role & Responsibility	Reference
1. Select family template - Select correct family template	Designers	• Family create manual
2. Create family	Designers	
3. Create family clearance - If the family nave apecific clearance requirement, create clearance in the family according to Ananda clearance standard	Designers	• Ananda clearance manual • Ananda clearance standard
4. Setting family naming convention - Name the family accoding to the Family Naming Convention in Section 3.3.4 Family and Type Naming	Designers	• Ananda naming convention
5. Adding cost code - Adding code in family accoding to	Designers	• Cost code • Adding code manual
6. Quality check family - Validate the family and give feedback to the modeler. - Modeler revise family as needed.	BIM Manager Designers	• Family with code .rfa
7. Export loadable family - Export loadable family and add into Ananda Family Library Catalogus	BIM Manager	

4.0 QUALITY CONTROL

Model Quality Control ensure that the model has the capacity to serve all project goals in all aspects both technicality and design. There are three types of control, Model Quality Review, Design Review and Clash Detection. This diagram below illustrates quality control procedure for all three types. The full-size link can be found in *Appendix D1 - Quality Control Workflow*.

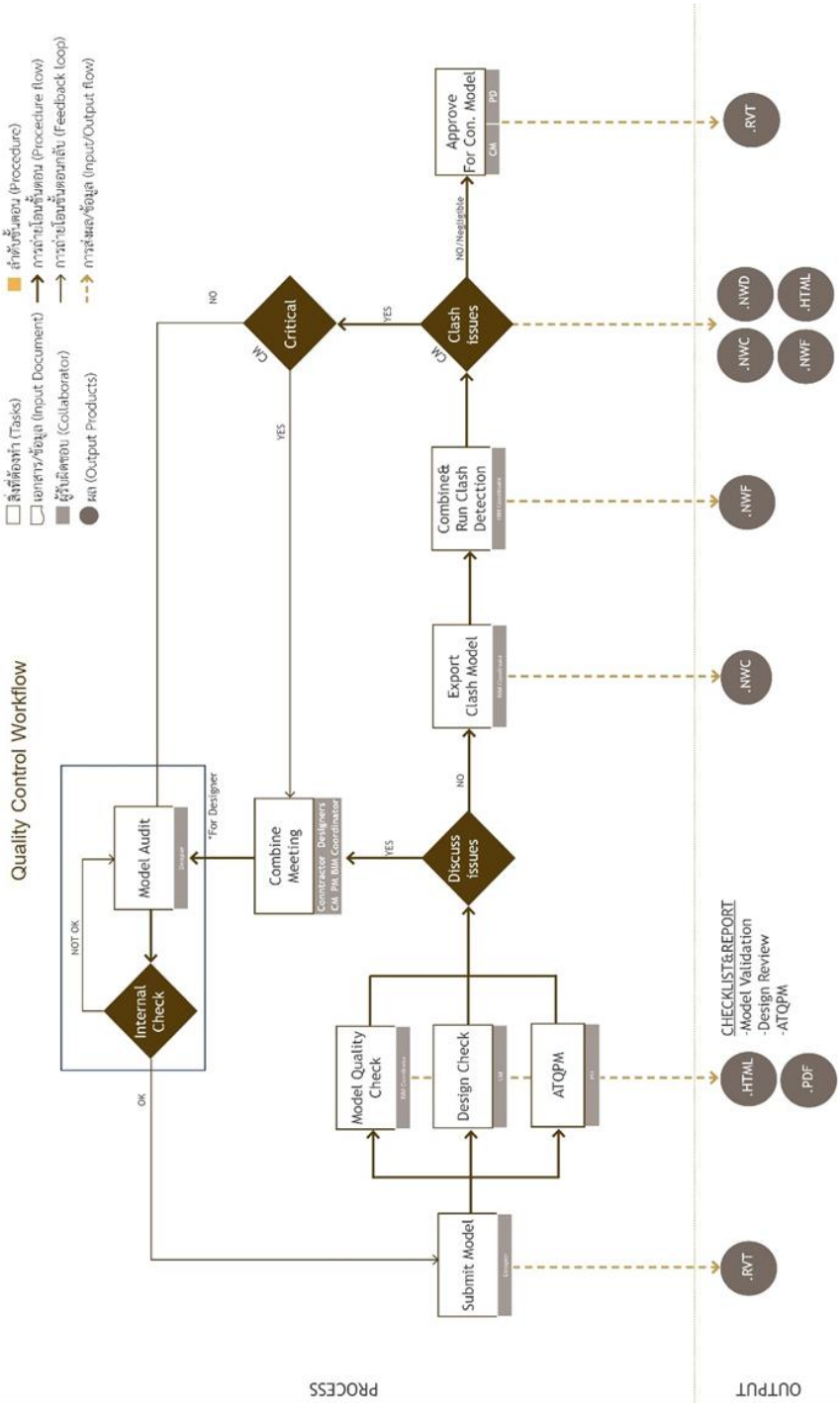


Figure 4.1 Quality Control Workflow

4.1 Model Quality Review

Model quality review ensures model' s completeness and precision for model to be used to achieve the goals. This also allows next responsible parties handling model to proceed immediately.

This process is responsible by BIM Manager, to control the quality. However, designers are encouraged to follow these review lists to confirm the quality of their own models before the submission. There are two significant tools provided for the quality review; Model Validation Checklist and Model Ownership Checklist.

4.1.1 Model Validation Checklist

Model Validation Checklist, download from *Appendix D2 - Model Validation Checklist Report,* consists of the following checks to assure quality within models and information, to eliminate errors and achieve desired project outcomes.

Table 4.1 Model Validation Checklist Definition

Check	Definition
Project Coordination Check	Ensure correct location of the building across all models of all disciplines.
Model Element Check	Ensure that model elements are correct according to the standard.
Model Integrity Check	Ensure correct location and reference of the model elements.
Interference Check	Detect problems in the model where two building components are clashing.
Link File check	Ensure that all links will be valid and easy for further use.
Excess Information Check	Ensure that there is no unnecessary information in the model.
File Location Check	Ensure that all the files in the Central Workspace are valid and in correct location.

Note*

Warning Message and Error Report; Each discipline should keep their review warning as low as possible, preferably 0 of possible. Although this technique will do very little to affect the over file size, the Warning dialog box will alert problems within the model that should regularly be addressed to ensure file stability.

4.1.2 Model Ownership Checklist

Model Ownership Checklist specify elements and information in the element require for each stage are fulfilled. This ensures the model can be used to accomplish the goals and deliverable of each stage. This list can be found in *Model Ownership and LOD Definition* in Maru 360 Standard Page.

4.1.3 Model Quality Report

Model Quality Report is part of the feedback and progress tracking to help designers and construction manager keep up with the model revision.

Model Validation Check Report has report in two forms, Model Validation Check Report (using the form itself) and File Coordination Check Tracking. While Model Ownership can be reported in the form itself.

A. Model Validation Check Report

These reports show Pass (✓) and Fail (✗) for each topic in the checklist form as well as identify issues, then give comments and suggestion in the report form. The template can be found in *Appendix D2 – Model Validation Checklist Report*. Example as follow;

Model Validation Checklist	
Model Check	✓/✗
1. Project Coordination Check	
1.1 Model has Acquired Coordination from GRID.rvt	**See File Coordination Check tracking**
1.2 All Grid and Level are Copied-Monitored from GRID.rvt	
1.3 Survey Point and Project Base Point are in the correct position (Refer to BEP A1.2 Project Coordinate)	
1.4 Project Base Point is located on the correct gridline (X,X) and has been clipped	
1.4 For project with links file: All files are drawn at the correct level.	
2. MARU 360 Standards BEP and Model Element Check	
2.1 File naming is correct according to the standard (Refer to BEP 3.3 Naming Convention)	✗
2.2 Family Name and Type Name are correct according to the standard (Refer to BEP 3.3 Naming Convention)	✗
2.3 Family's Type Mark is correct according to project specification	✓
2.3 Use family from the appropriate category (Refer to BEP 3.4 Family Management)	✓
2.4 Model have required elements and information in the elements as specify in Model Ownership	**See Model Ownership Checklist**
2.5 MEP ONLY: Ducts and Pipes are in the correct System Classification and System Type	✓

Figure 4.2 Example of Model Validation Checklist

1.3 Model Check Tracking - 20170823									
		โมเดลจาก TEKA วันที่ 28 สิงหาคม 2560							
Uddate	**Discipline**	**File Name**	**Acquire Coordinate**	**มีเส้น Grid&Level อยู่ในไฟล์** เพื่อให้สามารถตรวจสอบตำแหน่งได้เมื่อนำมา Link กับไฟล์อื่นๆ	**Copy Monitor Grid&Level** เพื่อให้มีการแจ้งเตือนและสั่งปรับ Grid/Level ได้เมื่อมีไฟล์ Grid ปรับใหม่	**Project Base Point อยู่ถูกตำแหน่ง**	**Survey Point อยู่ถูกตำแหน่ง** เพื่อให้อยู่ตำแหน่งบน Site ที่ถูกต้อง	**อยู่ใน Level ที่ถูก**	**อื่นๆ**
		MEP							
X	SN	GEM38-SN-MAIN-X-RVT16	ไฟล์ร่วม SN	× ขาด Grid Line	×	✓	✓	✓	
✓	SN	GEM38-SN-X-RISER-RVT16	✓	✓	✓	✓	✓	✓	
X	EE	GEM38-EE-17,19,21,23,25,27,29,31 FL-X-RVT16	×	× ขาด Grid Line	×	✓	✓	✓	
X	AC	GEM38-AC-16-25 FL-X-RVT16	×	× ขาด Grid Line	×	✓	✓	× มีโมเดลแค่ชั้น 16-17	
		Structure							
X		GEM38-ST-STAIR RUN-X-RVT16	×	✓	×	✓	✓	✓	
X		GEM38-ST-STAIR RUN 2-X-RVT16	✓	✓	×	✓	✓	✓	
X		GEM38-ST-LANDSCAPE-X-RVT16	×	✓	×	✓	✓	✓	
		Architecture							
✓		GEM38-AR-MAIN-X-RVT16	ไฟล์ร่วม AR	✓	✓	✓	✓	✓	
X		GEM38-AR-DROPOFF-X-RVT16	×	×	×	✓	✓	✓	

Figure 4.3 Example of Model Validation Feedback Report

B. File Coordination Check Tracking

This report consolidate result for Project Coordination Check in one sheet. Template for this report can be found in *Appendix D3 – File Coordination Tracking Template*. Example as below;

Uddate	**Discipline**	**File Name**	**Acquire Coordinate**	**Grid&Level in file - มีเส้น Grid&Level อยู่ในไฟล์** เพื่อให้สามารถตรวจสอบตำแหน่งได้เมื่อนำมา Link กับไฟล์อื่นๆ	**Grid&Level are copy monitored - Copy Monitor Grid&Level** เพื่อให้มีการแจ้งเตือนและสั่งปรับ Grid/Level ได้เมื่อมีไฟล์ Grid ปรับใหม่	**Correct Project Base Point - Project Base Point อยู่ถูกตำแหน่ง**	**Correct Survey Point - Survey Point อยู่ถูกตำแหน่ง** เพื่อให้อยู่ตำแหน่งบน Site ที่ถูกต้อง	**Model is in the correct level - อยู่ใน Level ที่ถูก**	**Note - อื่นๆ**
	Structure								
✓	Structure	XXXX_ST_TOWER_ALL_R2017	×	✓ ไม่ใช้ File Grid&Level กลาง	×	×	×	✓	
	Architecture								
✓	Architecture	00_XXXX_AR_MAIN_MODEL_PUBLISH	×	✓ ไม่ใช้ File Grid&Level กลาง	×	×	×	✓	
✓	Architecture	XXXX_AR_CORE_XX_R2017	×	✓ ไม่ใช้ File Grid&Level กลาง	×	×	×	✓	
✓	Architecture	XXXX_AR_INT_XX_R2017	×	✓ ไม่ใช้ File Grid&Level กลาง	×	×	×	✓	
✓	Architecture	XXXX_AR_Podium_XX_R2017	×	✓ ไม่ใช้ File Grid&Level กลาง	×	×	×	✓	
✓	Architecture	XXXX_AR_TOWER_XX_R2017	×	✓ ไม่ใช้ File Grid&Level กลาง	×	×	×	✓	
	Interior								
✓	Interior	00_XXXX_IN_ALL_R2017.rvt	×	✓	✓	× รอกำหนิด	× รอกำหนิด	✓	

Figure 4.4 Example of File Coordination Check Tracking

Model Ownership Report

This report compares require information specify by *Model Ownership and LOD Definition* in Maru 360 Standard and the elements in submitted model. Template for this report can be found in *Appendix D4 – Model Ownership Checklist Template*. Example as below;

PROJECT NAME:
Zone: Level: Date DD/MM/YYYY
Design Stage: Name Mr.

Model Ownership Checklist

MODEL ELEMENT		MODEL INCLUSIONS	DATA AND DRAWING REQUIREMENT	DD50 MARU	DD75 MARU	DD100 MARU	Picture	Remark
42)	Elevator System	Geometric complexity		■				
		Elevator System size		■				
		Elevator structural support		■				
		Elevator System clearance		■				
			Type and code	■				
			Location and size					
			Equipment Spec.	■				
43)	Autoparking	Geometric complexity		■				
		Auto parking size		■				
		Auto parking structural support		■				
			Type and code	■				
			Location					
			Autoparking size					
			Equipment Spec.	■				
44)	Air Terminal Devices	Geometric complexity		■				
		Air terminal device size		■				
			Type and code	■				
			Air terminal device size					
			Location					
			System name	■				
			Equipment Spec.	■				
45)	A/C Equipment (FCU, CDU, AHU)	Geometric complexity		■				
		Air terminal device size		■				
			Type and code	■				
			Air terminal device size					
			Location					
			System name	■				
			Equipment Spec.	■				
46)	A/C Duct	A/C Duct		■				
		A/C Duct size		■				
			Type and code	■				
			Location					
			System name	■				

Figure 4.5 Example of Model Ownership Report

4.2 Design Review

4.2.1 Design Review Checklist

Design Review is one of quality control reviews used as a tool facilitating the Model Quality Review and improving the Quality Control in a project. Design Review Checklist is one of design quality control tools varies upon projects. The Design Review checklist establishes in *Appendix D5 – Design Review Checklist Template*.

Construction Manager is responsible to validate these design aspects to ensure Ananda Development Design Standard is accomplished.

4.2.2 ATQPM Checklist

Ananda Total Quality Project Management (ATQPM) is a project quality control standard specified under the owner of the project, used to control overall quality. The ATQPM checklist is provide by ATQPM team (owner) referred to ATQPM Standard.

Designers is responsible to submit the report, illustrate that the design has met the required standard as part of the submission package. It shall be reported with DD50 and DD100 submission, using model as a tool.

DS Management Sheet Gate 2 **Project Name :**
D.03.02 Doc. No : Date :

Item	Description	Area	Risk Level	Checker		Gate check schedule		Refer Drawing No.	Comment (BU)	Comment (ATQPM)
				BU	ATQPM	Due date	Actual date			
	Architecture									
AR01.01.02	กำหนดให้มีลูกระนาด (Speed Bump) เพื่อลดความเร็วของรถยนต์ ก่อนถึง Gate Barrier อย่างน้อย 3,000 mm.	Driveway	Extremely Serious	E					ไม่มีแบบลูกระนาด (Speed Hump) อาจทำให้เกิดการชุ่องรน Gate Harrier ได้ แสดงในแบบ LA	
AR01.02.02	กำหนดให้ความสูงราวกันตกบริเวณที่จะลดระดับลง เป็นไปตามนี้ 1. สำหรับช่องเปิดที่มีความสูงน้อยกว่า 3,000 mm. ให้ติดตั้งราวกันตก สูงอย่างน้อย 900 mm. 2. สำหรับช่องเปิดที่มีความสูงมากกว่า 3,000 mm. ให้ติดตั้งราวกันตก สูงอย่างน้อย 1,100 mm. 3. ความสูงราวกันตกต้องวัดจากระดับพื้นที่สูงที่สุด ในบริเวณที่ติดตั้งราวกันตก	Car Park	Extremely Serious	E				A-301	เพิ่ม Dimension และแบบขยายราวกันตก	

Figure 4.6 Example of ATQPM Report

4.2.3 Design Review Report

Design Review Report is providing by Construction Manager through save views on found design issues in the .nwd clash files and a form of .html (Tabular). Example of saved views for design issues are as follow;

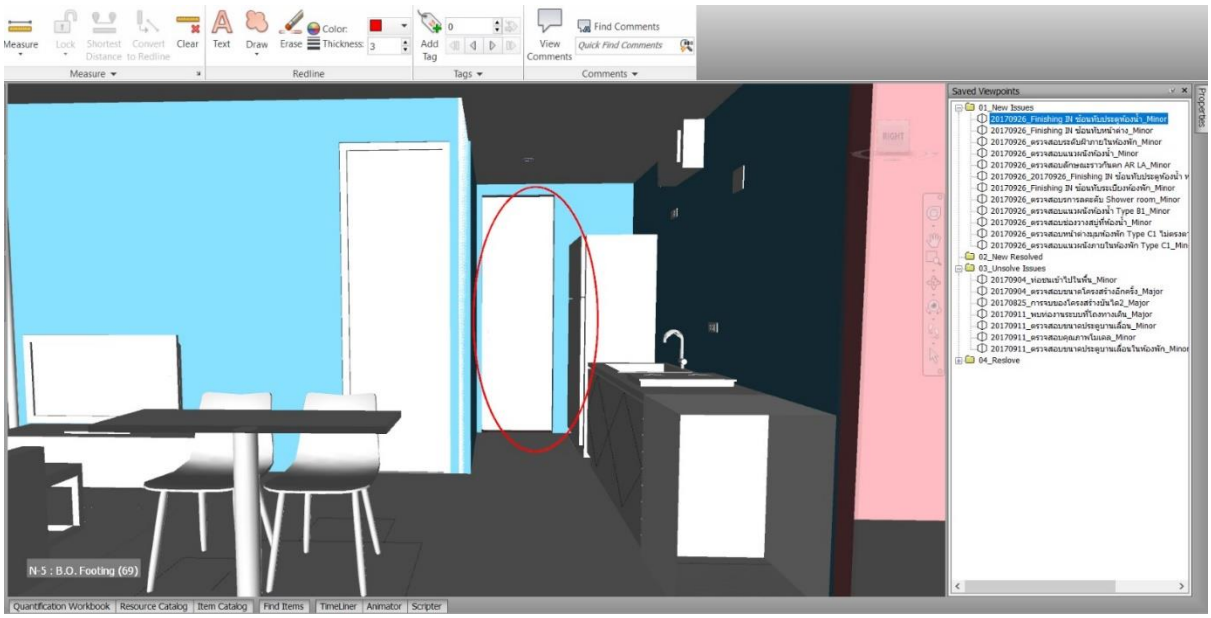


Figure 4.7 Example of View Point saved in Navisworks File

4.3 Clash Detection

4.3.1 Clash Detection Workflow

Clash Detection Protocol explains process in 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 design process and facility management.

4.3.2 File Types in Navisworks

As the program chosen for clash detection procedure in Navisworks, the following file types apart from .RVT are necessary.

- .nwc – Navisworks Cache File
- .nwf – Navisworks File Set
- .nwd – Navisworks Document

Table 4.2 File Type in Navisworks Description

File Types	Description	File Naming
NWC	an NWC files is not intended for general use. It contains a cached version of the converted model geometry and is created by the Navisworks exporters to allow users to pass files into Navisworks to be save in the NWF or NWD file format.	[Project]_[Discipline]_[Sub Category]_[Zone]_[Description-if there is]_[Software Version].nwc
NWF	an NWF file contains an index of all model files you are using. It also stores all other Navisworks data.	[Project]_[Discipline]_[Sub Category]_[Zone]_[Description-if there is]_[Software Version].nwf
NWD	NWD files are intended to be used to publish and distribute a complied version of the current project for others to review.	[Date]_[Project]_[Discipline]_[Sub Category]_[Zone]_[Description-if there is]_[Software Version].nwd

The Models used for Clash Detection need to be converted from .rvt (Revit File) to .nwc (Navisworks Cache File). Preparing Revit File is explained in *Appendix D6 – How to - Prepare Revit File for Clash Detection*.

A. Colour Coding for Inter-Disciplinary Combination

Distinguish between each discipline while managing clash helps speed up the process, therefore the suggested colour code is chosen to not be the same as Navisworks default colour as follow;

Table 4.3 Model Search Set Colour Appearance

Search Set	Model	Colour Code (RGB)	Colour
AC	Mechanical Model	(245, 128, 0)	Orange
SN	Sanitary Model	(0, 255, 255)	Cyan/ Aqua
EE	Electrical Model	(255, 255, 0)	Yellow
FP	Fire Protection Model	(255, 0, 0)	Red
ST	Structural Model	(128, 128, 128)	Grey
AR	Architectural Model	(255, 255, 255)	White
IN	Interior Model	(128, 0, 255)	Violet
LA	Landscape Model	(148, 128, 48)	Brown/ Tan

These colours can be applied in Navisworks using Colour Appearance download from *Appendix D7 – Colour Appearance*.

4.3.3 Clash Criteria

Clash results shall be grouped for further management as followed criteria.

Table 4.4 Clash Criteria

Criteria	Clash Group Naming	Description	Example
MINOR	MINOR_<clash details>	a clash which does not affect or slightly affect to the project that can be solved later without issue discussion and design changing.	junction box vs. window
MAJOR	MAJOR_<clash details>	a clash that needs to be solved spontaneously or discussed for solutions. Some major clash issues concern design changing.	pipe vs. ceiling which ceiling needs to be dropped down

4.3.4 Clash Test Matrix

Clash test is the selection of two Sets of elements to be analysed whether they are overlapping one another. The table below shows all suggested groups of elements or "Sets", while the "Tests" of overlapping between two or more sets are to be discussed for each project. Pre-set Clash Test can be downloaded from ***Appendix D8 – Clash Test*** and import into Navisworks.

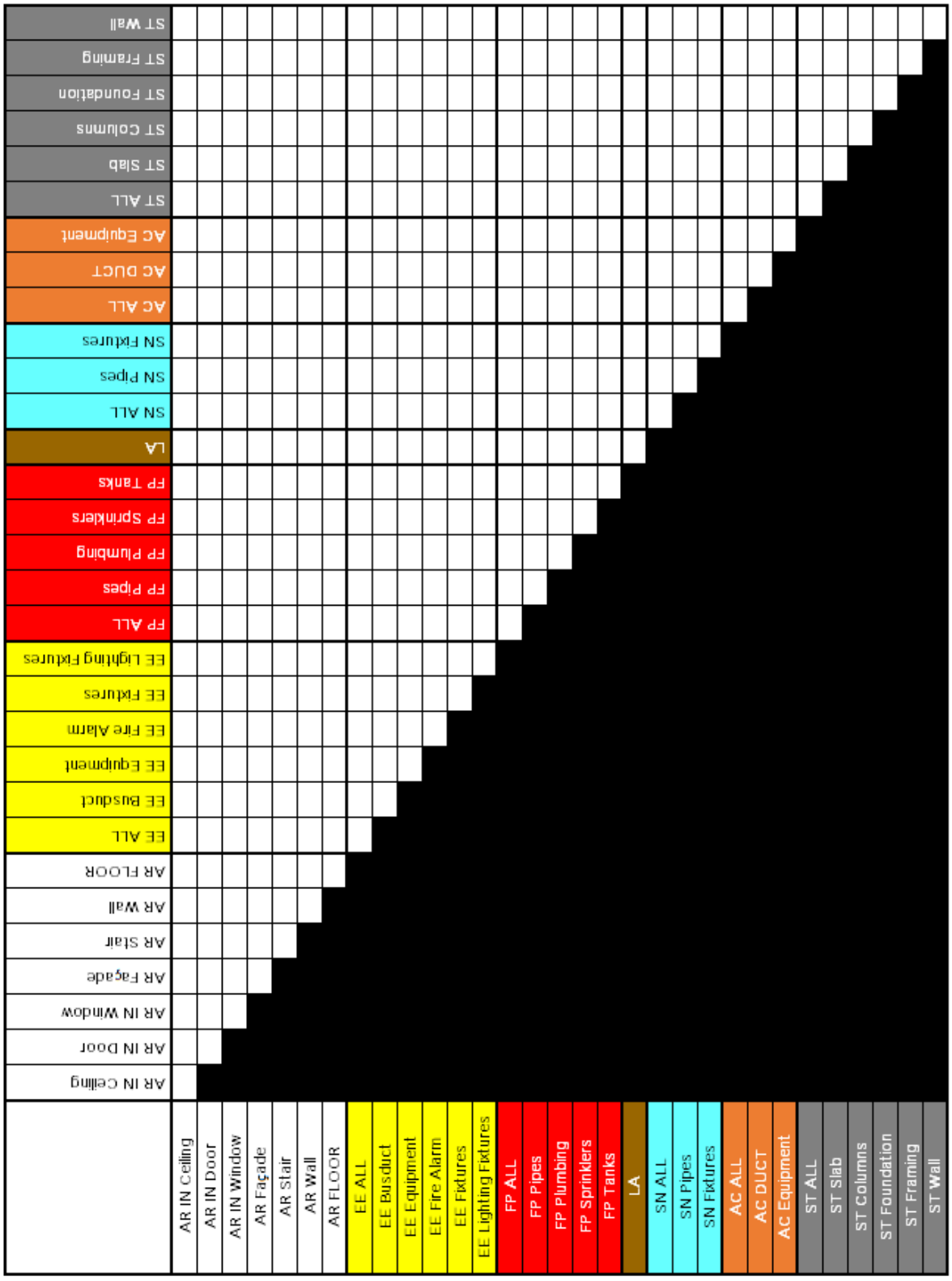


Figure 4.8 Clash Test Matrix

By ABuild Management

4.3.5 Clash Rules

Setting the following rules will reduce unnecessary clash found in the process.

Table 4.6 Clash Rules

Rules	Description	Action
Items in same layer	Any items found clashing that are in the same layer are not reported in the result.	Un-Select
Items in same group/block/cell	Any items found clashing that are in the same group (or inserted block) are not reported in the result.	Select
Item in same file	Item within the same will not be considered as a clash.	Un-Select
Items with coincident snap points	Any items found clashing that have snap points that coincide are not reported in the result.	Select

4.3.6 Clash Responsibility

Table 4.7 Clash Responsibility

Team	Responsibilities
Designers/ Contractors	• Model author • Model interference check • Export .nwc files for clash detection
BIM Manager	• Provide BIM technique solution • Check .nwc files and search set • Run and update clash detection • Review clash groups • Participate clash meeting to review clash issues • Provide clash tracking
Construction Manager (CM)	• Group clash detection • Participate clash meeting to give feedback • Provide clash issues for clash meeting • Participate clash meeting to review clash issues

4.3.7 Clash Detection Report

After the clash detection process and grouping are done, Construction Manager (CM) produces clash report as a guideline for model revision or as an approval document when the model is clash free. The report shall be in the form of .html (Tabular) and .nwd file.

Clash Detection Report Template can be found through *Appendix D9 - Clash Detection Tracking Template*.

No.	Clash Date		Clash			ผู้รับผิดชอบ	วิธีการแก้ไข	สถานะ	วันที่ตรวจ	หมายเหตุ
			Clash File	View point	Description					
1	Clash ARST-MEP_Basement									
1.1	20180109	MINOR	IDEO_ARvsST_xx_BASEMENT_R2017_20180109	20170821_ประตู Corelift_Basement_Minor	Visual			ยังไม่แก้ไข		
1.1	20180109	MAJOR	IDEO_ARvsST_xx_BASEMENT_R2017_20180109	20170901_เสา ST ไม่ครบ_Basement_Major	Visual			ยังไม่แก้ไข		
					เสา ST ไม่ครบ					
1.2	20180109	MAJOR	IDEO_ARvsST_xx_BASEMENT_R2017_20180109	20170901_ผนังARชนกับเสาSTกับ_Basement_Major	Visual			ยังไม่เสร็จสิ้น		
					ผนัง AR ชนกับเสา ST					
1.3	20180109	MAJOR	IDEO_ARvsST_xx_BASEMENT_R2017_20180109	20170901_ผนังAR ST ซ้อนกัน_Basement+Ground_Major	Visual			ยังไม่เสร็จสิ้น		
					ผนัง AR ST ซ้อนกันกัน					
1.4	20180109	MINOR	IDEO_ARvsST_xx_BASEMENT_R2017_20180109	20170904_ตรวจสอบระดับท่อ drain_Minor	Visual			ยังไม่สรุป		
					ท่อ drain ผิดระดับ					
1.5	20180109	MINOR	IDEO_ARvsST_xx_BASEMENT_R2017_20180109	20170904_ท่อวิ่งเดียผนัง_Minor	Visual			เสร็จสิ้น		
					ท่อ kitchen pipe วิ่งเดียผนัง					

Figure 4.8 Example of Clash Detection Tracking

5.0 QUANTITY TAKE-OFF

5.1 Quantity Take-off Workflow

Quantity take-off from model elements is the product of the model creation. Therefore, for the accuracy of the quantity, the model shall be created according to Section 3.0 Data and Model Management and *Appendix C1 – Conclusion – Model Standard for QTO*.

The process starts with designers develop DD75 model according to Section 3.0 Data and Model Management. For current stage, designers are required to insert material code with follow the concept in Section 5.2 Material Code. Model quality is then validated according to Section 4.0 Quality Control, to ensure the accuracy of the quantity take-off especially the model quality under Section 4.1 Model Quality Review. Then designers shall revise the model as require before submitting it at the end of the phase.

This would follow by the procedures of quantity take-off in Pre-Construction phase as shown below and in following diagram. The full-size diagram can be downloaded from *Appendix C8 - Quantity Take-off Workflow*.

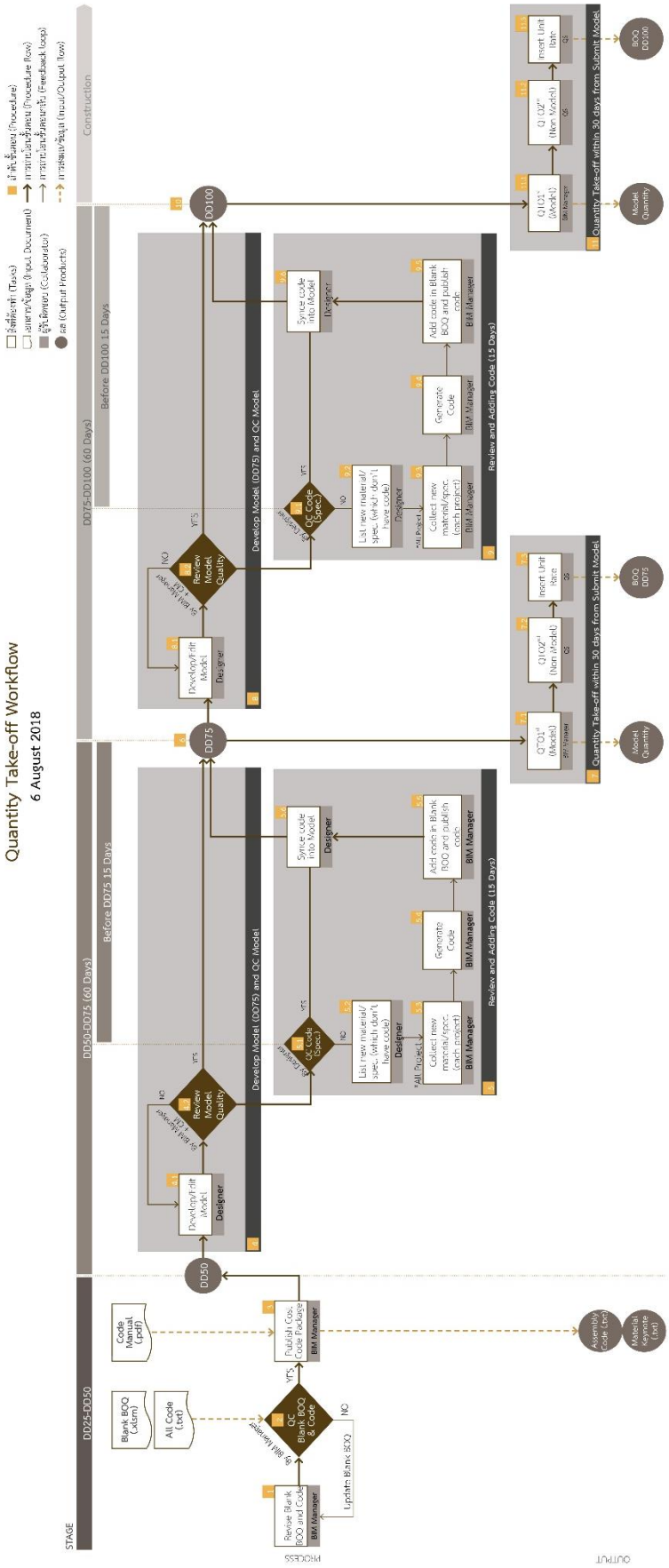


Figure 5.1 Quantity Take-off Workflow

Table 5.1 Quantity Take-off Activities Workflow Description

Activity & Deliverable	Role & Responsibility	Reference
DD 25 - DD 50		
1. Revise Blank BOQ And Code	BIM Manager	-
2. QC Blank BOQ And Code	BIM Manager	- Blank BOQ (.xlsm) - Assembly Code and Material Keynote (.txt)
3. Publish Cost Code	BIM Manager	- Insert Code Manual (.pdf)
DD 50 - DD 75		
4. Develop and QC Model	-	-
4.1 Develop/ Edit Model	Designer	-
4.2 Review Model Quality	BIM Manager & CM	
(If model does not complete (No) : 4.1 Edit Model)	Designer	-
5. Review & Adding Code	-	-
5.1 Review & QC Code (If Code complete (Yes) : 5.6 Sync Code into Model) (If Code does not complete (No) : 5.2 – 5.5 Identify New Material / Spec.)	Designer	- Assembly Code and Material Keynote (.txt)
5.2 Identify New Material / Spec. (Which don't have code)	Designer	- Request New Code Form (Google Sheet)
5.3 Collect New Material / Spec. Each Project	BIM Manager	-
5.4 Generate New Code	BIM Manager	-
5.5 Add Code in Blank BOQ and Publish Code	BIM Manager	-
5.6 Sync Code into Model	Designer	-

Activity & Deliverable	Role & Responsibility	Reference
6. Publish Model DD 75	Designer	-
7. Quantity Take off (QTO) DD75	-	-
7.1 QTO from Model DD75	Quantity Surveyor	- QTO Template (.xlsm, .dyn) - Ananda Cost Code & QTO Manual (pdf.)
7.2 QTO from Non-model	Quantity Surveyor	-
7.3 Insert Unit Rate	Quantity Surveyor	-

Note* When DD100 Model is created, validated, revised and submitted, it will also proceed through the same procedures produce DD75 BOQ.

5.2 Material Code

For the accuracy of the quantity take-off using the process above with Ananda Development BOQ system, there are two areas of concern; Location and Material/Elements. Location is to specify where the element is allocated according to BOQ setup which calculate elements by zone, floor and unit room. The location is ensured by correct reference floor and room tag as part of the model management in Section 3.2 Model Management. Materials/Elements are to specify a model element as a material list according to BOQ list. This specification is done through the numbering system call Material Code.

There more than one way to extract quantity from a model, material code is selected in this case. Material acts as a medium between model elements and BOQ list. This improves speed and accuracy of the quantity take-off process. In this stage, the code is required to be inserted by designers.

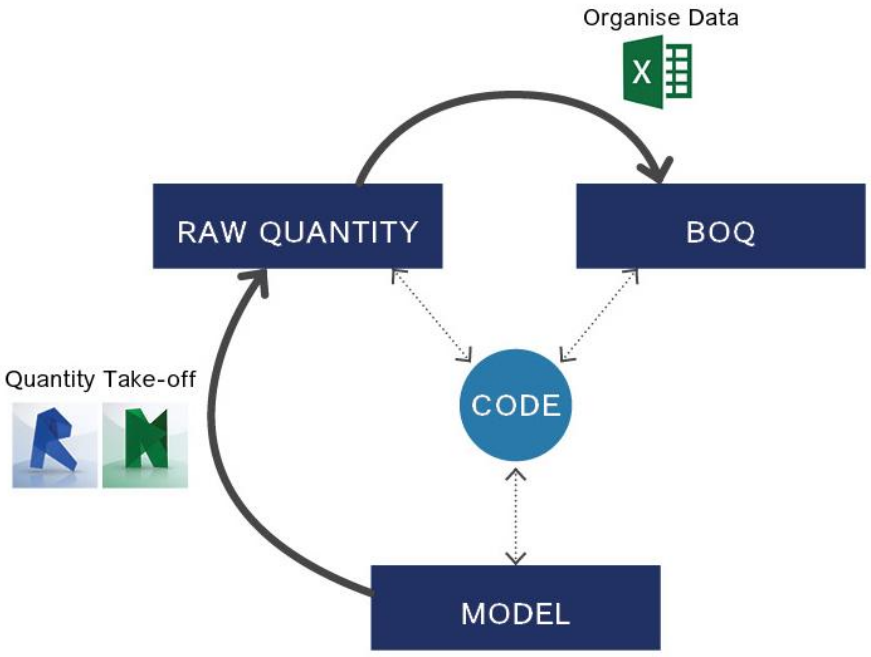
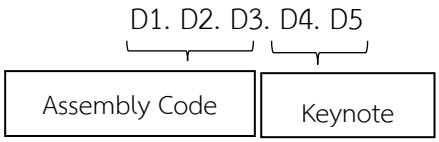


Figure 5.2 Material Code in the Quantity Take-off process

There are slightly difference in classification criteria between Structural & Architectural elements and MEP elements which is explained below.

Structural and Architectural Elements

The code for structure and architecture elements consists of 5 digits, each digit is separated by "." as shown below.



- Assembly Code: Identify the building elements with the first 3 digits of the code. It can be put into Revit family in "Assembly Code" parameter. This can be select for each family by adding .txt file into the project. This file can be downloaded from ***Appendix C11 - Assembly Code***.
- Keynote: Identify material use for that particular elements with the last 2 digits of the code. It can be put into 'Material Keynote' parameter in the Revit material, which is selected for each type of elements. At current stage, this can be selected by adding .txt file into the project. This file can be downloaded from ***Appendix C12 – Material Keynote***.

Table 5.2 Assembly Code and Material Keynote of Structural and Architectural Elements

	Code Digit	Description	Example
Assembly Code	Digit 1	Discipline	Architecture, Structure
	Digit 2	Type of building element/ Type of construction work.	Column, Beam, Floor, Wall
	Digit 3	Work breakdown structure	Brick Wall, Formwork, Wall Finishes
Keynote	Digit 4	Materials	Concrete, Ceramic Tile
	Digit 5	Material Specification	Concrete 350 ksc., Ceramic Tile Size 15x15 cm.

Example:

01.01.02.01.01 Structural Concrete Bored Pile 240 Ksc.

01.01.02.01.02 Structural Concrete Bored Pile 280 Ksc.

02.01.01.50.01 Architectural Floor Finishing Work of Ceramic Tile Size 12X12 cm

02.02.02.12.01 Architectural Wall Work of Precast Thickness 10 cm.

Mechanical, Electrical and Plumbing (MEP) Elements

The code for MEP elements also consists of 5 digits, each digit is separated by "." as shown below.

D1.D2.D3.D4.D5

Table 5.3 Assembly Code and Material Keynote of Mechanical, Electrical and Plumbing (MEP) Elements

Code Digit	Description	Example
Digit 1	Discipline	Electrical, Sanitary, Fire Protection
AC, Sanitary and Fire Protection		
Digit 2	Work breakdown structure	Equipment, Piping Works
Digit 3	Elements	Water Heater, Pump, Air Conditioner
Digit 4	System Type	Cold Water, Soil, Supply Air
Digit 5	Specification	Pipe Sizing
Electrical		
Digit 2	System Type	High Voltage System, Main Plant
Digit 3	Elements	Manhole, Handhole, Cable & Conduit
Digit 4	Materials	XLPE cable, RSC Conduit
Digit 5	Specification	70 sq.mm - 24 Xlpe cable, RSC 5"/127 mm.

Example:

03.01.01.01.01 Electrical and Communication System High Voltage Equipment 12M Riser Pole.

04.02.01.01.03 Sanitary Piping HDPE Class PN10 for Cold Water System Diameter 1/2"

05.02.01.01.05 Fire Protection Piping Black Steel Pile Schedule 40, ASTM A53 (Seamed) Class A Diameter 1"

06.01.01.01.01 Air Conditioning System Split Type CS

The procedure of inserting material code, both assembly code and keynote, is explained in ***Appendix C10 – HOW TO - Insert Assembly Code and Keynote***. If the code provides do not satisfy project materials, designers and contractors shall notify BIM Manager to add new code.

6.0 PROJECT INFORMATION

6.1 Background

6.1.1 Project Information

Project name:
Project owner:
Project Type
Brief project description:
Contract type/delivery methods
Contract engagement – indicative date

6.1.2 Project Coordinate

Project set out point	Intersection of grid .....
Coordinate System for Project	Survey Coordinate System • N/S ..... • W/S..... • Elevation ..... Project Coordinate System • N/S ..... • W/S..... • Elevation .....
Project North to true North Angle	

6.2 BIM Collaboration Team

6.2.1 BIM Stakeholders

Organisation	Position	Contact name	Workplace Address	E-mail	Phone

6.3 Schedule

This section summarises submission and detail milestone dates for all three phase; Design Phase, Construction Phase and Post-Construction Phase. Phase schedule is the date according to master schedule of the project, while model submission milestone is the detail submission date between phase to ensure quality of the product at the end of each phase.

6.3.1 Design Phase Milestone

Design Milestone is a significant event in the course of a design building that is used to give visibility of progress in terms of achievement of predefined milestone goals for each discipline. Including Architecture, Structure, MEP, Interior and Landscape during pre-construction phase. The information in Design Milestone will provide overall process such as model submission sequence and duration for each discipline.

Objective of Design Milestone are;

- To design pre-construction schedule that suitable for BIM process.
- To provide model submission sequence for an effective design work.

The following diagram shows guideline for model submission sequence, for detail of submission schedule please refer to Section A3.1.2 Model Submission Milestone

ID	Resource Names	Task Name	Duration	Start	Finish	Predecessors
1	AR	Lay Out (ทั้งอาคาร)	10 days	Mon 6/5/17	Fri 6/16/17	
2	ST	Lay Out (ทั้งอาคาร)	10 days	Mon 6/19/17	Fri 6/30/17	1
3	MEP	Lay out (ทั้งอาคาร)	10 days	Mon 7/3/17	Fri 7/14/17	2
4	ID	Lay Out (ห้องพัก)	10 days	Mon 7/17/17	Fri 7/28/17	3
5	ST	Basement - Foundation	15 days	Mon 8/28/17	Fri 9/15/17	1,2,3
6	AR	Basement - Basement	15 days	Mon 9/25/17	Fri 10/13/17	5
7	CLASH	Clash AR-ST (Pilling & Basement)	10 days	Mon 10/16/17	Fri 10/27/17	6,5
8	AR	Typical Floor	15 days	Mon 7/31/17	Fri 8/18/17	4
9	ST	Typical Floor	15 days	Mon 8/21/17	Fri 9/8/17	8
10	MEP	Typical unit AC/SN	15 days	Mon 8/21/17	Fri 9/8/17	8
11	ID	Typical Unit	15 days	Mon 8/21/17	Fri 9/8/17	8
12	MEP	Typical Unit EE/FP	15 days	Mon 9/11/17	Fri 9/29/17	11
13	MEP	Riser ย่อย	15 days	Mon 9/11/17	Fri 9/29/17	10
14	CLASH	Clash AR-ST (Pilling & Basement)	1 day	Mon 10/30/17	Mon 10/30/17	13,7
15	MEP	Riser Main	15 days	Mon 7/3/17	Fri 7/21/17	1,2
16	MEP	ชั้นรวบท่อ	15 days	Mon 10/2/17	Fri 10/20/17	13
17	AR	Podium	15 days	Mon 7/17/17	Fri 8/4/17	1,2,3
18	ST	Podium	15 days	Mon 7/17/17	Fri 8/4/17	1,2,3
19	ID	Podium	15 days	Mon 8/7/17	Fri 8/25/17	17
20	MEP	ห้องเครื่องต่างๆ	15 days	Mon 7/17/17	Fri 8/4/17	1,2,3
21	MEP	Public space	15 days	Mon 8/28/17	Fri 9/15/17	18,19
22	AR	Crown - Facility (ทั้งอาคาร)	15 days	Mon 7/17/17	Fri 8/4/17	1,2,3
23	ST	Crown - Facility (ทั้งอาคาร)	15 days	Mon 7/17/17	Fri 8/4/17	1,2,3
24	LS	Crown - Landscape (ทั้งอาคาร)	15 days	Mon 7/17/17	Fri 8/4/17	1,2,3
25	ID	Crown - Facility (ทั้งอาคาร)	15 days	Mon 8/7/17	Fri 8/25/17	22
26	MEP	Crown - งานระบบ AC/SN/EE/FP	15 days	Mon 8/28/17	Fri 9/15/17	25
27	CLASH	Clash ARST-MEP (Typical)	60 days	Mon 10/23/17	Fri 1/12/18	16
28	CLASH	Clash ARST-MEP (Podium)	60 days	Mon 10/23/17	Fri 1/12/18	16
29	CLASH	Clash ARST-MEP (Crown)	60 days	Mon 10/23/17	Fri 1/12/18	16
30	CLASH	ARST-MEP (Entire building)	1 day	Mon 1/15/18	Mon 1/15/18	27,28,29

Figure 6.1 Example of Design Milestone

A. Project design phase schedule

Project phase schedule will give the information of estimate start date and completion date during design phase. Which including all of project stakeholder in each specific times. Pre-Construction phase can be divided into 3 durations. Start from DD50, DD75 and DD100.

Project Phase/ Milestone	Estimated start date	Estimated completion date	Project stakeholder involved
Pre-Construction Phase			
DD50			AR, ST, MEP, IN, LA
DD75			AR, ST, MEP, IN, LA
DD100			AR, ST, MEP, IN, LA
Clash (Entire Building)			AR, ST, MEP, IN, LA

B. Model Submission Milestone

Model submission Milestone will provide a specific date and deliverable that need to be submitted during design phase.

Project Phase/ Milestone	Estimated start date	Estimated completion date	Project stakeholder involved
Pre-Construction Phase			
Lay out (Building)			AR, ST, MEP, IN
Basement			AR, ST
Typical			AR, ST, MEP, IN
Podium			AR, ST, MEP, IN
Crown			AR, ST, MEP, IN, LA

The following schedule shows guideline for model submission sequence in specific part of building, for detail of submission schedule please refer to ***Model Ownership and LOD Definition*** in Maru 360 Standard page.

6.3.2 Construction Phase Milestone

A. Project Construction Phase Schedule

Project phase schedule will give the information of estimate start date and completion date during Construction phase. Which including all of project stakeholder in each specific times.

Project Phase/ Milestone	Estimated start date	Estimated completion date	Project stakeholder involved
Construction Phase			
Construction			
Clash Detection			
Basement			
Podium			
Typical			
Crown			

B. Model Submission Milestone

Model Submission Milestone will provide a specific date and deliverable that need to be submitted during construction phase.

Project Phase/ Milestone		Estimated start date	Estimated completion date	Project stakeholder involved
	Construction Phase			
Pilling				AR, ST, MEP
Basement				AR, ST, MEP
Typical				AR, ST, MEP, IN
Podium				AR, ST, MEP, IN
Crown				AR, ST, MEP, IN, LA

The following schedule shows guideline for model submission sequence in specific part of building, for detail of submission schedule please refer to *Model Ownership and LOD Definition* in Maru 360 Standard page.

6.3.3 Post-Construction Phase Milestone

A. Project construction phase schedule

Project phase schedule will give the information of estimate start date and completion date during Post-Construction phase. Which including all of project stakeholder in each specific times.

Project Phase/ Milestone	Estimated start date	Estimated completion date	Project stakeholder involved
Post-Construction Phase			
As-built			
Manual			

B. Model Submission Milestone

Model submission Milestone will provide a specific date and deliverable that need to be submitted during Post-Construction phase.

Project Phase/ Milestone	Estimated start date	Estimated completion date	Project stakeholder involved
Post-Construction Phase			
As-built			CM
3D model			CM, BIM Consult
2D pdf			CM, Contractor
Manual			CM
AR			CM, Contractor
ST			CM, Contractor
MEP			CM, Contractor

The following schedule shows guideline for model submission sequence in specific part of building, for detail of submission schedule please refer to ***Model Ownership and LOD Definition*** in Maru 360 Standard page.

6.3.4 Meeting Schedule

Meeting type	Project stage	Frequency	Participant	Location
BIM Requirement Kick-off				
Design Coordination				
BIM Coordinate				
Any other BIM meetings				

APPENDICES

Appendices can be download from the link in Maru 360 Standard page. The folder will consist of the following files.

Appendix List		Type
APPENDIX A: BIM Process		
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APPENDIX B: Model Management		
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APPENDIX D: Quality Control		
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Appendix List		Type
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Appendix D7 -	Colour Appearance	Add-in
Appendix D8 -	Clash Test	Add-in
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APPENDIX E: Acronym List		

MARU 360°
FORUM

BIM EXECUTION PLAN

PRE-CONSTRUCTION