Building Information Modelling

# Alpha Consulting Engineers Pte Ltd
# BIM Manual

20140905

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DRAFT

# 1. INTRODUCTION

## a. Introduction

This manual is to establish the standards, procedures and methodologies for Building Information Modelling (BIM) for Alpha Consulting Engineers Pte Ltd for work undertake by the firm.

The manual is based on the Revit MEP authorizing software used by the firm and the manual will be reviewed and update regularly.

The objectives of BIM are:

- To maximise production efficiency through adopting a coordinated consistent approach to working in BIM.
- To define the standards, settings and best practices that ensure delivery of high quality and uniform drawing output across all projects undertaken by the firm.
- To ensure BIM files are structured correctly and in an orderly manner to enable easy retrieval and efficient data sharing with multi-disciplinary teams both internally and in external BIM environments.

This manual is a live document and shall be reviewed and updated regularly to meet the needs of successful implementation of BIM

## b. Standard Conformance

All project teams shall comply with the standards and procedures outlined in this manual. Approval shall be obtained from the Project Director for any deviations from the standards and procedures. The deviations shall be documented on the BIM Execution Plan for the project.

**c. BIM Committee**

The BIM Committee consists of the following members

| | |
|---|---|
| Mr Choong Choon Guan | Director |
| Mr Goh Soon Huat | Director |
| Ms Chong Lai Meng | Senior Associate |
| Ms Noraini Bte Hj Sairi | Executive Engineer |
| Ms Rukiah Bte Suttan | Engineer |
| Ms Rahimah Bte Ali | Assistant Engineer |
| Mr Affendi Bin Abdul Rahman | Assistant Engineer |
| Mr Abdul Rahman Bin Ramlan | Assistant Engineer |

**d. Definitions**

In this manual, the following definitions shall apply:

*i. Building Information Modelling (BIM)*

BIM is the process of generating 3-dimensional, digital representation of building data throughout its life cycle. BIM is an innovative technology for bridging communications between the architecture, engineering and construction industries.

*ii. BIM Manager*

A person appointed to coordinate the use of BIM in a project, determine schedule of use, sharing activities, quality control, modelling responsibilities and document in BIM Execution Plan.

*iii. BIM Coordinator*

A person appointed to develop and implement a Project BIM Execution Plan which shall record the key project task, outputs and model configuration. Maintain the BIM Execution Plan updated over the life of the project. The BIM coordinator shall also coordinate with modelers and designers as well as project members for model review and model exchange. Ensure all stakeholders (internal and external) are in alignment with the BIM Execution Plan. Take a lead role in planning, setup and maintaining models

*iv. BIM Execution Plan*

BIM Execution Plan is a document which specifies project-specific requirements, and contains details on how the project will be executed, monitored and controlled with regard to BIM deliverables, in order to satisfy the project objectives.

*v. BIM Model*

It is an object-based digital representation of the physical and functional characteristics of a facility. It serves as a shared knowledge resource for information about a facility forming a reliable basis for decisions during its lifecycle from inception onward.

The Final Design Model is the final stage of the model which is suitable to be published as 2D design drawings that can be used for tender. This model is used to develop the Construction Model

*vi. Model Author*

The model author is a party responsible for creation and maintenance of a specific model to the level of detail as required. Model authors are responsible to check the accuracy and quality of the model before sharing with model users.

*vii. Model Users*

Model users are parties authorised to use the model on the project for review and comments and should use for reference only. The model is provided in native or neutral (IFC) format. The model user shall notify the model author for clarification in case of inconsistency of the model.

*viii. Level of detail*

It is the amount and quality of the information contains in the BIM Model element/assembly. This information comes in the form of geometric and non-geometric attributes that are stored in each single BIM element (or assembly of elements).

Examples of Geometric and Non-Geometric Attributes of BIM Elements

| Geometric attributes | Non-geometric attributes |
|---|---|
| • Size<br>• Volume<br>• Shape<br>• Height<br>• Orientation | • System data<br>• Performance data<br>• Regulatory compliance<br>• Specifications<br>• Cost |

The attributes of a BIM element will change at different project stages milestones; namely Conceptual Design, Schematic/Preliminary Design, Detailed Design, Construction , As-Built and Facility Management

*ix. Industry Foundation Class (IFC)*

A vendor-neutral, open data exchange specification. It is an object-oriented file format developed for the building industry and is commonly used in Building Information Modelling to facilitate interoperability between software platforms.

*x. Interoperability*

The ability to manage and communicate electronic product and project data between collaborating firms and within individual companies design, procurement, construction, maintenance, and business process systems.

## 2. DOCUMENT MANAGEMENT

### a. General

All BIM project data shall be save in the standard project folder structure located on Central Network Server. Standard templates, title blocks, families and other non-project-specific data shall be created and save keep in the Central Server Resource Library.

Where a project comprises of a number of separate elements such as multiple buildings, zones or areas, the BIM structure shall be maintained within a set of designated sub-folders representing the various project elements.

A data security protocol should be established to prevent any possible data corruption, virus “infections,” and data misuse or deliberate damage by project team members, other employees or outside sources. Adequate user access right should be established to prevent data loss or damage during file exchange, maintenance, and archiving. BIM project data residing on network servers should be subjected to regular back-ups.

**b. Small–scale Project**

For small scale project of not more than 2,000 sq.m, a single Model will be created. For each stage of review, "DWF" file will be generated for visual quality check and for use by analysing software.

BIM Project File (xyz.rvt)

BIM Model with:

Plans View

Elevations View

Sections View

Details

Schedules, etc.

**c. Large-scale Project**

For large scale project, separate model will be created for each services as follows:-

- Model of Fire Fighting & Alarm Installation
- Model of Plumbing and Gas Services
- Model of Sanitary Services
- Model of Air-Conditioning & Mechanical Ventilation Installation
- Model of Electrical Installation

Other model where necessary may be created upon the approval from the Project Director or the BIM Manager.

**d. Project Folder Structure**

i. Central Server Structure

All common library files shall be reviewed and approved by the BIM Manager prior to saving to the central server for use as Company standard documents.

The common library files shall be stored in the server as follows:-

- Root\Library\Revit
  - + Titleblocks
  - + Standards
  - + Templates
  - + Families

ii. Project Folder Structure

Working copies of project models can be saved in the local drive and copied to the Server Home directory at the end of the day for back-up. The local project drawing folder structure as be as follows:-

- D:\Drawing_____ [Local Drawing Folder]
  - BIM_Projects _____ [Storage of Revit projects]
    - <Project Number> _ [Project Number]

iii. Central Project Folder Structure

The central project models shall be stored in the central server according to the following folder structure:

| | |
|---|---|
| - ***[Project Folder]*** | |
| - **BIM** | [BIM data repository] |
| - **01-WIP** | **[WIP data repository]** |
| - CAD_Data | [CAD files (incl. "Modified")] |
| - BIM_Models | [Design models (incl. "Modified")] |
| - Sheet_Files | [Sheet/dwg files] |
| - Export | [Export data e.g. gbXML or images] |
| - Families | [Components created during this project] |
| - WIP_TSA | [WIP Temporary Shared Area (TSA)] |
| - **02-Shared** | **[Verified Shared data]** |
| - CAD_Data | [CAD data/output files] |
| - BIM_Models | [Design models] |
| - Coordination_Models | [Compilation models] |
| - **03-Published** | ***[Published Data]*** |
| + YYMMDD_Description | [Sample submission folder] |
| - **04-Archived** | **[Archived Data repository]** |
| + YYMMDD_Description | [Archive folder] |
| - **05-Incoming** | **[Incoming Data repository]** |
| - Source | [Data originator] |
| + YYMMDD_Description | [Incoming folder] |
| - **06-Resource** | **[Project support files]** |
| + Titleblocks | [Drawing borders/titleblocks] |
| + Logos | [Project logos] |
| + Standards | [Project standards] |

Folder naming shall not have any space in between word as this can potentially interfere with certain file management tools and collaboration across the internet.

iv. Component Library Sub-Folders

All locations for the storage of Family components to be sub-divided as follows:

| | |
|---|---|
| - 🗀 ***Families*** | ***[Exists in several locations]*** |
| + 🗀 2012 | [The version of the software] |
| - 🗀 Architecture | [Architectural components] |
| - 🗀 Structure | [Structural components] |
| - 🗀 Mechanical_Services | [MEP components] |
| - 🗀 Electrical_Services | [MEP components] |
| - 🗀 General | [Non discipline-specific elements] |
| - 🗀 Autodesk_Metric_Library | [Default supplied components] |
| - 🗀 Material_Library | [Textures libraries and images for render output] |

The individual disciplines shall then be broken down as follows, with new sub-folders added as required by additional functionality in the software.

v. MEP Components

- 🗀 Mechanical Services
  - 🗀 Ceilings
  - 🗀 Ducts
  - 🗀 Electrical_Components
  - 🗀 Fire_Protection
  - 🗀 Generic_Models
  - 🗀 Mechanical_Components
  - 🗀 Pipe
  - 🗀 Plumbing_Components
  - 🗀 Profiles
  - 🗀 Speciality_Equipment
  - 🗀 Sustainable_Design

vi. Non Discipline-Specific Components

| | |
|---|---|
| - 🗀 **General** | |
| - 🗀 Annotation | [Tags and symbols] |
| - 🗀 Titleblocks | [Drawing frame families] |

## e. General Naming Conventions

- Use only letters A-Z, hyphen, underscore and numbers 0-9 for all fields.
- All fields shall be separated by a hyphen character "-" Do NOT use spaces.
- Within a field, either CamelCase or an underscore "_" shall be used instead of a space to separate words.
- A single period character "." shall be used to separate the file name from the extension. This character should not be used anywhere else in the file name.
- The file extension shall not be amended or deleted.
- An "XX" shall be used if the file does not refer a single specific zone or level.
- The scheme for zone and level sub-division shall be agreed with the other project professionals at the outset and defined in the Project BIM Execution Plan.

### i. Model File Naming

The File naming convention below to be used for all project files:

Sample:

| Project ID | | | | | Author | | Zone | | | Version | | User-defined |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 9 | 9 | 9 | _ | M | - | 0 | 1 | _ | A | - | L1_LAYOUT |

Naming convention for each 3D model or BIM file

| Name of Field | Indicators | Description |
|---|---|---|
| Project Identification | XXXX | Project No |
| Author | A- | Architect |
| | C- | Civil engineer |
| | E- | Electrical engineer |
| | L- | Land surveyor |
| | M- | Mechanical engineer |
| | E- | Electrical engineer |
| | E- | Equipment supplier |
| | S- | Structural engineer |
| | T- | Telecommunication engineer |

| | | |
|---|---|---|
| | V- | Other disciplines |
| | X- | Contractor |
| Zone (or Block) | NN | where, N: zone or block number e.g.: 01 for Block 1 A1 for Zone A1 |
| | -- | For all blocks |
| Version (Revision/ Submission) | A- | 1st revision/submission |
| | B- | 2nd revision/submission |
| | C- | 3rd revision/submission |
| User-defined | | Brief description of drawing |

Within each DWF/PDF submitted to the regulatory agencies, all its related drawing views (plans, elevations, sections and 3D views) and layouts (contain only data information such as qualified person's declarations and schedules) should follow the naming convention below:

Sample:

| **Agency** | | | | | | **Type of View** | | | **View Name** | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **F** | **S** | **S** | **D** | **-** | **_** | **F** | **P** | **_** | **1st** | **S** | **T** | **O** | **R** | **E** | **Y** |
| **C** | **B** | **P** | **U** | **-** | **_** | **D** | **G** | **_** | **S** | **C** | **H** | | | | |

| Name of Field | Indicators | Description |
|---|---|---|
| Agency | CBPU | Central Building Plan Unit |
| | PUB-WRN | Public Utility Board – Water Reclamation (Network) |
| | PUB-WTR | Public Utility Board – Water Supply Network |
| | FSSD | Fire Safety and Shelter Department |
| | IDA-TFCC | Infocomm Development Authority, Telecommunication Facility Coordination Committee |
| | CITYGAS | CityGas Pte Ltd |
| Type of View | SP | Site Plan |
| | FP | Floor Plan |
| | FE | Elevation |
| | FX | Section |
| | DT | Details |

| | | |
|---|---|---|
| | 3D | 3D View |
| | LG | Legend |
| | DG | Schematic Diagram |
| View Name | 1st Storey or 2nd Storey or Nth Storey | Where, N is the storey number |
| | Elevation N | Where, N is the direction (eg. North, south, East & West) |
| | Section N | Where, N is the section number |
| | Details N | Where, N is the detail number |

Except for 3D model view, all other submitted views such as plans, schematic diagrams, elevations and sections should be indicated clearly with the necessary annotations, dimensions, scalebar and north point, as specified by the respective regulatory agency.

For details, reference shall be made to BCA's MEP BIM Submission Guidelines.

**f. Object Library**

The central resource library shall be loaded with the standard templates (with RFA extension) supplied with Revit and also other templates collected from manufacturers and suppliers. This library shall be regularly updated.

You can create a new family template for a particular project following the steps below.

- Browse for the list of templates and select the appropriate family template for editing
- Lay out references planes to aid in drawing component geometry
- Add dimensions to specify parametric component geometry
- Add labels to dimensions to create type or instance parameters
- Test the new model to verify correct component behaviour
- Add geometry in Solids and Voids, locked to reference planes
- Specify 2D and 3D geometry display characteristics with sub-category and entity visibility settings
- Define family type variations by specifying different parameters
- Save the newly-defined family, than load it into a new project and see how it performs

## 3. STANDARD PROJECT TEMPLATE

Create project template by using the standard project template. For submissions, the template use shall be taken from the BCA e-submission template.

Go to menu and click “New” and browse for standard template and save as “Project template”

Add in Project Description, Drawing Title, Owner’s name, Architect’s name, other consultant’s name (where applicable), Drawing Number.

Go to the ribbon, click “Manage” and go to MEP settings which is sub divided into the following settings

- Mechanical settings
- Electrical Settings
- Load classification
- Demand Factors
- Building/Space Type Settings

Select and edit each of the default settings to suit the project:

- Mechanical settings
  - Duct settings
  - Pipe settings

- Electrical settings
  - General, wiring
  - Voltage definitions
  - Distribution systems
  - Cable tray settings
  - Conduit settings
  - Load calculations
  - Panel schedules

- Load classification type
  - Motor
  - Others
  - Spare

- Demand factor
  - Motor

- Others
- Spare

- Building/Space Type settings
  - Area per person in m2
  - Sensible heat gain per person in watts
  - Latent heat gain per person in watts
  - Lighting load density in w/m2
  - Power load density in w/m2
  - Plenum lighting contribution in %
  - Occupancy schedule from what time to what time
  - Lighting schedule from what time to what time
  - Power schedule from what time to what time
  - Opening time
  - Closing time
  - Unoccupied cooling set point

- Set Project units
- Create Shared Parameters
- Set Location of project
- Define object Styles –

Set all line weight, line colour, line pattern & material for model objects, annotation objects, analytical model objects & imported objects.

## 4. PROCEDURE FOR PRODUCING 2D DRAWINGS

All BIM models shall be generated in 2D Drawings (in .dwg format) including plans, sections, elevations, details etc. to be used as design drawings, tender drawings and working drawings. Only 2D drawings can form part of the contract document. The BIM model is basically for reference only.

All 2D drawings/ details not produced from the BIM models should be clearly labelled.

Below is the procedure to produce 2D drawings from the BIM model

- Open the BIM model files and select the views, e.g. floor plans, sections, elevations, details etc. that you want to create the 2D drawings

- From the menu, create a new sheet and select a 'Title block" template with the appropriate paper size (A0, A1, A2 or A3 etc)
- Drag and drop the view from the project browser onto the sheet you have just created and move it around or change the scale and title.
- Add in text, dimensions and descriptions as required.
- Procedures shall be repeated to generate all the necessary 2D drawings as required.

## 5. BIM EXCHANGE FORMATS

The BIM Exchange Formats shall be established and agreed upon before the commencement of the production of the BIM model. The formats used shall be documented in the BIM Execution Plan. The format shall be an open protocol standards such as IFC. Proprietary formats can be used if model users are using the same BIM software.

Revit files could be exported to the following Exchange Format:

- Revit to CAD Formats (DWG & DXF files)
- Revit to Design Review (DWF or DWFx)
- Revit to IFC files
- Revit to gbXML files
- Revit to Reports

Similarly the following files could be imported to Revit:

- 2D CAD Formats to Revit
- IFC files, images to Revit

To export, go to File menu and select the type of exchange format.

## 6. BEST PRACTICE

To achieve technical excellence and a successful outcome to a project, it is essential that BIM working and subsequent drawing production output is carefully planned.

Below are the key principles that will aid efficient, high quality working.

**a. BIM**

I. A Project BIM Strategy shall be put in place that identifies key project tasks, outputs and model configuration.

II. BIM Project Reviews should be agreed and take place regularly to ensure model integrity and project workflow is maintained.

III. Develop clear guidelines for internal and external collaborative working which maintain the integrity of electronic data.

IV. Identify clear ownership of model elements through the life of the project.

V. Understand and clearly document what is to be modelled and to what level of detail. Do not over model. Refer to Appendix A for the MEP modelling guidelines for the various stages

VI. Sub-divide models between disciplines and within single disciplines to avoid file sizes becoming over ~100MB.

VII. All changes to the model shall be carried out as 3D modifications, rather than 2D patches to maintain the integrity of the model.

VIII. Outstanding warnings shall be reviewed regularly and important issues resolved.

IX. The Central file shall never be opened, only copied to create local files.

X. The Central file should be recreated at regular intervals in order to eliminate redundant data retention.

**b. Drawing Production**

I. A drawing shall contain design information solely for the purpose of the intended use of the drawing.

II. To maximise efficiency a policy of minimum detailing without compromising quality and integrity shall be adopted.

III. Numbers of drawings should be kept to an absolute minimum and organised in a logical manner.

IV. Avoidance of view duplication is essential to ensure drawings maintain their integrity as the iterative design process progresses and amendments are made.

V. Efficient minimum detailing and above all the elimination of detail repetition shall be the method adopted.

**c. Guidelines to reduce Revit file size**

i. Minimize the use of Revit in-place families.

ii. Maintain fewer and only essential links.

iii. Link only in appropriate view. For example, a detail should be referenced to a detail view.

iv. Use graphical symbols whenever detailed modeling is not required, such as for plumbing fixtures, furniture, etc.

v. Avoid use of extensive details unless necessary. Determine appropriate level of data granularity.

vi. Minimize the use of void forms when modelling.

vii. When modeling, use families rather than groups.

viii. Avoid exploding geometry unless necessary.

ix. Delete unused groups.

x. Purge model files on a regular basis.

xi. Create and use a default view with minimum information.

xii. Set model view depth to a minimum.

xiii. Eliminate unnecessary views from model files.

xiv. When possible, use wireframe or shading view option instead of hid-den or shading with edges view.

xv. Turn off shadow when not necessary for viewing.

xvi. Avoid using volumes unless necessary

## APPENDIX A - MEP BIM Modelling Guidelines

### A. Air Conditioning & Mechanical Ventilation Installation

| Stages | Elements | Modelling Guidelines | Remarks |
|---|---|---|---|
| **Conceptual** | System distribution lines | Use line diagrams to show the entire system distribution.<br>Include equipment symbols in the line diagrams. | Output :<br>Schematic diagrams |
| | Space objects | Use box objects to represent spaces required for MEP systems.<br>Add names and colours to the space objects. | |
| **Preliminary Design** | Zone Objects, | Zone the spaces that have common design requirements with colour legends on plans. | Output :<br>Preliminary Model |
| | Air Handling Unit, Chiller, Variable refrigerant flow unit and Cooling tower | Model each element using the correct BIM generic object.<br>Each element should have an approximate size. | Shows main distribution into different zones. |
| | Exhaust air ducts, Fresh air ducts, Supply air ducts, Return air ducts and Transfer air ducts.<br>Chilled water supply pipes, Chilled water return pipes and Condensate drain pipes. | Show only the main routes of the systems.<br>All ducts and pipes should be connected to the equipment.<br>Fasteners and hangers are not required.<br>In-line accessories, e.g. valves, fire dampers, volume controls and air filters are not required.<br>Use CP83 symbols. | Engineers should verify the space allocated by the Architect. |

## A. Air Conditioning & Mechanical Ventilation Installation

| Stages | Elements | Modelling Guidelines | Remarks |
|---|---|---|---|
| **Detailed Design** | Main elements of Preliminary Design:<br>Fire dampers, Motorized dampers, Volume control dampers.<br>Split-type indoor & outdoor air conditioning units<br>Exhaust or extract air fans, Fresh air fans,<br>Other fans such as jet fans<br>Diffusers, air-boots, air grilles, air filters, registers<br>Fan Coil unit,<br>Switch boards,<br>Control,<br>BMS & DDC panels<br>BMS control & monitoring modules. | Use CP83 symbols and colour standards.<br>Model each element using object correspond to actual component with actual size, material, type code and performance criteria.<br>Include insulation to reflect actual size for coordination purpose.<br>System routing should be connected with fittings.<br>Unavailable BIM objects that are modelled using different objects should be identified accordingly, e.g. use proper names and colours.<br>Downward slopes of the pipes should be modelled realistically.<br>Required fittings allowances, cross-over spaces and maintenance spaces should be considered.<br>Fasteners and hangers are not necessary.<br>Commercial product libraries can be used to the extent allowed by the modelling software<br>Fire rating should be included in the fire damper objects.<br>Pipe Accessories should follow the CP83 symbols in plan views.<br>For design coordination, documents such as coordinated services plans, sections, elevations, etc. should be derived from the model. | Output:<br>Detailed model for e-Submission and Tender.<br>For BIM e-Submission, please also refer to submission guidelines.<br>Services should be coordinated with architecture model.<br>Proposed position of mechanical components base on calculation or analysis e.g. air terminals, FCU should be approved by the architect. |

### A. Air Conditioning & Mechanical Ventilation Installation

| Stages | Elements | Modelling Guidelines | Remarks |
|---|---|---|---|
| **Construction** | The elements are the same as Detailed Design stage. | Model the portions of the building that need more attention.<br>All changes made by contractor & approved by consultants should be clearly indicated.<br>Objects not found in BIM tool can be represented by a box with proper identification and attributes such as equipment name, capacity, etc.<br>Levels of the elements comprising the system from finish floor line or at the certain reference in the model should be clearly annotated.<br>For construction coordination, documents such as coordinated services plans, sections, elevations, etc. should be derived from the model.<br>Fasteners can be modelled if necessary. | Output:<br>Model with construction details.<br>Contractor to develop the detailed Design BIM into Construction BIM. |
| **As-Built** | The elements are the same as Construction phase. | When the building is completed, the consultant will check the Detailed Design to correspond with the final implementation (As-Built) based on the information from the Contractor. | Output:<br>Model that can be used for space management, building maintenance and modifications made during occupancy by the FM /Employer |

### B. Plumbing & Sanitary Installation

| Stages | Elements | Modelling Guidelines | Remarks |
|---|---|---|---|
| Conceptual | System distribution lines | Use line diagrams to show the entire system distribution.<br>Include equipment symbols in the line diagrams. | Output:<br>Schematic diagram |
| | Space objects | Use box objects to represent spaces required for MEP systems.<br>Add names and colours to the space objects. | |

## B. Plumbing & Sanitary Installation

| Stages | Elements | Modelling Guidelines | Remarks |
|---|---|---|---|
| Preliminary Design | Zone objects,<br>Plumbing equipment<br>Plumbing fixtures<br>Sump and sewage pits<br>Storage, water holding tanks, pressure vessels<br>Water meters chambers<br>Manholes, outlets, surface and slot channels | Zone the spaces that have common design requirements with colour legends on plans.<br>Model each element using the correct BIM generic object<br>Each element should have an approximate size.<br>Show only the main routes of the systems.<br>All main pipes should be connected to the equipment.<br>Fasteners and hangers are not required.<br>In-line accessories e.g. valves, filters, water meters are not required.<br>Use CP83 symbols. | Output:<br>Preliminary Model<br>Shows main distribution into different zones<br>Engineers should verify the space allocated by the Architect. |

## B. Plumbing & Sanitary Installation

| Stages | Elements | Modelling Guidelines | Remarks |
|---|---|---|---|
| Detailed Design | Main elements of Preliminary Design<br>Fresh water piping, Fittings,<br>Valves, including hot and cold water pipes<br>Rainwater and storm water pipes<br>Foul drainage and kitchen waste pipe work including<br>Floor drains, Open trapped gullies, Sealed trapped gullies, Clean outs, Vents<br>Control panels, Monitoring and control sensors<br>Underground public utilities for water supply<br>Underground public utilities for drainage | Use CP83 symbols and colour standards.<br>Model each element using object correspond to actual component with actual size, material, type code and performance criteria.<br>Include insulation to reflect actual size for coordination purpose.<br>System routing should be connected with fittings.<br>Unavailable BIM objects that are modelled using different objects should be identified accordingly, e.g. use proper names and colours.<br>Downward slopes of the pipes should be modelled realistically.<br>Required fittings allowances, cross-over spaces and maintenance spaces should be considered.<br>Fasteners and hangers are not necessary.<br>Commercial product libraries can be used to the extent allowed by the modelling software.<br>Pipe Accessories should follow the CP83 symbols in plan views.<br>For design coordination, documents such as coordinated services plans, sections, elevations, etc. should be derived from the model. | Output:<br>Detailed model for e-Submission and Tender.<br>For BIM e-Submission, please also refer to submission guidelines<br>Services should be coordinated with architecture model |
| Construction | The elements are the same as Detailed Design stage. | Model the portions of the building that need more attention.<br>All changes made by contractor & approved by consultants should be clearly indicated.<br>Objects not found in BIM tool can be represented by a box with proper identification and attributes such as equipment name, capacity, etc<br>Levels of the elements comprising the system from finish floor line or at the certain reference in the model should | Output:<br>Model with construction details.<br>Contractor to develop the detailed Design BIM into Construction BIM |

### B. Plumbing & Sanitary Installation

| Stages | Elements | Modelling Guidelines | Remarks |
|---|---|---|---|
| | | be clearly annotated.<br>For construction coordination, documents such as coordinated services plans, sections, elevations, etc. should be derived from the model.<br>Fasteners can be modelled if necessary. | |
| As-Built | The elements are the same as Construction phase. | When the building is completed, the consultant should check the Detailed Design to correspond with the final implementation (As-Built) based on the information from the Contractor. | Output:<br>Model that can be used for space management, building maintenance and modifications made during occupancy by the FM / Employer. |

### C. Fire Fighting & Alarm Installation

| Stages | Elements | Modelling Guidelines | Remarks |
|---|---|---|---|
| Conceptual | System distribution lines | Use line diagrams to show the entire system distribution<br>Include equipment symbols in the line diagrams. | Output:<br>Schematic diagrams |
| | Space objects | Use box objects to represent spaces required for MEP systems<br>Add names and colours to the space objects. | |
| Preliminary Design | Zone Objects | Zone the spaces that have common design requirements with colour legends on plans. | Output: Preliminary Model<br>Shows main distribution into different zones |

## B. Plumbing & Sanitary Installation

| Stages | Elements | Modelling Guidelines | Remarks |
|---|---|---|---|
| Detailed Design | Main elements of Preliminary Design<br>Sprinkler pipework<br>Fire sprinkler pumps Sprinkler heads<br>SIB (Sub-Indicator Board)<br>Sprinkler control valve sets (Main stop valve, Subsidiary valve with indicator.<br>Alarm valve,Water motor alarm/gong , Test and drain valve, Pressure gauges and Direct read water flow meter<br>Hydrants and hose reels, including street fire hydrant system<br>Fire alarm gongs, Break glass unit<br>Fire shutters and hoods above<br>Gas piping for suppression systems.<br>Heat or smoke detectors, Control panels, Monitoring and control sensors.<br>Pump panels,<br>Check meter positions<br>Breeching inlet<br>Breeching inlet cabinet<br>Fire extinguishers | Use CP83 symbols and colour standards.<br>Model each element using object correspond to actual component with actual size, material, type code and performance criteria.<br>Include insulation to reflect actual size for coordination purpose.<br>The types, finish, temperature rating and orifice sizes should be indicated.<br>Unavailable BIM objects that are modelled using different objects should be identified accordingly, e.g. use proper names and colours.<br>System routing should be connected with fittings.<br>Required fittings allowances, cross-over spaces and maintenance spaces should be considered.<br>Fasteners and hangers are not necessary.<br>Commercial product libraries can be used to the extent allowed by the modelling software.<br>Pipe Accessories should follow the CP83 symbols in plan views.<br>Size of breeching inlet cabinet.<br>For design coordination, documents such as coordinated services plans, sections, elevations, etc. should be derived from the model.<br>For design coordination, documents such as coordinated services plans, sections, elevations, etc. should be derived from the model | Output:<br>Detailed model for e-Submission and Tender.<br>For BIM e-Submission, please also refer to submission guidelines.<br>Services should be coordinated with architecture model.<br>Engineers should verify the space allocated by the Architect. |

### B. Plumbing & Sanitary Installation

| Stages | Elements | Modelling Guidelines | Remarks |
|---|---|---|---|
| Construction | The elements are the same as Detailed Design stage. | Model the portions of the building that need more attention.<br>All changes made by contractor & approved by consultants should be clearly indicated.<br>Objects not found in BIM tool can be represented by a box with proper identification and attributes such as equipment name, capacity, etc.<br>Levels of the elements comprising the system from finish floor line or at the certain reference in the model should be clearly annotated.<br>For construction coordination, documents such as coordinated services plans, sections, elevations, etc. should be derived from the model.<br>Fasteners can be modelled if necessary. | Output:<br>Model with construction details.<br>Contractor to develop the detailed Design BIM into Construction BIM. |
| As-Built | The elements are the same as Construction phase. | When the building is completed, the consultant should check the Detailed Design to correspond with the final implementation (As-Built) based on the information from the Contractor. | Output:<br>Model that can be used for space management, building maintenance and modifications made during occupancy by the FM / Employer. |

### D. Electrical Installation

| Stages | Elements | Modelling Guidelines | Remarks |
|---|---|---|---|
| Conceptual | System distribution lines | Use line diagrams to show the entire system distribution.<br>Include equipment symbols in the line diagrams. | Output:<br>Schematic diagrams |
| | Space objects | Use box objects to represent spaces required for MEP systems.<br>Add names and colours to the space objects. | |

## D. Electrical Installation

| Stages | Elements | Modelling Guidelines | Remarks |
|---|---|---|---|
| Preliminary Design | Zone Objects, Transformers,<br>HV & LV switch boards, Switchgear, DB.<br>Cable trays, Trunking & cable containment<br>Electrical risers.<br>Generators and exhaust flues, including acoustic treatments<br>Diesel tanks & fuel pipes<br>Telecom equipment and computer racks | Zone the spaces that have common design requirements with colour legends on plans.<br>Model each element using the correct BIM generic object<br>Each element should have an approximate size.<br>Show only the main routes of the systems.<br>All cable trays, conduits and trunkings should be connected to the equipment.<br>Wires, fasteners and hangers are not required.<br>In-line accessories eg. valves, fire dampers, volume controls and air filters are not required.<br>Use CP83 symbols. | Output:<br>Preliminary Model<br>Shows main distribution into different zones |

## D. Electrical Installation

| Stages | Elements | Modelling Guidelines | Remarks |
|---|---|---|---|
| Detailed Design | Main elements of Preliminary Design:<br>Light fittings, Fixtures, Housings for light fixtures,<br>Conduit, Busduct, Power feeds,<br>Concealed and cast-in conduits<br>Outlets, Panels,<br>Wall switches,<br>Circuiting to devices, Security devices,<br>Card access,<br>"Plug moulds" (socket points)<br>Conduit associated with access, data communication, security systems and electrical equipment,<br>Security system including<br>CCTV camera, smart card system, door monitoring system<br>Car park control system, Barrier gates<br>Equipment and associated installations maintained by public utility companies | Use CP83 symbols and colour standards<br>Model each element using object correspond to actual component with actual size, material, type code and performance criteria.<br>Include insulation to reflect actual size for coordination purpose.<br>System routing should be connected with fittings.<br>Unavailable BIM objects that modelled using different objects should be identified accordingly, eg, use proper names and colours.<br>Required fittings allowances, cross-over spaces and maintenance spaces should be considered.<br>Fasteners and hangers are not necessary.<br>Commercial product libraries can be used to the extent allowed by the modelling software.<br>Electrical devices e.g. switches, power outlets, telephone and TV outlets should follow the CP83 symbols in plan views.<br>For design coordination, documents such as coordinated services plans, sections, elevations, etc. should be derived from the model. | Output:<br>Detailed model for e-Submission and Tender.<br>For BIM e-Submission, please also refer to submission guidelines<br>Services should be coordinated with architecture model<br>Engineers should verify the space allocated by the architect |

### D. Electrical Installation

| Stages | Elements | Modelling Guidelines | Remarks |
|---|---|---|---|
| Construction | The elements are the same as Detailed Design stage. | Model the portions of the building that need more attention.<br>All changes made by contractor & approved by consultants should be clearly indicated.<br>Objects not found in BIM tool can be represented by a box with proper identification and attributes such as equipment name, capacity, etc.<br>Levels of the elements comprising the system from finish floor line or at the certain reference in the model should be clearly annotated.<br>For construction coordination, documents such as coordinated services plans, sections, elevations, etc. should be derived from the model.<br>Fasteners can be modelled if necessary. | Output:<br>Model with construction details.<br>Contractor to develop the detailed Design BIM into Construction BIM. |
| As-Built | The elements are the same as Construction phase. | When the building is completed, the consultant should check the Detailed Design to correspond with the final implementation (As-Built) based on the information from the Contractor. | Output:<br>Model that can be used for space management, building maintenance and modifications made during occupancy by the FM /Employer. |