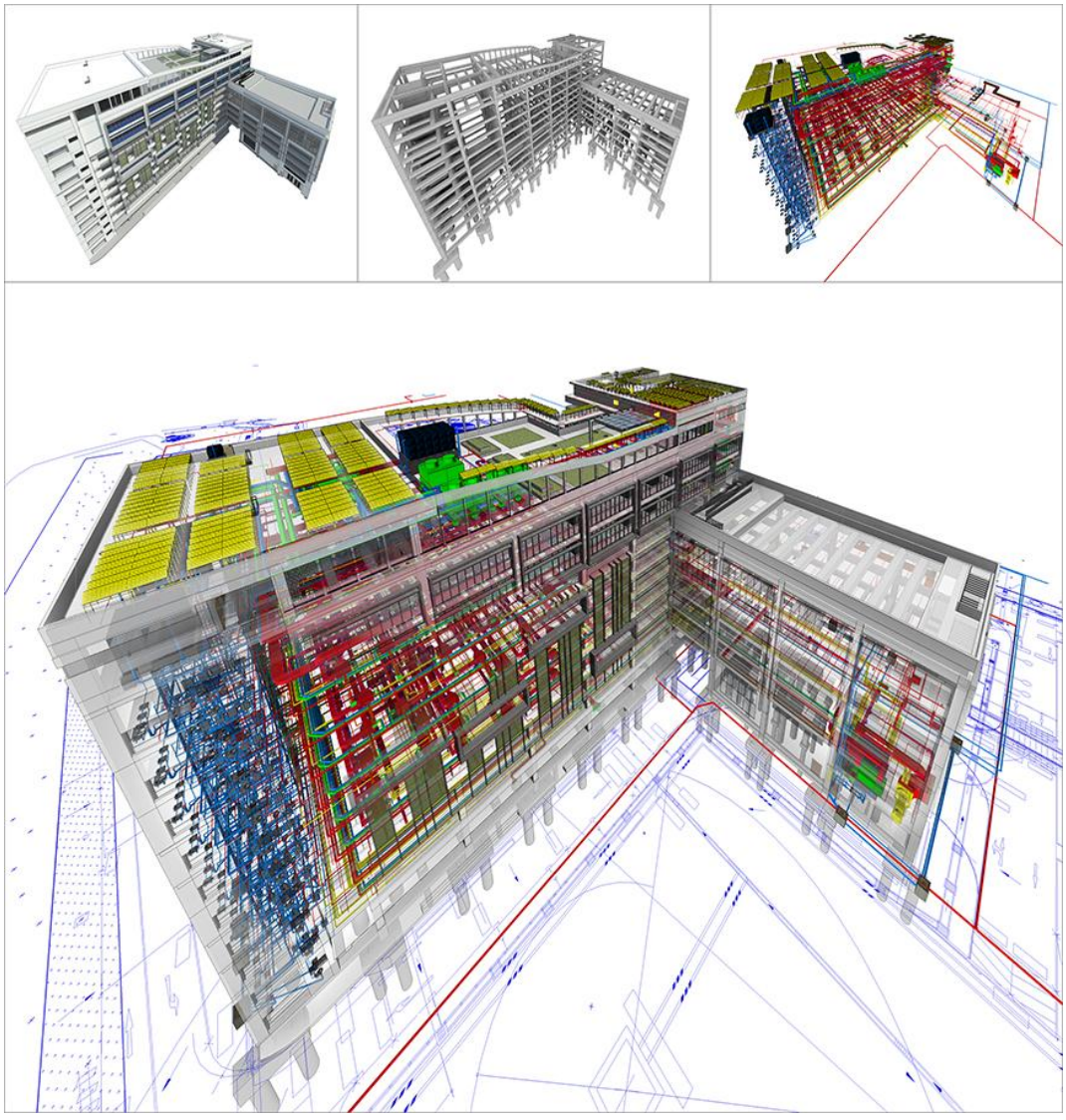
Building and Construction Authority

BIM Essential Guide

For BIM Execution Plan



BCA acknowledges the leadership provided by the BIM Steering Committee in support of the production of the BIM Essential Guides

The BIM Essential Guides have been drafted by the Centre for Construction IT on behalf of BCA and the BIM Steering Committee.

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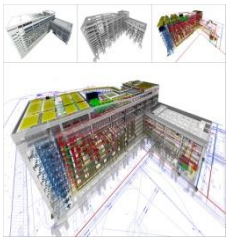

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CEO's Message

Dear readers,

Building Information Modelling (BIM) has gained much traction in recent years as digital construction technology that will fundamentally transform the building and construction industry practice in the delivery of an excellent built environment. It is a game changing technology that will improve the construction productivity as well as the level of integration and collaboration across the various disciplines in the construction value chain. It is therefore important for the industry to embrace the technology with clarity.

The BIM Essential Guides are part of the industry's efforts to demystify BIM and to give clarity on the requirement of BIM usage at different stages of a project.

Under the leadership of the BIM Steering Committee chaired by Er Lee Chuan Seng, Emeritus Chairman, Beca Carter, and comprising of leaders in BIM, the BIM Managers Forum has contributed much time and effort to compile the various best practices to make this Guide possible over a short span of time. We would like to thank them for their contribution.

We hope that every BIM user can truly reap the benefits of BIM by integrating it into his/her day-to-day workflow – from feasibility study to facility management. We hope that BIM users can use these guides as a platform to jumpstart their BIM adoption, before they leap to greater heights, innovating and transforming their workflow.

BIM is a journey. We envisage that it will grow with time and will inspire more advanced and innovative use of BIM. I would like to encourage all BIM practitioners to join in this industry effort to grow this Guide into a wealth of BIM knowledge.

Dr John Keung

1 INTRODUCTION

The **BIM Essential Guide for BIM Execution Plan** (BEP) serves to jump start the development of a BEP for a project. The BEP provides a baseline document, approved by the Employer, to guide the project team in achieving goals set with regards to BIM deliverables throughout the project.

The BEP specifies the **roles and responsibilities** of project members when using Building Information Modelling (BIM) at different stages of a project. It contains details with regards to the **BIM deliverables** and the **process** through which the deliverables are created, maintained and shared, in order to meet a set of project goals.

Typical content of a BEP includes the following:

- Project information;
- Project members;
- Project goals;
- BIM use cases for each stages of a project;
- BIM deliverables for each BIM use case,
- Model author and users for each BIM deliverables;
- Model elements, level of details and attributes for each BIM deliverable;
- Process for BIM creation, maintenance, release and collaboration;
- Technical Environment; and
- Others

The BEP is usually defined at the start of the project and can be updated to accommodate new project members or new uses of BIM. All updates should be made with the permission of the Employer or his appointed BIM Manager.

The BEP can be defined by the client, and made reference by the Principal Agreement via the BIM Conditions (see BIM Conditions Version 2 / Essential Guide to BIM Conditions).

2 STEP BY STEP QUICK GUIDE

Users could follow the following steps to define a **BIM Execution Plan (BEP)** using the various templates and materials found in the Singapore BIM Guide.

STEPS	DESCRIPTIONS	REFERENCES
1	Fill up Project Information in the BEP Template	Section 2

2	Fill up Project Members particular in the BEP Template.
	• Confirm the roles of responsibilities of the following at this point
	  ○ BIM Manager
	  ○ BIM Coordinators
		Singapore BIM Guide

3	Define Project Goals for in the BEP Template	
4	Define BIM Use Cases for each project phase in the BIM Use Case (BUC) Template • Confirm any Value-added BIM Use Cases at this point	Appendix A Singapore BIM Guide
5	Confirm BIM Deliverables for each BIM use case in the BUC Template • Fill up Author and Users for each BIM Deliverable in the BUC Template • Confirm the authoring software used and file exchange format at this point • Confirm the File Naming Convention and Model Structure for the deliverables	Appendix A Singapore BIM Guide
6	Select BIM Elements for each BIM Deliverable from the BIM Elements by Discipline Table • Confirm the Level of detail and non-geometry attributes for each BIM element at this point	Appendix B Singapore BIM Guide
7	Define process for model creation, release and collaboration • Confirm the quality checks to be performed by BIM Authors before releasing the deliverable	Appendix C Singapore BIM Guide
8	Technical Environment Needs • Confirm the list of software for the project • Confirm share workspaces and databases (if any) to house and share the BIM deliverables	

3 BIM Execution Plan Template

Section A: Project Information

This section defines basic project information.

1. Project Title: _____
2. Project Reference Number: _____
3. Contract Type / Delivery Method: _____
4. Brief Project Description & Address:_____

Section B: Project Members

Details of BIM Manager Contact

Contact Name	Title	Company	Email	Phone
	BIM Manager			

List of project members' and the respective BIM Coordinators' and Modellers' contacts.

Contact Name	Title	Company	Email	Phone
	BIM Coordinator			

Section C: Project Goals

Describe how BIM is used to achieve specific project goal at different stages of the project

Section D: Project Use Cases and Deliverables

List of expected BIM use cases and deliverables for each BIM use (see table in Annex A). Include value added use cases and deliverable

Section E: Author or Users of BIM Deliverables

List the author and users for each BIM Deliverable (see table in Annex A)

Determine Authoring Software and File Naming Convention and Model Structure for the Deliverables

Section F: Model Elements for Each Project Deliverable

List of model elements for each deliverables (see tables in Annex B)

Confirm the Level of detail and non-geometry attributes for each BIM element

Section G: Process for BIM creation, release and collaboration

Define Project Flow (see Annex C) with Schedules for BIM Deliverables Release

Define how project team will collaborate and coordinate the respective deliverables (see Annex C)

Define quality checks performed by BIM Authors before releasing the deliverables …

Section H: Technological Infrastructure Needs

List of software to be used in the project

Identify share workspaces and databases (if any) to house and share the BIM deliverables

Section O: Attachments

1. _____
2. _____

Appendix A – BIM Use Case Template

BIM Use Cases	Author Arc, Str, MEP, QS, Con, FM, Others	Users Arc, Str, MEP, QS, RS, Con, FM, Others
Conceptual Design Quality: Model with indicative dimensions, area, volume, location and orientation		
Essential: Create site BIM models for - Site Analysis - Apply an Outline Planning Permission if necessary Expected Deliverable • Site Model		
Essential: Create and compare BIM massing models for - space, areas and volumes study - design alternative study - presentation to client/design reviews Expected Deliverable • Massing Models or • other 3D Models (e.g. sketch-up)		
Value-added (optional): please specify Expected Deliverable • Please specify		
Schematic / Preliminary Design Quality: Models contain generalized building components and systems with approximate dimensions, area, volume, location, orientation and quantity. Non-geometric properties may be provided.		
Essential: Develop the selected massing models into architectural model for - regulatory submissions (PP, WP) Expected Deliverable • Architectural Model for URA submissions		
Essential: Develop & maintain structural model based on architectural model for - preliminary structural analysis - permit to commence work application Expected Deliverable • Structural Model for BCA submission		

BIM Use Cases	Author Arc, Str, MEP, QS, Con, FM, Others	Users Arc, Str, MEP, QS, RS, Con, FM, Others
Essential: Identify main routing and space (plant room & ceiling) clearances for MEP model on top of architectural model for - Preliminary M&E analysis - In preparation for regulatory submission Expected Deliverable • Prelim MEP Model		
Essential: Implement design coordination between the Architectural and Structural Models Expected Deliverables • Preliminary Design Coordination Report		
Essential: Derive preliminary project cost estimates based on Architectural and Structural BIM Models Suggested Deliverable • Preliminary Cost Estimate		
Value-added (optional): please specify Expected Deliverable • Please specify		
Detailed Design Quality: Models contain detailed version of generalized building components and systems with accurate dimensions, shape, location, orientation and quantity. Non-geometric properties should be provided .		
Essential: develop & maintain the Architectural Model for - regulatory submission - tender Expected Deliverable • Architectural Model		
Essential: develop & maintain the Structural Model based official release version of Architectural Model for - Design, analysis and detailing - In preparation for regulatory submission - In preparation for tender Expected Deliverable • Structural Model and Calculation		

BIM Use Cases	Author Arc, Str, MEP, QS, Con, FM, Others	Users Arc, Str, MEP, QS, RS, Con, FM, Others
Essential: Maintain and update the MEP Model, based on the latest Architectural Model - Design, analysis and detailing - In preparation for regulatory submission - In preparation for tender Expected Deliverable • MEP Model and Analysis		
Essential: Implement design coordination between the Architectural, Structural and MEP Models (before issuing for tender) - Identify element conflicts and interferences - Verify valid headroom and working spaces for building operations and maintenance activities - Penetration conflicts will be addressed Expected Deliverables • Clash Detection and Resolution Report • Spatial Validation Report		
Essential: Produce detailed cost estimation and Bill of Quantities (in accordance with the standard method of measurement) based on BIM models. - In preparation for tender Expected Deliverables • Detailed Quantity Cost Estimate & BOQ		
Essential: Tender Preparation Expected Deliverable • Tender model and drawings		
Value-added (optional): please specify Expected Deliverable • Please specify		
Construction Quality: BIM element is modelled with fabrication and assembly details where applicable or useful for construction works; otherwise, details may be represented in 2D CAD drawings to complement the Detailed Design models		
Essential: Produce Construction Models from Architectural, Structural and MEP Models. The models will be produced in stages Expected Deliverables • Construction Models with Key Services Coordinated		

BIM Use Cases	Author Arc, Str, MEP, QS, Con, FM, Others	Users Arc, Str, MEP, QS, RS, Con, FM, Others
Essential: Produce schedules of materials, areas and quantities from the BIM databases for contractors' reference Expected Deliverables • Schedules of materials, areas and quantities		
Essential: Sub-contractors and specialist sub-contractors will generate documents based on the Construction Models Expected Deliverables • Shopdrawings • Fabrication models and drawings • Combined Services Drawings (CSD) • Single Services Drawings (SSD)		
Essential: Contractors should provide the latest record model and drawings to the consultant if the consultant is required to do an amendment submission. Expected Deliverables • Record model • Record model-generated drawings • Other non-BIM deliverables		
Value-added (optional): please specify Expected Deliverable • Please specify		
As-Built Quality: BIM element is similar in level of detail to the Detailed Design stage, but updated with changes during Construction stage		
Essential: prepare final As-Built BIM Model to reflect amendments in the Architectural, Structural, MEP models before submitting to the consultants for verification Expected Deliverables • Final as-built models for each discipline with the necessary third party certifications		
Essential: Incorporate operation and maintenance information of major systems and equipment in the BIM model elements for provision to the Facility Manager Expected Deliverables • Final as-built models fit for space management, building maintenance and modifications made during occupancy by the FM / Employer		
Value-added (optional): please specify Expected Deliverable • Please specify		

Appendix B – Typical BIM Elements by Discipline

Kindly tick and write down the attributes of the selected elements on the table.

(I) ARCHITECTURAL BIM ELEMENTS

	Element	Elements or Parameters needed by each non-Architectural discipline
Site Model	Site infrastructure within site boundary (roads, pavements, car park spaces, access and parking arrangements and surrounding land use)	
	Street fire hydrant (only indication of locations necessary)	
	Surface drainage (only indication of locations necessary)	
	External drainage & underground drainage	
	Hard landscaped areas within site boundary	
	Planter boxes including sub-soil drainage systems	
	Massing of adjacent buildings relevant to project	
Rooms / Spaces	Room spaces, corridors, other spaces, plant and equipment rooms (including designated use)	
Walls and Curtain Walls	Interior / Exterior walls / Non-structural walls / Blockwork walls (*Including finishes to identify if tiled / painted / plastered)*	
	Curtain wall with mullions and transoms with true profile and window glazing units including shading devices	
Doors, Windows and Louvers	Interior / Exterior doors	
	Interior / Exterior windows	
	Louvers	
Basic structure	Beams (based on location and size indicated by the Structural Engineer)	
	Columns (based on location and size indicated by the Structural Engineer)	
Roofs	Roofs with overall thickness (including finishes & insulation)	
Ceilings	Ceilings (without support sub-frames) including module arrangement, material choices and finishes.	
	Hangars and sub-frames for ceilings*	
Floors	Horizontal floors	

	Sloped floors and ramps	
	Floor finishes details including tiling, carpet, screed only	
Vertical Circulation	Steps & stairs including risers, threads and railings including headroom clearance requirements	
	Elevator shafts (without fit-out installations by lift contractor)	
	Access ladders and catwalks	
Architectural Specialties and Casework	Precast / Prefab / GRC / Fibreglass facades	
	Railing & parapets, including mesh & metalwork	
	Fixed Building Maintenance Units in their overall bulk form	
Schedules	Schedules allowing information to be extracted from elements	
Fixtures and Equipment ∗ (with input from interior designers, specialist sub-contractors, etc)	Loose furniture including desks and computer workstations, casework (carpentry), including upper and lower cabinets	
	Appliances such as in kitchen equipment	
	Toilet fixtures, plumbing faucets	

∗ these elements may cause BIM models to become too big and unmanageable.

(II) STRUCTURAL BIM ELEMENTS

Element	Elements or Parameters needed by each non-Structural discipline
Foundations including piles, pile caps, tie / ground beams & footings	
Diaphragm walls & retaining walls	
Beams	
Columns	
Walls	
Slabs, including slab on grade and floating slab, recesses, curbs, pads and major penetrations	
Other types of transfer structure not mentioned above	
Stairs (steps, risers, threads, landings): all framing members and openings	

Shafts and Pits (and openings)	
Precast & Prestressed concrete systems: all primary and secondary elements	
Temporary structures and platforms	
Concrete reinforcement details (Rebar), imbeds and cast-ins ✶	
Steel frame structures including bracing systems ✶	
Base plates, bolts, clip angles, fixings, etc. ✶	
Connection details of structural steel members ✶	

✶ these elements may cause BIM models to become too big and unmanageable.

(III) CIVIL BIM ELEMENTS

	Element	Elements or Parameters needed by each non-Civil discipline
Digital Terrain Model (DTM) ❄	3D surface based on topography that shows site conditions and building locations Include existing walkways, roads, curbs, ramps and parking lots etc	
Geology Report △	Soil investigation report (A BIM Model is not required)	
Utilities Model	All points of connection for existing and new utilities within site boundary	
Rainwater & storm water pipe work	Includes outlets, surface channels, slot channels and manholes	
Underground Public Utilities	For drainage only	
Others	Drains, canals, crossings, retaining walls, and underground harvesting tanks	
	Underground electrical supply cables and sewer lines, IDA (telecom) line and Gas Lines.	

❄ Data of Digital Elevation Model to be provided by registered surveyors

△ Data of Geology Report to be provided by geotechnical engineers

(IV) ACMV BIM ELEMENTS

	Element	Elements or Parameters needed by each non-ACMV discipline
ACMV Equipment	Air Handling unit	
	Chiller unit	
	Variable refrigerant unit	
	Cooling Tower	
	Split-type indoor & outdoor air conditioning units	
	Exhaust or extract air fans	
	Fresh air fans	
	Other fans such as jet fans	
	Heat Exchanges for projects with District Cooling	
ACMV Distribution	Exhaust air ducts (excluding hangars)	
	Fresh air ducts (excluding hangars)	
	Supply air ducts (excluding hangars)	
	Return air ducts (excluding hangars)	
	Transfer air ducts (excluding hangars)	
	Diffusers, air-boots, air grilles, air filters, registers	
	Fire dampers, motorized dampers, volume control dampers, CO_2 sensors, CO sensors	
Mechanical Piping	Chilled water supply pipes including connections, fittings & valves	
	Chilled water return pipes including connections, fittings & valves	
	Condensate drain pipes including connections, fittings & valves	
Others	Switch boards, control, BMS & DDC panels, BMS control & monitoring modules	
	Fan Coil unit	
	Engineering Smoke Extract System (e.g. smoke curtains, ductless fans)	

(V) PLUMBING AND SANITARY BIM ELEMENTS

Element	Elements or Parameters needed by each non-Plumbing and Sanitary discipline
Pipe supports and brackets ∗	
Pumps	
Control panels, monitoring and control sensors	
Plumbing BIM Elements only	
Fresh water piping, fittings, valves including hot & cold water pipe work with all plumbing equipment, sinks	
Water meters	
Storage, water holding tanks	
Pressure Vessels	
Underground Public Utilities for water supply	
Underground Public Utilities for drainage	
Grey water systems	
Pool filtration equipment	
Sanitary BIM Elements only	
Foul drainage, kitchen waste pipe work including floor drains, open trapped gullies, sealed trapped gullies and clean outs, vents and manholes	
Grease and sand traps	
Sump and sewage pits	

∗ these elements may cause BIM models to become too big and unmanageable.

(VI) FIRE PROTECTION BIM ELEMENTS

Element	Elements or Parameters needed by each non-Fire Protection discipline
System piping, droppers, fittings, valves and sprinkler heads, sprinkler inlets, sprinkler control valve set, subsidiary valves, flow switches	
Pipe supports and brackets ∗	
Fire alarm gongs & break glass unit	
Fire sprinkler pumps	
Sprinkler tanks	
Hydrants and hose reels (location of street fire hydrant determined by architects)	
Gas piping for suppression systems	
Heat or smoke detectors, control panels, monitoring and control sensors, pump panels, check meter positions	
Fire extinguishers	
Fire shutters & hoods above	
Smoke Curtains	

∗ these elements may cause BIM models to become too big and unmanageable.

(VII) ELECTRICAL BIM ELEMENTS

Element	Elements or Parameters needed by each non-Electrical discipline
Cable trays, trunking & cable containment, electrical risers, conduit, bus duct, power feeds	
Outlets, panels, wall switches, circuiting to devices, security devices, card access and “plug moulds” (socket points)	
HV & LV switch boards, switchgear, MCCB boards, MCB boards	
Transformers	
Light fittings & fixtures & housings for light fixtures	

Conduit associated with access, data communication, security systems and electrical equipment	
Telecom equipment and computer racks	
Generators and exhaust flues including acoustic treatments	
Diesel tanks & fuel pipes	
Security system including CCTV camera, smart card system, door monitoring system	
Car park control system, barrier gates	
Equipment and associated installations maintained by public utility companies (including manholes / drawpits for the Power Grid)	
Earthing and lightning protection system	
Lifts, PA systems, BMS equipments including display panels (e.g. power consumption display)	

* these elements may cause BIM models to become too big and unmanageable.

Gas BIM Elements

Element	Elements or Parameters needed by each non-Gas discipline
Gas piping and supply	

Appendix C – BIM Modelling Guidelines

The following guidelines recommend how BIM elements should be modelled in different disciplines at different project stages. It does not state who is the Model Author required to model the BIM elements. Modelling guidelines for Facility Management will be addressed in the future version of the Guide.

(i) Overview
(ii) Quality Assurance
(iii) Architectural BIM Modelling Guidelines
(iv) Structural BIM Modelling Guidelines
(v) MEP BIM Modelling Guidelines
    a. ACMV
    b. Plumbing and Sanitary
    c. Fire Protection
    d. Electrical

(I) OVERVIEW

Disciplines / Stages	Architectural Design	Structural Design	MEP Design	Intended Use
Conceptual	Topo, Massing, Site Elements, Site Boundary, Levels, Location, Orientation	*(optional)*	*(optional)*	Site planning, Location of the building(s) on the site, Starting situation for renovation project, Investigation, Visualization, Design options, Investment analysis, Preliminary energy simulation, Alternate spatial designs, Scope management, Investment calculation, Energy simulation, Finalised spatial requirements for structures and MEP systems, Visualisation
Preliminary Design	Building elements with nominal dimensions and details	Load-bearing structures, Proposed structural system & basic structure	MEP Schematics	Definition of building elements, Comparison of building element and structural alternatives, Management of quantity information, Preliminary dimensioning of structures, MEP Analysis, Visualisation
Detailed Design	Building elements with actual dimensions and details	Frame structures, Joints, Foundations, Joining to foundations, Penetrations & Reservations Connections	Service areas of MEP systems, Central units, Ducts, Pipe work, Terminal devices, Switchboards, Cable routes, Lighting fixtures, Penetrations & Reservations	Dimensioning of structures to the precision required for tenders, Definition of MEP systems, Quantity take-off, Penetration & Reservation design, Energy simulation, Visualisation. Combined Services Design
Construction	Model used to extract construction information	Model used to extract construction information	Model used to extract construction information	Detailed Design Information for construction, Prefabricated element design, Production planning
As-Built	Updated detail model as per actual site conditions	Updated detail model as per actual site conditions	Updated detail model as per actual site conditions	Information to be handed over for FM (maintenance & repairs; space & occupancy management)

(II) QUALITY ASSURANCE

Architectural Detailed Design BIM	**Structural Detailed Design BIM**	**MEP Detailed Design BIM**	**Merged model at Preliminary Design, Detailed Design, Construction and As-Built stages**
- BIM in agreed version - BIM includes defined stories - Building elements & spaces modelled separately in each story - BIM includes required building elements - Building elements modelled using correct objects - Building elements include types - No excess building elements - No overlapping or doubled building elements - No significant clashes between objects - No conflicts between structures in architectural and structural BIM - BIM includes GFA spaces objects - Space areas match space program - BIM includes spatial reservations for MEP - Space height defined (including suspended ceilings) - Shape and size of spaces matches with walls - Spaces do not overlap - All spaces have unique IDs	- BIM in agreed version - BIM includes defined stories - Building elements defined separately in each story - BIM includes required building elements - Building elements modelled using correct objects - Building element types are as agreed - No excess building elements - No overlapping or doubled building elements - No significant clashes between objects - No conflicts between structures in architectural and structural BIM - No conflicts between penetrations in architectural and structural BIM - Columns and beams converge - MEP penetrations & reservations included in structures	- BIM in agreed version - BIM includes defined stories - Components defined separately in each story - BIM includes required components - Components modelled using correct objects - Components belong to a correct system - System colours are defined systematically - System colours are defined systematically - No excess components - No overlapping or doubled components - No significant clashes between components - No clashes between MEP disciplines - No clashes between M&E and electrical BIM - Components fit into their spatial reservations - No clashes between M&E, architectural and structural BIM	- All agreed models available - Models represent the same design version - Models are located in the correct coordinate system - No conflicts between vertical shafts and MEP systems - No conflicts between horizontal reservations and MEP - No conflicts between suspended ceilings and MEP - Penetrations of columns OK - Penetrations of beams OK - Penetrations of slabs OK

(III) ARCHITECTURAL BIM MODELLING GUIDELINES

General Architectural Guidelines:

1) Architectural modelling is carried out in the following stages: Conceptual, Preliminary Design, Detailed Design, Construction and As-Built. The types of models produced at each stage depend on the BIM deliverables required.
2) If the design has precast or prefab design then those elements can be placed as Objects.
3) The building elements must be created using the correct tools (Wall tool, Slab tool, etc.). If the features of BIM authoring tool are not sufficient for modelling the element, the required building elements must be created using other appropriate objects. In that case, define the "Type" of the element correctly.
4) 2D can be used to complement the BIM model when the elements are smaller than the agreed size, e.g. Elements smaller than 100mm do not need to be modelled.
5) 2D standard details can be used to complement the BIM model.
6) Building Elements must be modelled separately for each storey.
7) Required Parameters: Type, Material, ID, Size. Type is required for the Quantity Take-off.
8) If more than one tool is used to model certain elements then the elements should be grouped and identified correctly by "Type", e.g. Slabs and Beams can be used to model the Road. The elements must be grouped as one and define the "Type" as a "Road"
9) Structural elements should be modelled based on the information (e.g. Size) from Structural Engineers. The alternative is to link or work in a shared model with the Structural Engineers.

Stages	Elements	Modelling Guidelines	Remarks
Conceptual	Topo (Existing Site)	Existing site's contour and location should be modelled based on the land surveyor's information (spot levels, northing and easting). Renovation Projects (A&A): If the existing buildings were not in BIM, then 2D drawings of the existing building can be used to complement the BIM model.	Follow BIM e-Submission guidelines for the content and colour code of existing/proposed site.
	Topo (Proposed Site)	Proposed site's cuts and fills of earth should be shown with a proposed site Element	
	Massing (Buildings)	Shape, Location and Orientation of building in site should be modelled using massing element. Name/identify the Mass element clearly, e.g. BLK 1, PODIUM etc. Site elements like Trees, Boundary, Roads, IC, etc can be drawn in 2D.	Output: Concept model that shows site arrangements and building geometries to share with the project members.
Preliminary Design Note: Conceptual	General Requirement	If the actual dimension is not available then model using the nominal dimension or expected dimension. Examples - Door opening modelled without considering the fittings.	Output: Authorities submission (URA). Refer to BCA BIM e-Submission requirement and

Stages	Elements	Modelling Guidelines	Remarks
model is further developed into Preliminary Design model (Massing of the selected design should be converted to real building elements like Wall, Slab, Door, Window, etc...)		- Walls modelled without considering the different layers thickness. Note: Since the designers has the libraries and templates with element settings, they can model the actual size	Guidelines. Use BIM e-Submission Template. Output: Model for co-ordination with Engineers.
	Wall	Model all the Walls (Brick, Dry wall, Glass, Concrete, wood, etc...) from Finish Floor Level to soffit of Slab/Beam above. When the Wall spans across different heights, if the BIM authoring tool permits model as a single Wall with varying height then model as one Wall. Alternative is to model as multiple Walls. Distinguish the internal and external Walls by "Type" parameter.	
	Slab / Floor	Top of Slab = Finished Floor Level When there is a slope in the Slab or the Slab has a special shape and the BIM authoring tool does not have the functionality to create such Slabs, then create the slab geometry using other tools and define the 'Type' as a "slab".	
	Door	Place the Door object with nominal dimensions and parameters required for Preliminary Design.	
	Window	Place the Window object with nominal dimensions and parameters required for Preliminary Design.	
	Column	Model the Columns on the desired locations from Structural Floor Level to Structural Floor Level for the Preliminary Design co-ordination with Structural Engineer. Columns must be modelled by their outer dimensions, taking into consideration the thickness of the finish and structure. Create objects for Columns with special shapes and cross sections.	
	Roof	Model using the Roof or Slab object and define the "Type" as Roof. The supporting structures can be modelled with general objects or beams.	
	Others	If there is a need to model more elements than what is specified in the Preliminary Design based on the project, refer to the Detailed Design stage. Model those elements with the information available at this stage.	
	Space group (Zone or Space	Note: Similar to individual space/room object	

Stages	Elements	Modelling Guidelines	Remarks
	or Room object)	Examples - Apartment, Fire Compartment, Departments, GFA Boundary, etc Follow BIM e-Submission guidelines for the details required for the Agencies requirement and display them accordingly in the plans	
	Individual Space (Space or Room object)	Space height = floor height from FFL to the soffit of slab above or the suspended ceiling above. One space may belong to more than one space groups. Area/Volume will be automatically calculated from the space geometry. Follow BIM e-Submission guidelines for the details required by the Agency and display them accordingly in the plans. Give a unique ID that can be used to locate the correct space when there is a need. Name the space based on the function of the room, e.g. Office, Lobby, etc... Follow the BIM e-Submission guidelines for various agencies requirement on the space requirements. Category can be used to group the spaces like Commercial, Residential, etc...	
Detailed Design Note: Preliminary Design model is further developed into Detailed Design model	General Requirement	Model all the elements using the actual/accurate dimension and correct materials.	Output: Authorities submission. Refer to BCA BIM e-Submission requirement and Guidelines. Use BIM e-Submission Template. Output: Model for co-ordination with Engineers. Output: Tender Documents
	Wall	Update the Walls created in the preliminary design with the parameters required for Detailed Design, e.g. Add different Layer thickness, Fire Rating, etc…	
	Load-bearing wall	Load bearing walls includes Core Walls/Shear Walls. Similar to Wall except if the Walls are between Floors then model from Structural Floor Level to Structural Floor Level of Slab below.	
	Slab / Floor	Update the Slabs created in the Preliminary Design with the parameters required for Detailed Design, e.g. Add different Layer thickness, Fire Rating, etc…	
	Door	Update the Doors placed in the Preliminary Design with the parameters required for Detailed Design, e.g. Fitting information. It is good to identify the functional difference (Types), e.g. "Fire Door"	
	Window / Louver	Update the Windows placed in the preliminary design with the parameters required for Detailed	

Stages	Elements	Modelling Guidelines	Remarks
		Design, e.g. Fitting information.	
	Column	Update the Columns created in the Preliminary Design based on the Location and Size information from the Structural Engineer.	
	Beam	Model the Beams based on the Location and Size information from the Structural Engineer. Create objects for Beams with special shapes and cross sections.	
	Staircase / Step / Ramp	Create objects for Staircases, Steps and Ramps with special shapes when it is not available in the BIM authoring tool. If required then the Landings and Stair Platforms can be modelled as Slabs. In that case define their "Type" accordingly.	
	Curtain Wall	Model the Curtain Wall to the full height and not necessary to break it storey by storey. Most BIM Authoring tools enable users to insert Doors and Windows into parts of the Curtain Wall.	
	Balcony	Model using either as an Objects or use Walls, Floors, Beams and Railings. Check the specific elements for their modelling guideline.	
	Canopy		
	Roof	Update the Roofs created in the preliminary design with the parameters required for Detailed Design. E.g. Add different Layer thickness, etc…	
	Skylight	Model using objects and define the "Type" accordingly.	
	Hatch		
	Furniture		
	Balustrade / Railings		
	Project-specific objects		
	Suspended ceiling	If the BIM authoring tool do not have a ceiling tool then modelled using a slab tool or object, and define the "Type" as a Ceiling.	
	Space	Refer to Preliminary Design	
	Civil defence shelter, Service platforms, Structures of passageways, Service ducts, Others	Model using Wall, Floor, Column, Roof, Opening, Objects, Door, Space etc. Check the specific elements for their modelling guideline.	
Construction	Refer to Detailed Design model	Model the portions of the buildings that are affected as a result of updates from the Detailed Design models by the other disciplines and variations/RFIs in	Output: Construction model.

Stages	Elements	Modelling Guidelines	Remarks
Note: Work together with the contractors and sub contractors to develop the Detailed Design model into Construction model		the design.	
As-Built	Refer to Construction model	When the building is complete, the consultant should check the Detailed Design to correspond with the final implementation (As-Built) based on the information from the Contractor.	Output: Model that can be used for space management, building maintenance and modifications made during occupancy by the FM / Employer.

(IV) STRUCTURAL BIM MODELLING GUIDELINES

General Structural Guidelines:

1) The structural consultant produces both an analysis model and a physical model (Structural BIM) with actual member size and position. The model will be used for documentation. These documents cover the Structural BIM only.
2) Structural modelling is carried out in the following stages: Conceptual, Preliminary, Detail, Construction and As-Built. The types of models produced at each stage depend on the BIM deliverables required.
3) If the design has precast or prefab design. The part can be designed and modelled by a specialist and incorporated/linked into the model for reference.
4) Structural BIM covers all load-bearing concrete, wood and steel structures, as well as non-load-bearing concrete structures. The basic building elements used are Wall, Slab, Beam, Column and Lattice. The building elements must be created using the correct tools (Wall tool, Slab tool, etc.). If the features of BIM authoring tool are not sufficient for modelling the element, the required building elements must be created using other appropriate objects. In that case, define the "Type" of the element correctly.
5) The model can be phased and divided for various ST submissions as per the project planning/individual firm's practice.
6) Rebar and Joint details can be done in Detailed Design Stage based on the capability of the BIM authoring tool.
7) 2D or 2D standard details can be used to complement the BIM model when the elements are smaller than the agreed size, e.g. Elements Smaller than 100mm do not need to be modelled.
8) 2D can be used for loading plans.
9) 2D can be used for the column schedule when the BIM authoring tool has limitations. The shape and cutting of each column should be included in the schedule.

10) Building Elements must be modelled separately for each storey
11) Required Parameters: Type, Material, ID, Size. Type is required for the Quantity Take-off.
12) If more than one tool is used to model certain elements then the elements should be grouped and identified correctly by "Type". E.g. Individual beams can be used to model the roof truss the elements must be grouped as one and define the "Type" as a "Truss"

Stages	Elements	Modelling Guidelines	Remarks
Conceptual	Existing Buildings (As-Built Condition) for Addition & Alternations.	The Structural Consultants expertise may required when assessing and modelling existing structures, in particular the load-bearing structural system. The scope of Structural BIM model will be agreed upon on a project-specific basis. If the existing Buildings were not in BIM then 2D drawings of existing building can be used to complement the BIM model.	Output: Structural Model of Existing Building or portions thereof.
	New Buildings	The Structural Consultants expertise may be required in special cases in the assessment of the alternatives massing model from Architect and propose framing systems. Structural BIM model is optional at this stage.	Output: Structural concept alternatives.
Preliminary Design Note: Preliminary Design model will be based on Architectural Conceptual Design model. It will be developed further based on the co-ordination during Preliminary Design stage.	General Requirement	Model the elements using the nominal dimension or expected dimension based on precision available at Preliminary Design stage. Model the elements that are critical and required for Preliminary Design co-ordination (based on projects requirement) Connections/Joints and Members can be detailed in the Detailed Design stage or Construction stage, depending on the project delivery (traditional or D&B).	Input: Geotechnical information/model, Architectural Conceptual Design Model for intended use (for load assumptions) and geometry of the building (to determine the framing system) Note: The location of load bearing elements and the elevation of the floor will be based on the info from the Architect. Output: ST submission. Refer to BCA's BIM e-Submission requirement and Guidelines. Use BIM e-Submission Template. Output: Model for co-ordination with Architects and MEP Engineers

Stages	Elements	Modelling Guidelines	Remarks
	Piling (Pile Cap and Pile)	If the BIM authoring tool has relevant objects to represent the foundation elements then place them in the correct level and with the relevant parameter. Alternative is to use Slab, Column and Wall to represent foundation elements. Group them and define the "Type" correctly.	When the design is not confirmed the elements can be modelled as reference to use in the Preliminary Design co-ordination with the Architects and MEP Engineers.
	Diaphragm / Retaining Wall		
	Raft Foundation		
	Pad / Isolated Foundation		
	Strip Foundation		
	Slab / Roof Slab	Top of Slab = Structural Floor Level Multiple Slabs need to be placed if the levels, thickness, span direction and material are different. The soffit of the structural slab should be shown. When there is a slope in the Slab or the Slab with a special shape and the BIM authoring tool does not have the functionality to create such Slabs, then create the slab geometry using other tools and define the 'Type' as a "slab".	
	Beam	Top of Beam = As per design (Up stand Beam or Down hang Beam) Create objects for Beams with special shapes and cross sections, e.g. Tapering and haunch.	
	Truss	Model with multiple elements and group them as a truss. Note: Some BIM authoring tools have a function to automate this process.	
	Column	Model from the Structural Floor level to Structural Floor Level of Slab below. Create objects for Columns with special shapes and cross sections.	
	Wall	All Load bearing Walls and concrete Walls (non-load bearing) need to be modelled, e.g. Core Walls, Shear Walls, Retaining Walls, Diaphragm Walls. If the Walls are between floors then model from Structural Floor Level to Structural Floor Level of Slab below else the Walls need to model to the correct levels. When the Wall spans across different heights, if the BIM authoring tool permits model as a single Wall with varying height then model as one Wall. Alternative is to model multiple Walls.	
	Staircase, Step and Ramps	Model only the structure part of the Staircase, Steps and Ramps.	

Stages	Elements	Modelling Guidelines	Remarks
		Create objects for Staircases, Steps and Ramps with special shapes when it is not available in the BIM authoring tool. If required then the landings and Stair platforms can be modelled as Slabs. In that case define their "Type" accordingly.	
	Opening	Model the structural Opening for the Doors, Windows and Ventilations based on location and size information from the Architects. Model the structural Opening for the MEP elements like Ducts based on the location and size information from the MEP Engineers. Model the Floor openings based on location and Size from the Architects and MEP Engineers.	
	Special Structure Civil defence shelter, Tunnel, Link Way, External structures, Balcony, Canopy, Swimming pool, Temporary structures, Others	Model using Wall, Slab, Column, Beam and Opening or placed as an Object and assign the "Type" accordingly. Check the specific elements for their modelling guideline.	When the design is not confirmed the elements can be modelled as reference to use in the Preliminary Design co-ordination with the Architects and MEP Engineers.
Detailed Design Note: Preliminary Design model is further developed into Detailed Design model	General Requirement	Model all the elements using the actual/accurate dimension. Model all the model elements that are critical and required for the Design co-ordination (based on projects requirement) Detail the Connections/Joints and Members based on the BIM authoring tool's capability. The details can be imported as 2D, which is generated automatically by design tools that can link with BIM authoring tool. Divide the project/building as per various ST's or as per agreed Project Plan. Proceed with the modelling according to the schedule.	Output: ST Submissions. Refer to BCA's BIM e-Submission requirement and Guidelines. Use BIM e-Submission Template. Output: Tender Drawings. Output: Model for co-ordination with Architects and MEP Engineers.
	Refer to Preliminary Design	Develop the Preliminary design with more confirmed parameters like Location, Size and Material. Update the correct Type definition that helps detailed	The detail can be done only for the agreed portion of the building

Stages	Elements	Modelling Guidelines	Remarks
		quantity take-off.	based on the projects need.
Construction Note: Work together with the contractors and sub contractors to develop the Detailed Design model into Construction model	Refer to Detailed Design model	Model the portions of the buildings that are affected as a result of updates from the Detailed Design models by the other disciplines and variations/RFIs in the design. Deepening of structures should be detailed in shopdrawings, if necessary.	Output: Construction model.
As-Built	Refer to Construction model	When the building is complete, the consultant should check the Detailed Design to correspond with the final implementation (As-Built) based on the information from the Contractor.	Output: Model that can be used for operation, building maintenance and modifications made during occupancy by the FM / Employer.

(V) MEP BIM MODELLING GUIDELINES

a. ACMV

Stages	Elements	Modelling Guidelines	Remarks
Conceptual	System distribution lines	Use line diagrams to show the entire system distribution Include equipment symbols in the line diagrams.	Output: Schematic diagrams
	Space objects	Use box objects to represent spaces required for MEP systems Add names and colours to the space objects.	
Preliminary Design	Zone Objects, Air Handling Unit, Chiller Unit Variable refrigerant flow unit, Cooling tower, Exhaust air ducts, Fresh air ducts, Supply air ducts, Return air ducts,	Zone the spaces that have common design requirements with colour legends on plans. Model each element using the correct BIM generic object Each element should have an approximate size. Show only the main routes of the systems. All ducts and pipes should be connected to the	Output: Preliminary Model Shows main distribution into different zones Engineers should verify the space

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

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

b. Plumbing & Sanitary

Stages	Elements	Modelling Guidelines	Remarks
Conceptual	System distribution lines	Use line diagrams to show the entire system distribution Include equipment symbols in the line diagrams.	Output: Schematic diagram
	Space objects	Use box objects to represent spaces required for MEP systems Add names and colours to the space objects.	
Preliminary Design	Zone objects, Plumbing equipments Plumbing fixtures Sump and sewage pits Storage, water holding tanks,	Zone the spaces that have common design requirements with colour legends on plans. Model each element using the correct BIM generic object Each element should have an approximate size.	Output: Preliminary Model Shows main distribution into different zones

Stages	Elements	Modelling Guidelines	Remarks
	pressure vessels Water meters chambers Manholes, outlets, surface and slot channels	Show only the main routes of the systems. All main pipes should be connected to the equipments. Fasteners and hangers are not required. In-line accessories e.g. valves, filters, water meters are not required. Use CP83 symbols.	Engineers should verify the space allocated by the Architect.
Detailed Design	Main elements of Preliminary Design Fresh water piping, Fittings, Valves, including hot and cold water pipes Rainwater and storm water pipes Foul drainage and kitchen waste pipe work including Floor drains, Open trapped gullies, Sealed trapped gullies, Clean outs, Vents Control panels, Monitoring and control sensors Underground public utilities for water supply Underground public utilities for drainage	Use CP83 symbols and colour standards Model each element using object correspond to actual component with actual size, material, type code and performance criteria. Include insulation to reflect actual size for coordination purpose. System routing should be connected with fittings. Unavailable BIM objects that are modelled using different objects should be identified accordingly, e.g. use proper names and colours. Downward slopes of the pipes should be modelled realistically. Required fittings allowances, cross-over spaces and maintenance spaces should be considered. Fasteners and hangers are not necessary. Commercial product libraries can be used to the extent allowed by the modelling software. Pipe Accessories should follow the CP83 symbols in plan views. For design coordination, documents such as coordinated services plans, sections, elevations, etc. should be derived from the model.	Output: Detailed model for e-Submission and Tender For BIM e-Submission, please also refer to submission guidelines 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. All changes made by contractor & approved by consultants should be clearly indicated.	Output: Model with construction details

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

c. Fire Protection

Stages	Elements	Modelling Guidelines	Remarks
Conceptual	System distribution lines	Use line diagrams to show the entire system distribution Include equipment symbols in the line diagrams.	Output: Schematic diagrams
	Space objects	Use box objects to represent spaces required for MEP systems 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 Shows main distribution into different zones
Detailed	Main elements of Preliminary Design	Use CP83 symbols and colour standards	Output: Detailed model

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

Stages	Elements	Modelling Guidelines	Remarks
		and attributes such as equipment name, capacity, etc. Levels of the elements comprising the system from finish floor line or at the certain reference in the model should be clearly annotated. For construction coordination, documents such as coordinated services plans, sections, elevations, etc. should be derived from the model. Fasteners can be modelled if necessary.	Design BIM into Construction BIM.
As-Built	The elements are the same as Construction phase.	When the building is complete, the consultant should check the Detailed Design to correspond with the final implementation (As-Built) based on the information from the Contractor.	Output: Model that can be used for space management, building maintenance and modifications made during occupancy by the FM / Employer.

d. Electrical

Stages	Elements	Modelling Guidelines	Remarks
Conceptual	System distribution lines	Use line diagrams to show the entire system distribution Include equipment symbols in the line diagrams.	Output: Schematic diagrams
	Space objects	Use box objects to represent spaces required for MEP systems Add names and colours to the space objects.	
Preliminary Design	Zone Objects, Transformers HV & LV switch boards, Switchgear, MCCB boards,	Zone the spaces that have common design requirements with colour legends on plans. Model each element using the correct BIM generic object Each element should have an approximate size.	Output: Preliminary Model Shows main distribution into different zones

Stages	Elements	Modelling Guidelines	Remarks
	MCB boards Cable trays, Trunking & cable containment Electrical risers Generators and exhaust flues, including acoustic treatments Diesel tanks & fuel pipes Telecom equipment and computer racks	Show only the main routes of the systems. All cable trays, conduits and trunkings should be connected to the equipments. Wires, fasteners and hangers are not required. In-line accessories e.g. valves, fire dampers, volume controls and air filters are not required. Use CP83 symbols.	
Detailed Design	Main elements of Preliminary Design Light fittings, Fixtures, Housings for light fixtures Conduit, Bus duct, Power feeds Concealed and cast-in-place conduits Outlets, Panels Wall switches, Circuiting to devices, Security devices, Card access, “Plug moulds” (socket points) Conduit associated with access, data communication, security systems and electrical equipment Security system including CCTV camera, smart card system, door monitoring system Car park control system, Barrier gates	Use CP83 symbols and colour standards Model each element using object correspond to actual component with actual size, material, type code and performance criteria. Include insulation to reflect actual size for coordination purpose. System routing should be connected with fittings. Unavailable BIM objects that modelled using different objects should be identified accordingly, e.g., use proper names and colours. Required fittings allowances, cross-over spaces and maintenance spaces should be considered. Fasteners and hangers are not necessary. Commercial product libraries can be used to the extent allowed by the modelling software. Electrical devices e.g. switches, power outlets, telephone and TV outlets should follow the CP83 symbols in plan views. For design coordination, documents such as coordinated services plans, sections, elevations, etc. should be derived from the model.	Output: Detailed model for e-Submission and Tender For BIM e-Submission, please also refer to submission guidelines Services should be coordinated with architecture model Engineers should verify the space allocated by the architect

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

This guide is part of the BIM Essential Guide Series

BIM Essential Guide	FOR EACH BIM PROJECT		FOR EACH ORGANIZATION
	WITHIN EACH DISCIPLINE	ACROSS MULTIPLE DISCIPLINES	ALL DISCIPLINES
For Architectural Consultants	●		
For C&S Consultants	●		
For M&E Consultants	●		
For Contractor	●		
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