Appendix Z – Particular Specification for BIM-AM Implementation (For EMSD internal only)

The part of this document thereafter forms the template for particular specification (PS)

Notes:

1. The template can be edited as necessary by the EMSD Engineer's Representative.

   [ ] The brackets enclose editable text that may be edited and reformatted before sending out

   * The asterisk follows options; the option(s) that are not applicable should be deleted as appropriate

   # The number is for reference only and should be suitably determined according to nature, scale, complexity, mode of project delivery, number of consultant/contractor/sub-consultant/sub-contractor involved, etc. of the projects/works.

   Xx Text in italics and yellow highlights are notes for EMSD. These notes should be removed before sending out.

2. The latest version of EMSD BIM-AM Standards and Guidelines shall be attached with the PS.

Table of Content

Page

Particular Specification (PS) for EMSD BIM-AM Implementation

1 General Requirement

1.1 Introduction

1.1.1 This PS shall be read in conjunction with the documents as shown below:

a) BIM-AM Standards and Guidelines and the appendices – latest version, published by EMSD;

b) BIM-AM Handover Guidelines for Trade – latest version, published by EMSD;

c) The latest Development Bureau (DEVB) Technical Circular (Works) on Building Information Modelling Harmonisation Guidelines for Capital Works Projects in Hong Kong;

d) The latest DEVB Technical Circular (Works) on Adoption of Building Information Modelling for Capital Works Projects in Hong Kong;

e) Relevant technical circular(s) issued by DEVB; and

f) CIC BIM Standards.

1.1.2 In case of conflict between the technical requirements of this PS and other requirements, the order of precedence shall be:

a) This PS;

b) EMSD BIM-AM Standards and Guidelines; and

c) CIC BIM Standards.

1.1.3 BIM models for alternation and addition (A&A) work shall not only cover all the structural elements, architectural finishes, E&M services (including fire services) in the renovated zones, but also include the E&M routings from renovated zone to designated area including but not limited to corridors, and plantrooms etc. All the existing and new E&M services inside ceiling void above corresponding zones shall be covered.

1.1.4 The limited as-built information will be provided by the Engineer's Representatives after the contract awarded. The Contractor shall note that those as-built information is for reference only. The Contractor shall carry out the verification, ascertain all structural and architectural elements as well as E&M services after his own site inspection if necessary.

1.1.5 The Contractor shall provide all necessary labour, materials, tools, and transportation to complete the site survey and as-built information verification, construction of BIM model, inputting the asset information, supply & installation of the RFID tags with encoding to the relevant equipment, and provision of QR codes for assets, as well as zones as specified in the latest BIM-AM Standards and Guidelines.

1.1.6 The Contractor shall provide all necessary tools and facilities for the completion of works, including but not be limited the following:

a) Scaffolding with validated certification by the qualified person;

b) Cherry Picker Platform;

c) Ceiling & Raise Floor Panel Opening Tools;

d) Tools (including laser scanner) and software for site survey;

e) Workstation with relevant software and license for BIM model, such as the plug-in or add-in for COBieLite;

f) RFID Reader / Writer / Encoder; and

g) Waterproof label printer for RFID tags and QR codes.

1.1.7 The Contractor shall take lead to resolve any issues and ensure all the deliverables / milestones are completed on time with satisfaction by the Engineer's Representative. The Contractor shall be responsible for all costs for the completion of works.

1.2 Interpretation and Abbreviations

1.2.1 In this PS, the following words and expressions shall have the meaning hereby assigned to them except where the context otherwise requires:

Abbreviation / Term	**Definition**
A&A	Alternation and Addition
AIR	Asset Information Requirement
AIM	Asset Information Model
AIMP	Asset Information Management Platform which is a web-based system for EMSD to manage asset information and relationship.
AM	Asset Management
BEP	BIM Execution Plan
BIM	Building Information Modelling
BIM-AM	Building Information Modelling integrated with Asset Management System
BMS	Building Management System
CCTV	Closed-circuit Television
CIC	Construction Industry Council
CITF	Construction Innovation and Technology
COBie	Construction Operations Building Information Exchange
COBieLite	Lightweight XML format for COBie data exchange
Contractor	The person, firm or company named in the Memorandum of Quotation and includes the Contractor's permitted assignees
E&M	Electrical and Mechanical
E&M Services	This is the general naming for all building services system including the Level 1 System as mentioned in EMSD BIM-AM Standards and Guidelines
ELV	Extra Low Voltage
The Employer	The Government of the Hong Kong Special Administrative Region
EMSD	Electrical and Mechanical Services Department.
Engineer's Representative	Any person or persons appointed from time to time by the Engineer and notified to the Contractor to perform the duties.

Abbreviation / Term	Definition
EPC	Electronic Product Code which is memory bank of electronic product code for RFID tags.
Intellectual Property Rights	The patents, copyright, design rights, trademarks, service marks, trade names, domain names, database rights, rights mean in know-how, new inventions, designs or processes and other intellectual property rights whether now known or created in future (of whatever nature and wherever arising) and in each case whether registered or unregistered and including applications for the grant of any such rights
Latest Model	The latest model of the hardware available in the market at the time the order for the hardware is placed by the Employer
Latest Version	The latest version of the software available in the market at the time the order for the software is placed by the Employer
Level 1 System	The E&M systems as defined in the EMSD BIM-AM Standards and Guidelines
Level 2 Equipment	The crucial E&M equipment for asset management as specified in the BIM-AM Standards and Guidelines
IFC	Industry Foundation Classes
LOD-G	Level of Development – Geometry
LOD-I	Level of Development – Information
LOIN	Level of Information Need
O&M	Operations and Maintenance
QR Code	Quick Response Code
RFID	Radio Frequency Identification

1.3 Scope of Works

1.3.1 The works include but are not limited to:

a) Carrying out detailed site survey as well as as-built information verification, by means of 3D laser scanning or equivalent technology to produce a point cloud model with Forge. * *delete this for new building project or project in restricted area, where point cloud scanning is not applicable.*

b) Construction of as-built BIM models at not less than LOD-G 300 (architectural, structural, fire services, E&M, ELV and systems as stipulated in BIM-AM Standards and Guidelines) for multi-discipline coordination and clash analysis. The detailed standards and guidelines are stipulated in the latest BIM-AM Standards and Guidelines;

c) Exporting COBieLite file from the master federated system file for the data migration to EMSD ~~BIM-AM System and the~~ web-based Asset Information Management Platform (AIMP);

d) Inputting asset data to BIM models and asset templates ~~-~~as specified in the latest BIM-AM Standards and Guidelines;

e) Inputting asset data in the AIMP as specified in the latest BIM-AM Standards and Guidelines, including asset relationship, folder path to E&M documents and the creation of Level 1 System and Level 2 Equipment which are not drawn in the BIM model;

f) Supply, installation, and encoding RFID tags with waterproof printing labels for the Level 1 System and Level 2 Equipment as specified in the latest BIM-AM Standards and Guidelines as well as in this PS;

g) Supply and installation of QR codes for both asset tags and zone tags as specified in the latest BIM-AM Standards and Guideline, as well as in this PS; and;

h) Conversion of native 3D AIM models to lightweight models, e.g. in the format of SVF, to facilitate the BIM viewing on the BIM-AM platforms.

1.3.2 All software licences to be used by the Contractor in this works shall be the latest version (or with the Engineer's Representative's approval) available on the market.

1.3.3 The Contractor shall work with the Engineer's Representative to integrate the BIM models with the Asset Management (AM) System and associated electronics system.

1.3.4 The Contractor shall be responsible for verifying the as-built information, site survey results, as well as BIM models and modifying/adding any details, if necessary, for the completion of as-built BIM models.

1.3.5 All BIM deliverables, including BIM models and asset information (including the asset relationship and folder path to O&M documents which shall be inputted via AIMP), shall conform to the latest BIM-AM Standards and Guidelines.

1.3.6 The Contractor shall propose and establish a BIM team that is appropriate for the scale and complexity of the Contract, highlighting key roles and responsibilities of each position, within [14]# calendar days after commencement of Contract. The team shall be led by a BIM Team Leader who holds a key position in the Contractor's project team structure. The BIM team shall include sufficient and technically competent resources in order to complete all BIM tasks and deliverables specified in the Contract. Notwithstanding, the BIM team shall comprise at least [2]# personnel well trained [in relevant disciplines]#. This/These* personnel shall have the following qualifications:

a) *This para is following DEVB Technical Circular (Works) 2/2021 for public works.* BIM Team Leader shall be a CIC-Certified BIM Manager (CCBM) with effect from 1 July 2021 for all technical & fee proposals of consultancy agreements or construction works tenders to be invited on or after 1 January 2021.

Below paragraphs are added for EMSD's specific project and could be reviewed and edited to suit the project size.

OR

[shall have a minimum of [5]# years relevant post-qualification experience plus university degree or equivalent in an appropriate engineering or construction-related discipline; and

Shall have a minimum of [3]# years of practical experience in management of BIM projects and approved by Engineer's Representative.]

b) BIM Coordinator

Refer to DEVB Technical Circular (Works) 2/2021 for public works, (i) and (ii), in which "(i) shall have a minimum of three years related construction project experience; and (ii) shall have a minimum of one year practical experience in BIM projects"
To suit EMSD's specific project in different project size, the paragraphs (i) and (ii) below could be reviewed and edited.

(i) shall have a recognised diploma or above in engineering or equivalent with a minimum of [3]# years related construction project experience;

(ii) shall have a minimum of [1]# year practical experience in BIM projects; and

(iii) shall complete the CIC-accredited BIM Coordinator course with effect from 1 July 2022 for all technical & fee proposals of consultancy agreements or construction works tenders to be invited on or after 1 January 2022 if the engaged BIM Coordinators are not CCBC.*

OR

shall be a CIC-Certified BIM Coordinator (CCBC)

1.3.7 The BIM Team Leader shall be responsible for the overall BIM management and process controls. The BIM Team Leader shall delegate BIM Coordinator for handling BIM tasks such as BIM modelling, collaborate information exchange amongst related stakeholders, and maintain a drawing/information register to record the information to be incorporated in the BIM models.

1.3.8 The BIM team shall have experienced staff with knowledge to understand the E&M systems and the corresponding asset data requirement, including but not limited to asset relationship to perform the implementation of BIM-AM System.

1.3.9 The Contractor shall ensure the interoperability of the delivered BIM models and asset data with the EMSD asset management system. The Contractor shall take lead to resolve the issues and ensure all the deliverables are completed on time, regardless of the root cause(s) without any extra cost to the Employer.

1.3.10 For any proposed staff movement or change in the BIM team, the Contractor shall provide a CV of the replacement personnel together with evidence of equivalent BIM competency to the Engineer's Representative within [7]# calendar days for approval.

1.3.11 If the Contractor does not have the necessary expertise, the Contractor shall engage a sub-contractor with suitable expertise for the performance of BIM related tasks. If the Contractor intends to or is required to subcontract the BIM works to a BIM sub-contractor, the Contractor shall obtain approval from the Engineer's Representative before formal engagement and shall indicate this clearly in the project team structure. The positions of the staff members from the BIM sub-contractor shall also be indicated clearly in the BIM team organisation structure.

1.4 Standards and Specifications

1.4.1 Unless otherwise specified, all BIM and BIM-AM related deliverables shall be created and modified in compliance with the latest version of EMSD BIM-AM Standards and Guidelines.

2 Detailed Requirements

2.1 General

2.1.1 The Contractor shall provide all necessary labour, materials, tools, and transportation to complete the site survey, audit check, construction of asset information model, supply & installation of the zone codes during both office, non-office hours in weekdays and public holidays to suit the operational needs.

2.1.2 The Contractor shall provide all necessary tools and facilities for the completion of works in their own cost, including but not limited to:

a) Tools and software license for site survey;

b) Tools including but not limited to driver(s), software, related firmware, operation manual(s), and those tools required for proper operation as instructed by the Engineer's Representative,

c) Workstation with relevant software and license for construction of asset information model and the plug-in of COBieLite for data migration;

d) RFID Reader for site verification; and

e) Labellers for printing the black on white laminated tapes with the width of 24mm for zone code tagging.

2.1.3 All software licences to be used by the Contractor in this works shall be the Latest Version (or with Government Representative's approval) available on the market.

2.1.4 The Contractor shall liaise with the Engineer's Representative to obtain the User Manuals, login ID and password for the use of following systems after the contract award.

a) "Asset Information Management Platform (AIMP)" is a web-based system developed by EMSD to manage asset information, including documents, as-built drawings, photos, and BIM data. The Contractor shall use the AIMP to generate the COBieLite files for migrating the BIM and asset data to BIM-AM Systems.

b) "BIM-AM System" is a web-based and mobile application co-developed by EMSD and asset management vendors to support the integration of BIM model, asset data, and other electronic systems for facilitating the E&M operation and maintenance. The Contractor shall adopt the BIM-AM System to conduct the audit check on site.

c) "BIM Model Translator" is a web-based system developed by EMSD to convert the native BIM model to lightweight format to support the BIM viewing through web browser.

d) "BIM Model Checker" is a plugin of BIM authorised tool developed by EMSD for checking the parameters created in models for E&M equipment based on the Asset Data Templates as defined in Appendix B of BIM-AM Standards and Guidelines.

e) "AFM CobieLite Exporter" is a plugin of BIM authorised tool and developed by EMSD for exporting the information from BIM models to COBieLite XML format. The COBieLite file would be uploaded to AIMP for inputting the asset relationship and document path.

2.2 Carry out the detailed site survey and as-built information verification

2.2.1 To ensure that the BIM models can be constructed and contained up-to-date information, the detailed site survey would be an intrinsic part of the works. The Contractor is required to verify the positions, size, mounting details, and extend of the existing provisions of equipment and routing.

The Contractor shall carry out the site survey by means of 3D laser scanning or equivalent technology to produce a point cloud model with panorama photos. Scanned point cloud model and the textured 3D mesh shall be reviewed before BIM modelling. The scanned point cloud model shall be colorized based on the 360° imagery with accuracy within 1% of reality. The point cloud model shall be made to an accuracy suitable for checking the consistency between BIM models and actual condition.

a) **Detailed site survey** for builder works, services routing and E&M components at all plant areas, including but not limited to chiller plant rooms, cooling tower yards, AHUs rooms, pumps rooms, Main LV switch rooms, generator rooms, fuel tank room, battery rooms, pump rooms, lift machine room, fan rooms, laundry machine rooms, any equipment rooms and indoor / outdoor areas installed with any E&M plants / equipment; and

b) **Superficial scanning** for all fixed assets which are in visible sight at all common / public areas (including but not limited to corridors, entries, exits, lobbies, canopies and etc.) so as to formulate updated building layouts for indicating the location of E&M equipment which are NOT inside plant rooms/ at plant areas as specified in item (a) above

It is subjected to the project nature and scale that the Engineer's Representative may not consider adopting 3D laser scanning or equivalent technology for site verification.

2.2.2 The limited as-built information will be provided by the EMSD after the contract is awarded. The Contractor shall note that all information given are for reference only and the Contractor shall be responsible to verify the accuracy of those information and the cost associated with the verification.

2.3 Construction of BIM Model

2.3.1 The Contractor shall read in conjunction with the following documents as shown below for construction of BIM model:

a) BIM-AM Standards and Guidelines – latest issue, published by EMSD.

(https://www.emsd.gov.hk/en/engineering_services/project_management_consultancy/highlights_of_work/bim_am/index.html)

b) CIC BIM Standards and Guidelines- latest issue including but not limited to:

- CIC BIM Standards for Mechanical Electrical and Plumbing;
- CIC BIM Standards for Underground Utilities;
- CIC Production of BIM Object Guide General Requirements; and
- CIC BIM Standards – General;

2.3.2 The Contractor shall adopt the latest version of BIM software approved by the Engineer's Representative and other plug-in software(s) available on the market for the production of drawings, images, and schedules up to the standards acceptable by EMSD, and in accordance with prevailing regulations and guidelines (including but not limited to DEVB technical circulars, EMSD's latest BIM-AM Standards and Guidelines; and CIC BIM Standards).

2.3.3 The Contractor shall consider sufficient spatial and dimensional requirements of various disciplines for the installation of equipment and operation needs.

2.3.4 The Contractor shall ensure all the individual components of three-dimensional BIM models are free of clash and interference.

2.3.5 The Contractor shall develop the asset information for the as-built BIM models which contains the required level of details, development, and format of information exchange for asset management specification including asset template. The requirements are stipulated in the latest BIM-AM Standards and Guidelines.

2.3.6 The Contractor shall construct a BIM models at LOD-G 300* *delete this if BIM-AM lite models are adopted in this project* for architectural, structural, fire services, E&M and ELV systems. The Contractor shall submit BIM models in native format to the agreement and satisfaction of the Engineer's Representative. The requirements of the BIM models include but are not be limited to:

2.3.6.1 Architectural BIM Model

- Existing site topography, services and buildings, and access to site, if applicable;
- Architectural layout and works;
- Internal and external walls and columns;
- Rooms or space with labels for data exchange between the BIM models and BIM-AM System;
- Doors, shutters and its hood, access panels;
- Windows and louvers;
- Lift doors;
- Balustrades, parapets and railings;
- Staircases;
- Ramps, false ceilings with access openings;
- Built-in fixed furniture such as toilet partition, cabinets;
- Smoke barriers;
- Drainage / Services Channel covers;
- Cat ladders, catwalks, maintenance platform;
- Exterior elements such as canopy, sun-shading devices, wall features;
- Signage; and
- Sanitary Fitments.

2.3.6.2 Structural BIM Model

- All structural elements;
- Any structural steel members, such as bracing systems;
- Any precast & prestressed concrete systems;
- Details are required in congested areas, cast-ins, changes in level and junctions/connections between structural elements; and
- All penetrations / interfaces between structural members and Building Services/ E&M services / Builder's works. (e.g. openings, curbs, voids, pits, recesses, mass concrete, etc).

2.3.6.3 Fire Services Installation BIM Model

- All system components not embedded into concrete or building structure, including not but limited to, pipework, fire service equipment, alarm bell, alarm call point, sprinkler, hose reel, hydrant, fire detector, visual fire alarm, break glass unit, pressure switch, subsidiary valve set, pressure reducing valve set, control panels, switchgears, cable containments, hanger/support and relevant system components; and
- Associated builder work elements including but not limited to plinth, water tank, trust block, structure support, etc.

2.3.6.4 E&M BIM Model

2.3.6.4.1 Electrical Installation

- All switchgears, cable containments, lighting fittings, sockets, switches and other electrical devices, hanger / support and relevant system components not embedded into concrete or building structure.

2.3.6.4.2 Structured Cabling System

- Cable containments, bunch of cabling shall be modelled with approximate size for space coordination.

2.3.6.4.3 Heating, Ventilation and Air-Conditioning Installation

- All system components not embedded into concrete or building structure, including not but limited to, air ductwork, air grilles, pipework, insulation, air-conditioning equipment, fans, pumps, control panels, switchgears, cable containments, hanger/support and relevant system components.
- Associated builder work elements including but not limited to plinth, water tank, trust block, structure support, etc.

2.3.6.4.4 Plumbing and Drainage Installation

- All pipework and associated fittings of all sizes with as-built diameter;
- All system components not embedded into concrete or building structure, including not but limited to, pump set, control panel, pressure vessel, pipework, pressure reducing valve set, switchgears, cable containments, hanger/support and relevant system components; and
- Associated builder work elements including but not limited to plinth, water tank, trust block, structure support, manhole, sanitary fitments, etc.

2.3.6.4.5 Medical Gas Installation

- All gas pipes and associated fittings of all sizes with as-built diameter;
- All system components not embedded into concrete or building structure, including but not limited to, medical air compressors, medical vacuum pump set, medical gas cylinders (for nitrous oxides, nitrogen and carbon dioxide), control valves, cable containments, hanger/support and relevant system components; and
- Associated builder work elements including but not limited to plinth, trust block, structure support, etc.

2.3.6.4.6 Utilities / External Works (if applicable)

- All underground/aboveground cable ducts with associated cable pits structure for electrical and / or utilities;
- Manhole with detail information;
- All lamp poles, pergola, play and fitness equipment and lighting fitting with associated footing structure; and
- Slopes, Roadworks and Terrain model.

2.3.6.5 ELV BIM Model

- All system components not embedded into concrete or building structure, including not but limited to, Public Address System, Closed Circuit TV System, Access Control System, Integrated Radio Distribution System and Data Communications System.
- The ELV BIM models should be submitted in native format approved by the Engineer's Representative.

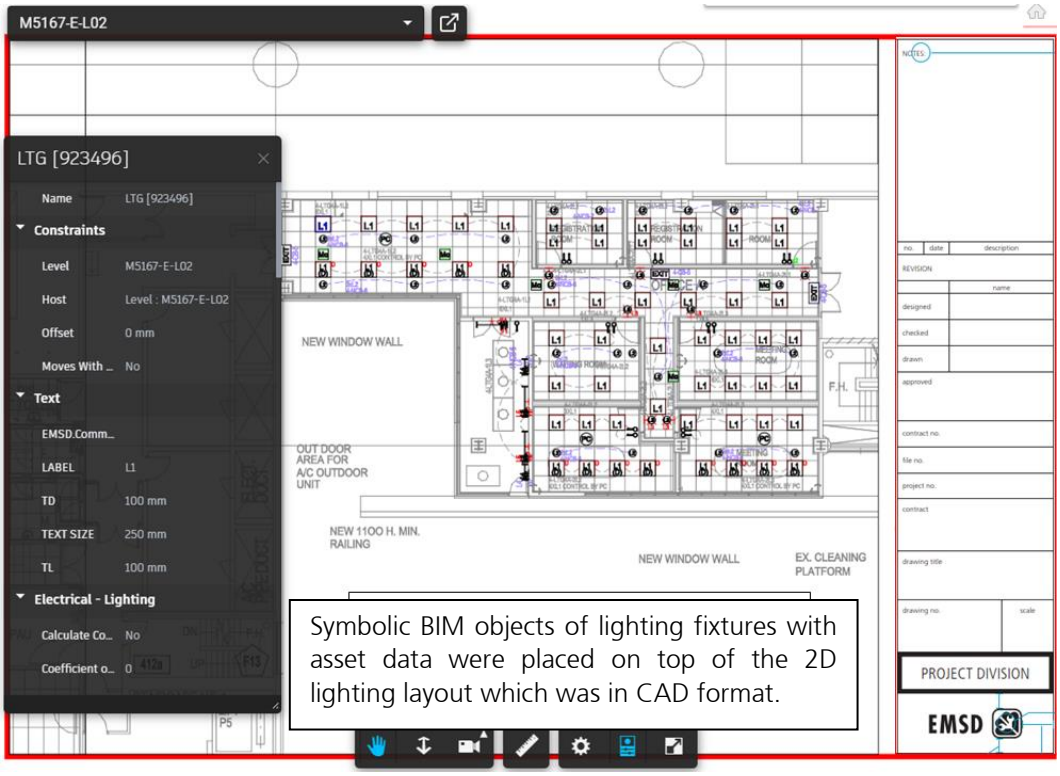
2.3.6.6 Other Systems

Other required installation(s) shall be modelled in accordance with the latest EMSD BIM-AM Standards and Guidelines or specified by the Engineer's Representative, including but not limited to, boiler system, filtration plant, lift and escalator installation, pneumatic tube transport, greywater, and rainwater treatment plant, etc.

***Section 2.3.7** is subjected to the venue nature and the Engineer's Representative may consider to adopt BIM-AM lite for BIM-AM operation. Please delete the entire section if full 3D models are adopted in this project.*

2.3.7 For those restricted/ sensitive venues where 3D models are not available, BIM-AM lite models with E&M BIM objects on top of the 2D as-built layout plans would be constructed as an alternative for BIM-AM operation. The Contractor shall construct the 2D layouts in form of 2D computer-aided drafting (e.g. AutoCAD) based on as-built information given by the Government Representative. The Contractor shall develop symbolic 3D BIM objects for E&M equipment and place the objects on the 2D layout plans. The sample of 2D-AIM Models (Plan) is shown below.

Figure 2-1 Sample of 2D-AIM Model for Lighting Installation



2.3.8 Individual BIM models of each system shall be linked to one "master" federated model file as specified in the latest BIM-AM Standards and Guidelines.

2.3.9 The Contractor shall ensure all the individual components of BIM models are free of clash and interference.

2.3.10 The Contractor shall provide the data rich as-built BIM models for future building operation and maintenance. The Contractor shall finally update the BIM models using as-built information for future handover to the EMSD. The as-built BIM models shall be contained not only geometry accurate information, but also contained all BIM object parameters as specified in the latest BIM-AM Standards and Guidelines. It shall be submitted together with the CobieLite file(s) as a proof of accuracy. COBieLite file(s) generated by the AIMP would serve to validate data accuracy and completeness of data input before data migration to BIM-AM System.

2.3.11 The Contractor shall provide editable native BIM model. The Contractor shall keep the latest deliverables that is in the current approved version at the time of delivery, BIM software may be upgraded throughout the works/phase/stage as agreed by the Engineer's Representative. Upgrade implementation will take into consideration in the deliverables.

2.3.12 The Contractor shall provide BIM Execution Plan (BEP) before the commencement of work. The Contractor shall treat their BEP as a live document and shall review and update it regularly. It is the Contractor's obligation to implement the BEP as a basis for what they are required to deliver. The BEP shall follow the requirements stated in the following sections, including but not limited to:

a) BIM Project Execution Plan Overview

b) Project Information

c) Client BIM Requirements

- BIM Goals
- BIM Uses
- BIM Data
- LOD Responsibility Matrix

d) BIM Management
- Roles, responsibilities, and authority
- BIM Team Resources, Competency & Training
- BIM Deliverable Schedule (Programme)
- Approval of BIM Deliverables

e) BIM Process
- Individual Discipline Modelling
- Collaboration and Model Sharing
- BIM Coordination and Clash Detection
- Drawing Production
- Quality Control
- Common Data Environment (CDE)

f) BIM Procedures
- BIM Origin Point & Orientation
- Modelling Methodology
- Model Division
- Model Units
- File Naming Convention
- Drawing Sheet Templates
- Annotation, dimensions, abbreviations, and symbols
- Colour Scheme

g) IT Hardware and Software Solutions
- Software Versions and Upgrade Plan
- Exchange Formats
- Hardware Specifications

h) Asset Management
- Asset Information Requirement of Level 1 System and Level 2 Equipment
- Data Deliverables with the use of COBieLite in XML format
- The use of AIMP to complete the asset input as specified in the latest BIM-AM Standards and Guidelines.

2.3.13 All as-built drawings submitted by the Contractor shall utilise BIM to generate the drawings.

2.4 Inputting asset data in BIM models and BIM-AM System

2.4.1 The Contractor shall liaise with the Engineer's Representative to obtain login ID and passcode for the use of AIMP and CDE.

2.4.2 Upon the completion of as-built E&M BIM models, the Contractor shall generate the COBieLite file from the as-built models and then import it to AIMP for the next step of data inputting and the Contractor shall use the AIMP for the following task to complete the asset data input.

a) To create and input asset data of Level 1 System and Level 2 Equipment which are required for asset management as specified in the latest BIM-AM Standards and Guidelines, but they are not drawn in the BIM model, such as HVAC air side system;

b) To create asset relationship by means of uploading the "relationship excel templates" to AIMP; and

c) To upload E&M documents under a zip file of each Level 1 System as specified in the latest BIM-AM Standards and Guidelines. The folder path would be automatically assigned by AIMP to each E&M asset upon the upload of zip file.

2.5 Supply and Install RFID Tags and QR Codes

2.5.1 The Contractor shall record all RFID tags and QR codes to be installed on site and submit the record of RFID tags as part of the site survey report.

2.5.2 The Contractor shall propose the methodology of sticking the RFID tags and QR codes and it shall be agreed with Engineer's Representative. The Contractor shall take lead to resolve any issues arising from the site work, ensuring installation is completed to the satisfaction of Engineer's Representative and be responsible for any rectification required without any extra cost to the Employer.

2.5.3 For asset tags by means of RFID tags, the Contractor shall provide sufficient RFID tags as specified in the latest BIM-AM standards and guidelines with waterproof printing label for Asset Code of Level 1 and 2 asset or specified by the Engineer's Representative. QR code of the asset code shall be also included on the waterproof label. The RFID tags shall be encoded under the memory banks of electronic product code (EPC) and securely installed by the Contractor. The specifications of the RFID (metal large tag) and paper tags are listed in below Tables.

Table 2-1 Specifications of Passive RFID Metal Tag

a)	Air Interface Protocol	EPC Class 1 Gen 2; and ISO 18000-6C
b)	Device Type	Passive metal tag
c)	Operating Frequency	860MHz - 960MHz
d)	Read Range	Over 12-meter on metal surface in air space within the 902MHz - 928MHz frequency range; and

		Over 8-meter on non-metal surface in air space within the 902MHz - 928MHz frequency range.
e)	Memory	496 EPC bits or better; 128 bits user memory or better; and 48-bit serialized TID.
f)	Data Storage	Not less than 10 years
g)	Read/ Write Cycle	100,000 or better
h)	Operation Temperature	-20°C to +85°C or better
i)	IP Rating	IP68 compliance
j)	Size	135mm x 36mm x 9mm or smaller
k)	Material	PET / ABS
l)	Attachment	Two rivet/screw holes for mounting; Available for adhesive option.

Table 2-2 Specifications of Printable Flexible RFID Tag

a)	Air Interface Protocol	EPC Class 1 Gen 2; and ISO 18000-6C
b)	Device Type	Passive anti-metal tag
c)	Operating Frequency	902MHz - 928MHz
d)	Read Range	Over 2-meter on metal surface in air space within the 902MHz - 928MHz frequency range; and Over 2-meter on non-metal surface in air space within the 902MHz - 928MHz frequency range.
e)	Memory	128 EPC bits or better; and 512 bits user memory or better
f)	Read/ Write Cycle	100,000 or better
g)	Data Storage	Not less than 10 years
h)	Operation Temperature	-40°C to +85°C or better
i)	IP Rating	IP68 compliance
j)	Size	100mm x 25mm x 1.5mm or smaller
k)	Material	Paper / PET
l)	Attachment	Self-adhesive

2.5.4 For asset code by means of QR codes, the Contractor shall provide sufficient QR codes as specified in the latest BIM-AM Standards and Guidelines with waterproof printing label for asset coding of Level 2 Equipment or specified by the Engineer's Representative.

2.5.5 The Contractor shall design and propose zoning plan for tagging zone codes. The proposed zones shall be well defined in the architectural models with labels. Zoning shall be included in the space of ceiling void and raised floor void. Zoning plan shall be approved by Engineer's Representative before the tagging work on site.

2.5.6 For the zone tag by means of QR codes, the Contractor shall supply and install the QR codes at the top of door frame on both sides of each door, as well as each floor box. The requirement of zone coding and the provision of waterproof printing label shall be referred to the latest BIM-AM Standards and Guidelines.

2.5.7 The Contractor shall supply black on white laminated label tapes with the width of 24mm for zone tags. The requirement of zone coding and the size of zone code labels shall be referred to the latest BIM-AM Standards and Guidelines.

2.6 Data Migration to BIM-AM Platforms

2.6.1 Upon the completion of data inputs within AIMP (as mentioned in section 2.4.2), the Contractor shall generate a second updated set of COBieLite files from AIMP for uploading to BIM-AM Systems.

2.6.2 The Contractor shall convert the native 2D/ 3D AIM models to lightweight format, such as SVF format, via the BIM Model Translator developed by EMSD. The lightweight models shall be uploaded to BIM-AM platforms.

2.7 Data Migration to CCS Platform

2.7.1 Upon the completion of data inputs within AIMP (as mentioned in section 2.4.2), the Contractor shall export CCS templates from AIMP to be uploaded into CCS.

3 Maintenance Requirements

3.1 General

3.1.1 One-year guarantee period shall be provided for all works as provided by the Contractor. Maintenance will start after successfully passing the requirement in the Reliability Specification as specified in Clause 3.3 with formal acceptance by the Employer.

3.1.2 The Contractor shall provide the necessary tools with sufficient instructions to access the BIM models and asset data.

As DLP arrangements are different between EMSD projects and projects of other information owners, the following sentence should be reviewed accordingly.

3.1.3 EMSD has developed the departmental CDE for BIM-AM. The Contractor shall work closely with the Engineer's Representative to upload the as-built BIM models to EMSD CDE within the six (6) months period from the initiation of defect liability period (DLP).

3.2 User Acceptance Test

3.2.1 The Contractor shall arrange User Acceptance Test in which the test specification and test results need to be satisfactorily accepted by the Employer.

3.3 Reliability Specification

3.3.1 Upon the acceptance of User Acceptance Test by the Employer, the Employer will use the BIM models and asset data provided by the Contractor as stipulated in this PS. *Please include this sentence for EMSD's project or otherwise to be removed* [For EMSD's project, twelve (12) consecutive weeks during the nursing period to determine whether the accuracy of the BIM models and asset data.]

4 Works Requirements

Section 4.1 is only applicable to EMSD projects and could otherwise be removed.

4.1 [Nursing Period]

4.1.1 [The Contractor shall update the BIM model(s) and asset data at no extra cost to the Employer.

4.1.2 The Contractor shall cooperate with the Engineer's Representative and different parties to deliver and complete the works.

4.1.3 For asset digitisation contracts, guarantee period shall commence after the nursing period.]*

4.2 Quality Control and Assurance

4.2.1 The Contractor shall perform quality control checks of the BIM design, dataset, and model properties by visual inspection and application of clash detection before submitting their deliverables.

4.2.2 The quality assurance of the BIM models shall be verified to the satisfaction the Engineer's Representative according to the following:

a) BIM and asset data in agreed version, LOD-G and LOD-I;

b) Components modelled using correct BIM objects;

c) Components belonging to a correct system;

d) No overlapping or doubled components;

e) Components fit into their spatial reservations;

f) No clashes between architectural, structural, fire services, E&M and ELV system in BIM models;

g) BIM model is located in the correct coordinate system;

h) Penetrations of columns, beams, and slabs; and

i) Compatibility with the AM software asset coding standards.

4.3 Model Compliance Check

The Contractor shall submit the compliance check report generated by the BIM Model Checker plugin provided by EMSD to ensure the parameter settings in the BIM models conforming to BIM-AM Standards and Guidelines.

Model compliance checks shall be carried out covering the following:

a) Format, such as software version and extension;

b) Naming, such as naming of the files and their corresponding folders;

c) General settings, such as grid, survey point, project base point, shared coordinate and coordinate system, shared parameters, attributes;

d) Consistency of 2D information generated from BIM model;

e) Attributes for asset entries tracking;

f) Model cleanness including flag links, unpurged elements, and unused views in final BIM models submission.

5 Documentation and Deliverables

The Contractor shall submit the following project documents for review and approval of the Employer.

a) BIM modelling master programme;

b) BIM team organization chart;

c) BEP;

d) O&M manuals and relevant documents;

e) Master Information Index (MII) in accordance with Annex 2 of BIM-AM Handover Guidelines for Trade;

f) Site survey report with the record of RFID tags and QR codes;

g) Material specifications for the RFID tags;

h) As-built BIM models;

i) 2D drawings generated from as-built BIM models in PDF format with annotation as requested by the Engineer's Representatives; and

j) COBieLite file with asset data exported from AIMP for data migration to asset management system.

6 Evaluation Criteria

6.1 Tenderer's Experience

6.1.1 The tenderer shall have at least three (3) relevant project experience with average contract sum no less than HK$ 1 million in local or oversea and projects completed in the past five (5) years for construction of BIM model with relevant systems (including but not limited to architectural, structural, fire services, E&M and ELV) demonstrating that the tenderer has the relevant management and technical experience.