Particular Specification PS.G20

Building Information Modelling (BIM)

Particular Specification for
Building Information Modelling (BIM)

1. SCOPE OF WORK

1.1   This Specification applies to all Works under this Contract. The Contractor shall according to the design concept for the Works, provide the services and submit all the deliverables as detailed in this Particular Specification.

1.2   The Contractor is required to set up a BIM Team with a Building Information Modelling Team Leader (BIM Team Leader) leading the BIM Team and to provide, a minimum of disciplinary BIM coordinators and modellers in architectural, structural and building services disciplines as detailed in the below table. Qualification of the BIM Team is specified in **Appendix 1** of this Particular Specification.

	Disciplinary BIM Coordinator (No.)	Modeller (No.)
Architectural		1
Structural	1	1
Building Services		1

The BIM Team Leader of the Contractor shall carry out the following duties and functions

1. Lead and manage the BIM Team and shall be responsible for the overall BIM management and provides control to ensure the deliverables are issued on time,
2. Coordinate with the Supervising Officer (SO) and his representatives including the SO's consultants,
3. Plan, develop and manage the project BIM standard and implementation strategy,
4. Provide quality control and checking procedures,
5. To ensure all the deliverables are issued on time,
6. Provide advice/guidance to the SO and his representatives in
   a) reviewing BIM modelling formats/protocol and co-ordination,
   b) reviewing analysis and findings on application by using different softwares such as the clash detection and resolve clashes,
   c) providing technical support to the SO's representatives regarding modelling enquiries.

The BIM Team shall provide the following services:

1. To coordinate all parties including but not limited to different design disciplines, sub-contractors, Specialist Sub-contractors, Specialist Contractors, suppliers, SO and his representatives, Government Departments and Utility Undertakings and collecting suitable information and data from them,

2. To build and develop the BIM models and all deliverables based on the information and data collected, to manage the BIM databases, to report any clash/conflict or difficulties in BIM models production and to resolve such difficulties with relevant parties,

3. To utilise BIM for avoidance of risks and minimisation of changes, to monitor project costs and programmes in various stages, and to enhance safety design for construction and operation,

4. To input the updated information and data, including but not limited to all variations, from time to time; to create, manage, develop and update the BIM models to all deliverables for the construction works; to ensure the updated BIM models are coordinated and always kept ahead of the site construction to enhance the project delivery process through BIM adoption,

5. To coordinate the BIM models and all deliverables to ensure consistency among all deliverables; to use the best practice in setting up the system for coordinating BIM models among all parties,

6. To provide technical support and guidance to the SO and his representatives in using the BIM models, managing the BIM database and resolving potential construction difficulties,

7. To consolidate design information from nominated sub-contractor(s) and develop the BIM model and all deliverable as requested in this Contract.

The Contractor shall submit the organization chart and qualification of members of the BIM Team for the Supervising Officer (SO)'s approval within **14 calendar days** after the commencement of the Contract. The Contractor shall provide sufficient and technically competent resources as agreed or directed by the SO or his representatives in order to complete all BIM tasks and deliverables specified in the Contract according to the approved programme.

2. OBJECTIVES

2.1 The objective of the application of BIM is to create a digital building information model for the Works and to use BIM as a platform to facilitate Works planning, site administration, safety planning, design co-ordination, clash detection prior to construction, financial planning, minimization of abortive works, waste reduction and efficient asset management in order to achieve the following beneficial purpose:

1. To minimize design discrepancies, improve design co-ordination and deliver a clash-free design through the use of 3D modelling technique,
2. To enhance visual communication between the Contractor and all stakeholders, improve mutual understanding of the design intent and facilitate design review and vetting process,
3. To support efficient delivery of drawings, including Combined Services Drawings (CSDs) and Combined Builder's Work Drawings (CBWDs),
4. To support the development of 4D modelling construction sequence during the construction stage to enhance communication, predict and manage construction process,
5. To support the development of asset management by using BIM with an as-built BIM model for effective operation and maintenance of the buildings.

3. GUIDELINES AND STANDARDS

3.1 The BIM Team Leader should adopt the predominant BIM industry standard on discharging his duties. Reference may be made to the published guidelines, such as:

1. CIC Building Information Modelling Standards (Phase One), September 2015, by the Construction Industry Council in Hong Kong;
2. AEC (UK) BIM Technology Protocol – Practical implementation of BIM for the Architectural, Engineering and Construction (AEC) industry, version 2.1.1, June 2015, by the AEC (UK);
3. BIM Project Execution Planning Guide, version 2.1, May 2011, by The Computer Integrated Construction Research Program of the Pennsylvania State University;
4. BIM Project Specification, revision 3.0, Jun 2011, by the Hong Kong Institute of Building Information Modelling;
5. The as-built BIM model and data structure shall make reference to the Building Information Modelling for Asset Management (BIM-AM) Standards and Guidelines, version 1.0, November 2017 issued by the Electrical and Mechanical Services Department.
6. BIM Guide for Facilities Upkeep by Property Services Branch, Architectural Services Department
7. CSWP (CAD Standard for Works Projects);
8. Drafting Specification for Engineering Survey;

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9. BS 1192:2007 Collaborative production of architectural, engineering and construction information. Code of practice;
10. PAS 1192-2:2013 Specification for information management for the capital/delivery phase of construction projects using building information modelling;
11. PAS 1192-3:2014 Specification for information management for the operational phase of construction projects using building information modelling;
12. PAS 1192-5:2015 Specification for security-minded building information modelling, digital built environments and smart asset management;
13. BS 1192-4:2014 Collaborative production of information. Fulfilling employer's information exchange requirements using COBie. Code of practice.

4. DELIVERABLES

The Contractor shall submit the following deliverables according to the programme stipulated in Clause 5 of this Particular Specification.

The copyright of all data and information contained in all deliverables including BIM models and reports created, developed and provided under this Contract, including all draft and final versions, shall be the property of the Employer.

4.1   BIM Project Execution Plan:

The Contractor shall prepare and submit a BIM Project Execution Plan as per **Appendix 2** for the SO's approval.

The Contractor shall define the full details of the implementation and collaboration process in the BIM Execution Plan.

The Contractor shall review the BIM Project Execution Plan regularly.

4.2   Architectural BIM model

The Contractor shall create, maintain and update the architectural BIM models and use BIM models to show the following components to the agreement and satisfaction of the SO or his representatives before construction, but not limited to:-

Architectural components	Level of Development
1. Existing site topography, services and buildings;	200
2. Site context of surrounding, including access to site;	100
3. Architectural layout and works;	100 - 300
4. Rooms, spaces, corridors, plant & equipment rooms area;	200 - 300
5. Floor slabs, ramps & roofs;	200 - 400
6. Internal and external walls and columns;	200 – 400
7. Doors, metal gates, fire shutters and its hood, access panels;	200 - 400
8. Metal and stone capping	200 - 400
9. Ironmongery;	200 – 400
10. Curtain wall & precast facades;	200 - 400
11. Cladding, windows and louvers;	200 - 400
12. Metal covered walkways and glass canopies	200 - 400
13. Balustrades, parapets and railings;	200 - 400
14. Staircases;	200 - 300
15. Ramps, raised access floor, false ceilings with access openings;	200 - 400
16. Built-in fixed furniture such as toilet partition, cabinets;	200 - 400
17. Smoke barriers;	200 - 400

18. Drainage/ Services Channel covers;	200 - 400
19. Cat ladders, catwalks, maintenance platform;	200 - 350
20. Exterior elements such as canopy, sun-shading devices, wall and green features;	200 - 400
21. Sanitary Fitments;	200 - 400
22. Signage;	200
23. External Works such as soft landscape, hard landscape, pavement, EVA	200 - 400
24. Joss Paper Burner and the associated builder's work	200 - 400
25. Hydraulic scissor platform for lifting coffin, screen door and the associated builder's work	200 - 400

4.3   Structural BIM model

Structural components	Level of Development
1. All elements requiring for the structural, foundation and geotechnical design.	200-400
2. Any precast / prefabricated & prestressed elements.	200-400
3. Details are required in congested areas, cast-ins, changes in level and junctions/ connections between structural elements.	200-400
4. 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).	200-400
5. Reinforcement details at certain congested zones, to be selected by the SO or his representatives, for interfacing coordination between reinforcement and building services elements.	200-400
6. Specific rendered views, to be selected by the SO or his representatives, from the BIM model on the structural framework and interfaces to illustrate connections among structural members.	200-400

4.4   Building Services BIM model

The Contractor shall create, develop and update the building services model and use BIM models to show the following details of building services installation to the agreement and satisfaction of the SO or his representatives before construction, but not limited to:-

Building Services components	Level of Development
1. Electrical Services - Motor control panels, MCCB & MCB boards, socket outlets, fused spur units, luminaire/ lighting fittings, bollard lights, occupancy & daylight sensors, power cables ($>50mm^2$), circuitries, metering, cable trays, trunkings, earth pits, earth tapes, down conductors, and relevant system components not embedded into concrete or building structure, etc.	200-400

2. Heating, Ventilation and Air-Conditioning Services - Variable refrigerant volume (VRV) outdoor units, indoor units, primary air-handling unit, fan-coil units, ventilation/ exhaust fans, ducts, dampers, diffusers/ grilles, control panels, pipes, valves, associated electrical services and relevant system components not embedded into concrete or building structure.	200-400
3. Fire Service Installation - Fire hydrants, hose reels, sprinkler control valves, sprinkler flow switches, sprinkler heads, detectors, breakglass units, fire alarm panel, battery panel, fire extinguishers, pumps, water tanks, pipes, valves, exit signs, directional signs, visual fire alarms, alarm bells, associated electrical services and relevant system component not embedded into concrete or building structure.	200-400
4. Burglar Alarm and Security System - CCTV cameras, public address speakers, microphone inlets, emergency call bells, intercom outlets, server racks & consoles, panels, associated electrical services and relevant system component not embedded into concrete or building structure.	200-400
5. Broadcast Reception Installation - Outlets, associated electrical services and relevant system component not embedded into concrete or building structure.	200-400
6. Plumbing Installation - Water tanks, pumps, pneumatic tanks, filters, water pipes, valves, fittings, associated electrical services and relevant system component not embedded into concrete or building structure.	200-400
7. Aboveground and Underground Drainage Installation - Drain pipes, valves, fittings, manholes, trap gullies, drain outlets & inlets, air vents, sub-soil drains, sanitary fitments, sewage pumps, associated electrical services and relevant system component not embedded into concrete or building structure.	200-400
8. Accessories - Hangers, maintenance platforms, cat ladders, hoisting beam, chain block, hoisting eyes, etc.	200-400
9. Utilities/ external works - All underground & aboveground cable ducts with associated cable pits structure for electrical and/ or utilities, etc. - Construction sequences of underground utilities and installation at external and EVA, etc. - All outdoor lighting fittings with associated footing structure, etc.	200-400

The Level of Development for design elements responsible by the Contractor shall be 200 to 300. The Level of Development for construction model shall be 400.

For efficient handling of models, the BIM model should be sub-divided into separate zones/ services/ systems as appropriate to maintain reasonable file size of the models. The model sub-division strategy (by zones/ services/ systems) should be stated in the BIM Project Execution Plan. File sizes of each sub-divided BIM model shall be kept in minimum by purging of unused views, BIM objects and settings before publish or submission. The maximum file size for each sub-divided BIM model should not exceed 150MB unless otherwise approved.

4.5   3D Coordination

The Contractor shall carry out clash analysis quarterly during the construction period based on the different BIM models created and updated at different stages in order to resolve all major system clashes prior to construction by identifying and resolving clashes among different disciplines.

Clash analysis shall include the checking of headroom requirements and working spaces for building services operations and maintenance activities. In particular, for major equipment which must provide services without any break, dynamic envelope model showing the estimated dimension of physical space sufficient for equipment delivery and maintenance is required as well as installation sequence. The Contractor shall liaise with the SO or his representatives to determine the criteria level of acceptable clashes, e.g. sprinkler pipes pass through beams.

Procedure of clash detection:

1.   Compare BIM models built up from design of different disciplines and shop drawings from sub-contractors,
2.   Identify clashes,
3.   Report to the SO or his representatives,
4.   Revise design information and shop drawing,
5.   Rebuild BIM models,
6.   Perform another round of analysis until clashes are eliminated.

Clash analysis should be presented in the form of a report to compare the different clashes, record the clash detection process and assumptions on element tolerances, areas and elements, identify any major conflict discovered in the process and generate resolution result summary. The report shall address the following:-

1.   Software to be used
2.   Process overview
3.   Responsibilities
4.   Outputs
5.   Technical query workflow
6.   Clash resolution process
7.   Action plan with target completion schedule to handle and resolve detected clashes
8.   Tolerance levels (mm) for different discipline
9.   Operation clearance
10.   Maintenance clearance
11.   Buildability
12.   Services compatibility

4.6   Phase Planning (4D Modelling)

The Contractor shall provide 4D Model simulations to the construction process of the Works to:-

1.   Establish relationships between the programme and sequence of construction activities, including the delivery of material and equipment, to be carried out during the construction,
2.   Demonstrate the Contractor's works sequences,
3.   Identify potential time and spatial conflicts,
4.   Optimize the use of critical resources,
5.   Enhance safety requirements and construction process control,
6.   Minimize disturbance to the operation of the neighbourhood,
7.   Better co-ordinate with affected parties and resolve interfacing issues at early stages,
8.   Monitor procurement status of project materials.

For works to be carried out in the existing crematorium building including but not limited to the construction of new hoisting beams and cremators in the existing cremator plant room, due considerations of the 4D Model simulations shall also be given to the works phasing plan / BS diversion requirements / method statements / specific submission time frame as stipulated on the Architectural, Building Services and Structural Drawings.

The 4D simulations shall be demonstrated upon revising master program linking all activities in the master programme and it shall be automatically matched with the activities as shown in the master programme with appropriate file format.

The Contractor shall submit a 4D Simulation Report containing the following but not limited to:-

1.   Description of the 4D simulation report, e.g., assumptions, time interval, construction method statement, guide for accessing the files and models,etc.
2.   Video of the 4D simulation.
3.   BIM native model(s).
4.   Models(s) for 4D simulation platform.
5.   Linked project programme or equivalent deliverable.

4.7   2D Drawing Generation (Drawing Production)

The Contractor shall generate 2-D drawings in .dwg /.pdf format from the BIM models including but not limited to architectural drawings, structural drawings, Combined Services Drawings, Combined Builder's Works Drawings etc. to facilitate the co-ordination and operation for the construction of the Works during the contract period.

It is acceptable that certain architectural components, the building services schematic /control logic diagrams /drawings, reinforcement details are not generated directly from the BIM model.

4.8   Existing Condition Modelling

The Contractor shall make use of 3D digital survey technology to provide as-built condition verified for the Works. It provides documentation of environment for future modelling and 3D design coordination. It can supplement photographic records of condition survey. The 3D digital survey model shall be georeferenced to the same absolute coordinate system, e.g. Hong Kong 1980 Grid, according to x, y, z coordinates. The format can be:-

1.   Point Cloud (.las)
2.   Build mesh (.tin)
3.   Export ortho-image (.jpeg, .png and .tiff)
4.   Video (H.264 & other formats specified in the latest version of OGCIO – The HKSARG Interoperability Framework (S18))

4.9   BIM Object

All BIM objects created by the Contractor for the Works shall comply with the latest version of the related guidelines and standards. The Contractor shall create and submit not less than 20 or as assigned by the SO for project specific BIM objects. The Contractor shall demonstrate which BIM objects are being used to facilitate the construction stage BIM.

4.10   As-built BIM Model for Asset Management and Facilities Upkeep

The Contractor shall submit the as-built BIM model of all components as described in Clause 4.2 to 4.4 of this Particular Specification.

The as-built BIM model shall be based on the final construction information that had actually been built, and shall be used to produce as-built drawings. Information on location such as room number and building name, staircase number, washroom number, lift lobby number is required to be incorporated into the as-built BIM model. The Contractor shall also import and display the operation data, product catalogues, manuals, warranties and maintenance history of equipment etc into the as-built model.

The as-built BIM models shall be prepared in accordance with the guidelines as detailed in **Appendix 4**.

The Contractor shall include as-built construction and equipment components of the Works with information as listed below for future handover to the Employer:-

1.   Room Data Sheets,
2.   Door Schedules,
3.   Ironmongery Schedules,
4.   Window Schedules,
5.   Access Panel Schedules,
6.   Shutter Schedules,
7.   Cat ladder Schedules,
8.   Louvre Schedules
9.   Sanitary Fitment Schedules
10.   Signage Schedules,
11.   Roofing System,
12.   Fall arrest system
13.   Comprehensive materials data sheet list and completed materials/equipment warranty list,
14.   Other textual information subject to agreement of facility management at later stage.
15.   As-built BIM models and 2D drawing files for building services installation;
16.   Export data files, if any;
17.   Folder storing the building services object files;
18.   Testing and Commissioning reports;
19.   Operation and Maintenance manuals;
20.   Relevant statutory certificates, approval documents and forms; and
21.   Other relevant project information as required.

The as-built model shall be provided with animation(s) for assemble, disassemble, repair and replacement procedure for follow components wall for viewing in the ArchSD's Asset Information System (AIS):-

1.   Aluminium composite panel enclosure of joss paper burner
2.   Pitched skylight at New Service Hall 4
3.   Dismantling metal canopy and its false ceiling
4.   Hoisting beams and cremators in the existing cremator plant room

In general, the animation shall not be lower than LOD350. The objective of the animation is to illustrate how to maintain the special part of the building. The extent of the animation required will depend on the design of the building. The Contractor shall propose the animation including but not limited to the requirement in the BIM Guide for Facilities Upkeep for approval.

The required as-built data and relevant documentations shall be stored in a standardized file folder structure.

5. PROGRAMME

The BIM models are built and developed for the purposes of design co-ordination, phase planning and communication.

The Contractor shall produce and submit at regular intervals updated BIM models on part or whole of the Works in a required file format, such that the project team can easily view and capture the images and perform simple marking-up of annotations on selected images and transmitted through internet or intranet.

The target programme for production of the BIM models and the deliverables, which will be subject to change according to actual circumstances as per the direction of the SO or his representatives is at **Appendix 3**.

6. QUALITY ASSURANCE AND QUALITY CONTROL

6.1   Quality Assurance / Control Requirements

The Contractor shall establish quality assurance plan for BIM, to ensure appropriate checks on information and data accuracy. The Contractor will be responsible for ensuring the integrity of their BIM and drawings as well as compliance with the BIM and CADD standards. The final BIM version shall be fully coordinated and without any conflict with as-built asset attributes.

The quality assurance and control shall include but not limited to the following contents:-

1.   model compliance according to the modelling methodology which is stated in the BIM Execution Plan
2.   data validation
3.   clash analysis checking

6.2   Model Compliance Check

Model compliance checks shall be carried out covering the following:-
1.   Format, such as software version and extension;
2.   Naming, such as naming of the files and their corresponding folders;
3.   General settings, such as grid, survey point, project base point, shared coordinate and coordinate system, shared parameters, attributes;
4.   Consistency of 2D information generated from model;
5.   Attributes for asset entries tracking;
6.   Model cleanliness including flag links, unpurged elements and unused view in final model submission.
7.   Newly added item, please delete / amend as appropriate.

6.3   Documentation Compliance Check

Documentation compliance checks shall be carried out including BIM Project Execution Plans, federation maps, lists of self-check items, clash reports and model register list.

7.   HARDWARE AND SOFTWARE REQUIREMENTS

7.1   The Contractor shall submit a proposal with details on specification and quantities of compatible software and hardware to build up a Common Data Environment (CDE). After the SO or his representative's approval of the proposal, the Contractor shall provide, set up and maintain the proposed hardware and software for the CDE.

7.2   The Contractor shall provide a dedicated common data environment for storage, viewing and sharing of contract related BIM models, drawings, animation, rendering and other related files of the Works with the following properties:-

1.   It shall have a clear folder structure, being part of the CDE to store various BIM related information,
2.   It shall contain encryption function for data security and be of sufficient capacity to store all files during the whole project life cycle,
3.   It shall be installed with anti-virus software and maintained with updated security patches for all software.

7.3   The Contractor shall be required to:-

1.   Submit the folder structure of the BIM storage CDE for the SO or his representatives' agreement before uploading files into the BIM storage CDE,
2.   Prepare access control plan of the BIM storage CDE for the SO or his representatives' agreement and ensure no unauthorized access to the BIM storage CDE,
3.   Provide daily backup and off-site backup for the BIM storage CDE in which the backup media shall be stored properly away from the working office,
4.   Maintain the BIM storage CDE to ensure it operates properly during the whole project life cycle,
5.   Handover the CDE's files in approved folder structure format to the SO before the issuance of the maintenance certificate.

7.4   Preferred File Formats

The Contractor shall submit editable native BIM and an open format file of the BIM such as IFC format to SO. The Contractor shall ensure all the deliverables comply with the approved BIM software versions during the contract period and at the time of delivery. The Contractor shall also convert the final version of the BIM to other additional software versions specified by the SO.

7.5   All tools and software applications used must be Industry Foundation Classes (IFC) compliant in order to allow BIM model interoperability.

8. TRAINING

8.1   The Contractor is required to nominate his staff for the SO's approval to attend, within **6 months** from the commencement of the Contract, free training courses organised by the CIC as follows:-

   1.   Building Information Modelling Basic Modelling Courses and
   2.   Building Information Modelling discipline-specific Advanced Modelling Courses.

The Contractor shall liaise with the SO's representative on the nomination procedures, check with CIC for the schedule of the above courses and shall obtain necessary approval from the SO before the commencement of the training courses.

After the completion of the training sessions, the Contractor shall submit a training log to the SO for record. The training log should list out, but not be limited to, description of the training course, date, duration, venue and attendee details. The content of the training log shall be commented and agreed by the SO. The training log should be reviewed and updated regularly.

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Appendix 1

Qualifications of the BIM Team

Position	Qualification
BIM Team Leader	1. Corporate membership of an appropriate professional institution or 5 years relevant post-qualification experience plus university degree or equivalent in construction related discipline 2. Minimum 3 years practical experience in management of BIM projects
Disciplinary BIM Coordinators : Architectural / Structural/ Building Services	1. 3 years related construction project experience 2. Minimum 1 year practical experience in BIM projects
Modeller	1. Preferably Associate Member of the Hong Kong Institute of Building Information Modelling or equivalent 2. Diploma holder in construction related discipline 3. Minimum 1 year experience in BIM for building projects

Appendix 2

BIM Project Execution Plan

The Project Execution Plan shall include but not limited to the following sections:

1. BIM Project Execution Plan Overview

2. Project Information

3. BIM Requirements
    3.1. BIM Goals
    3.2. BIM Uses
    3.3. BIM Data
    3.4. LOD Responsibility Matrix
    3.5. Meeting Schedule

4. BIM Management
    4.1. Roles, responsibilities and authority
    4.2. BIM Team Resources, Competency & Training
    4.3. BIM Deliverable Schedule (Programme)
    4.4. Approval of BIM Deliverables

5. BIM Process
    5.1. Common Data Environment (CDE)
    5.2. Individual Discipline Modelling
    5.3. Collaboration and Model Sharing
    5.4. BIM Coordination and Clash Detection
    5.5. Drawing Production
    5.6. Quality Control and Quality Assurance

6. BIM Procedures
    6.1. BIM Origin Point & Orientation
    6.2. Modelling Methodology
    6.3. Model Division
    6.4. Model Units
    6.5. File Naming Convention
    6.6. Layer Naming Convention
    6.7. Drawing Sheet Templates
    6.8. Annotation, dimensions, abbreviation and symbols
    6.9. Colour Scheme

7. IT Hardware & Software Solutions
    7.1. Software Versions
    7.2. Exchange Formats
    7.3. Data Security & Back-up
    7.4. Hardware Specifications
    7.5. IT Upgrades

8. Asset Management

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DEVB TC No. 7/2017		Construction Contract				
	BIM Use	**Main Contractor**	**NSC**	**DSC**	**Designers (for D&B)**	**Const. Stage**
1	Design Authoring	- Lead and consolidate construction design from DSC and NSC and develop combined BIM model - Lead BIM design coordination process	- Provide construction design information (2D drawing and design data) to MC - Participate BIM design coordination process and fine tune design if required	- Agree between MC and DSC	- Carry out AIP and DDA design using BIM - Architectural designer to take lead to coordinate design BIM model across disciplines	M
2	Design Reviews	- Take lead to review combined BIM construction model and coordinate design changes - Facilitate virtual mock-up for review and approval by designers or employer	- Participate the combined BIM construction model review process - Provide changes in construction design information (2D drawing and design data) to MC	- Agree between MC and DSC	- Architectural designer to take lead to review combined BIM design model	M
3	Existing Conditions Modelling	- Carry out 3D digital survey and produce BIM model for existing site condition (including E&M if any) to facilitate construction planning	N/A	N/A	N/A	M
4	3D Coordination	- Carry out clash analysis for the combined BIM construction model - Take lead to	- Participate the 3D coordination process and contribute the resolve of conflict	- Agree between MC and DSC	- Carry out clash analysis and resolve conflict by all disciplines - Architectural	M

DEVB TC No. 7/2017		Construction Contract				
	BIM Use	**Main Contractor**	**NSC**	**DSC**	**Designers (for D&B)**	**Const. Stage**
		resolve conflict			designer take lead to resolve conflict between disciplines	
5	Phase Planning (4D Modelling)	- Consolidate and coordinate construction programme with inputs from NSC - Carry out 4D planning using BIM	- Provide construction programme information to MC	- Agree between MC and DSC	*Optional*	M
6	As-Built Modelling	- Produce combined as-built BIM model	- Provide as-built information to MC	- Provide as-built information to MC - Agree between MC and DSC	- Verify on site the accuracy of as-built BIM model prepared by contractor	M
7	Drawing Generation (Drawing Production)	- Produce drawing deliverables from BIM model	- Produce drawing deliverables from BIM model	- Produce drawing deliverables from BIM model	- Produce drawing deliverables from BIM model	M

Appendix 3

Programme

Deliverables	Completion Time
4.1) BIM Project Execution Plan as per Appendix 2.	*Within 1 month from the date of acceptance of the Tender*
4.2) and 4.3) Architectural and structural initial BIM models in Level of Development together with required 2D drawings (i.e. plans, elevations and sections).	*Within 3 months from the date of acceptance of the Tender*
4.4) Building services initial BIM models in Level of Development together with required 2D drawings (i.e. schematic, plans, reflected ceiling plans, elevations and sections).	*Within 3 months from the date of acceptance of the Tender*
4.4) Submission of CSD and CBWD BIM models in Level of Development together with required 2D drawings (i.e. plans, reflected ceiling plans, elevations and sections).	*BIM models accompanying with the master programme within 8 months from the date of acceptance of the Tender*
4.5) Clash Analysis Report	*Submit to resolve all clashed at least 1 month before the construction of those elements*
4.6) Phase Planning (4D Modelling)	*It should be performed at least 1 month before the commencement of major construction sequences*
4.7) 2D Drawing Generation (Drawing Production)	*Submit according to the Works programme*
4.8) Existing Conditions Modelling	*Submit according to the Works programme*
4.9) BIM Object	*Submit according to the Works programme*
4.10) As-Built BIM models	*A draft as-built model shall be submitted within 6 months from the issuance of the certification of practical completion and the final as-built model shall be submitted within 12 months from the issuance of the certification of practical completion*
7.3) Common Data Environment	*Handover the CDE to the SO before the issuance of the maintenance certificate*

- Note: The definition of Level of Development shall refer to CIC Building Information Modelling Standards (Phase One), September 2015, issued by the Construction Industry Council in Hong Kong

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Appendix 4

Guidelines for As-built BIM Model

The Contractor shall prepare all as-built information according to the requirements detailed below. The as-built information format, structure, data arrangement and other details shall be proposed and submitted to SO for approval.

1.   Requirements on Architectural and Structural Model

    The As-built BIM models for architectural and structural works shall be prepared in accordance with the BIM Guide for Facilities Upkeep (version 1) by Property Services Branch (PSB), Architectural Services Department (ArchSD).

    The As-built Model and 2D as-built record drawings shall comprise customized building attributes and file structure for data submission in format agreed and approved by the SO. The as-built model and building attributes will be used for future development on retrieval of asset and works records mapping in ArchSD's Asset Information System (AIS), which is based on ArcGIS (Esri ArcGIS Enterprise Standard Edition 10.4.1.)

    The As-built Model shall be provided with an additional modified IFC version for viewing and integration with AIS. The BIM data shall be in HK1980 Grid Coordinates System and refer to Hong Kong Principal Datum. The data format shall be compatible with the IFC standard (IFC4 or alternative advance format as requested by PSB). Coordination with PSB's representatives and their information technology vendor is required to further proceed data conversion process to the submitted native BIM and IFC file for data conversion and AIS web application by using FME (FME is a software by Esri for transforming and exchanging data between ArcGIS and other applications) and GIS (Geographic Information System) using ArcGIS. Relevant schedules and contract documentations stored in pre-defined folder structure shall also be arranged to suit the file display / downloading functions in AIS.

    The IFC files shall be submitted for AIS integration under different detail levels agreed by PSB. The original As-built Model files shall also be submitted to PSB for necessary examination and data conversion purpose. The information of the As-built Model shall be modified for integration with ArchSD's Automated Communication Technical Information and Operations Network (ACTION) System, which is a property maintenance services management system of ArchSD. The objects of the As-built Model shall contain the properties as required in BIM Guide for Asset Management. Subject to the complexity of the project, the required properties shall be fine-tuned on request by PSB. The properties of the objects shall be mapped with and input with the codes from the Elemental Code Relation Table provided by the PSB in Microsoft Excel Format. PSB shall be approached separately for obtaining the latest version of the Elemental Code Relational Table. As the table is restricted solely for data input to the As-built Model purpose, distribution of this table to a third party is not allowed without prior consent from PSB. The table may also be subject to change or amendment without prior notification.

    It is required to work with and provide training to PSB staff, the AIS and ACTION System maintenance teams and/or their information system vendor(s) to ensure the As-built Model smoothly integrated with these two systems.

    The As-built Model shall be provided with files with 3D animation showing the assembly, disassembly, repair and replacement method for special component or special building system such as curtain wall system, etc. for viewing in the AIS.

    The As-built Model shall be able to create sheet records and contain information including photographic record, 3D Digital Point Cloud Scanning and other data to meet the requirements indicated in BIM Guide for Facilities Upkeep (version 1).

2.   Requirements on Plumbing and Drainage Model

The As-built BIM Model for plumbing and drainage works shall be prepared in accordance with the requirements as stated in Clause 1 of this Appendix.

3.   Requirements on Building Services Model

The As-built BIM Model for building services installations should make reference to the information requirements of the Building Information Modelling for Asset Management (BIM-AM) Standards and Guidelines issued by Electrical and Mechanical Services Department.