Note: This is the draft version for public consultation. The consultation period is from 27 April 2020 to 27 May 2020. Please send your comments and feedbacks to the email: bim@cic.hk
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1. BIM Personnel

1.1 Qualifications of BIM Personnel

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<tr>
<td>BIM Manager</td>
<td>1. A valid CIC Certified BIM Manager (CCBM) or satisfy the requirements 2, 3; 2. shall either have full membership of an appropriate professional institution or shall have a minimum of five years relevant post-qualification experience plus university degree or equivalent in an appropriate architectural, engineering, surveying or construction-related discipline; 3. shall have a minimum of three years of practical experience in management of BIM projects</td>
</tr>
<tr>
<td>Discipline-specific BIM Coordinators : Architectural / Structural/ Building Services</td>
<td>1. A valid CIC Certified BIM Coordinator (CCBC) or satisfy the requirement 2-4 2. A diploma (or equivalent) in Qualifications Framework (QF) Level 4 or above qualification in architecture, engineering, surveying, building or construction; 3. Minimum three (3) years full-time relevant work experience; 4. Minimum one (1) year practical experience in BIM projects; and completed at least one (1) CITF pre-approved BIM training course or possess at least one (1) BIM software certificate.</td>
</tr>
<tr>
<td>Discipline-specific BIM Modeller</td>
<td>1. A higher Certificate or Certificate in architecture, engineering, surveying, building or construction, or equivalent as recognised by CIC. 2. Minimum one (1) year practical experience in BIM projects. 3. Possess at least one (1) BIM software certificate.</td>
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2. Deliverables

2.1 BIM Execution Plan

A BIM Project Execution Plan, the outline of which as per Appendix 1, shall be prepared and submitted for the Employer's approval in the feasibility and planning stage or design stage whichever is earlier of BIM adoption in the project. Full details of the BIM implementation and collaboration process shall be defined in the BIM Project Execution Plan. In case of specific information that is not included in this BIM Specification such information shall be included in the BIM Project Execution Plan in the beginning of the project.
The BIM Project Execution Plan shall be maintained as a live document. It shall be reviewed and updated regularly at least [in quarterly intervals] and submitted to the Employer as and when required.

2.2 BIM Models

2.2.1 Contents of Models
The BIM models shall meet and satisfy the needs of the BIM uses and deliverables as required by the Employer. They shall have the property / attribute of system (e.g. Heating, Ventilation and Air-Conditioning (HAVC) system, Fire Protection system) and sub-system (e.g. Supply Air Duct / Return Air Duct / Exhaust Air Duct for HVAC system) such that project team can filter, isolate and manage the model by each complete system or sub-system.

2.2.2 Level of Development (LOD)
The LOD to be adopted are in terms of LOD-Graphical (LOD-G) and LOD-Information (LOD-I). The definitions should be referred to the latest CIC BIM Standards (General), CIC BIM Standards for Mechanical, Electrical and Plumbing, CIC BIM Standards for Underground Utilities.
The LOD to be adopted in the project are required as follows:

1. LOD-G
   a. In planning and design stage, model elements / BIM objects shall be modelled at up to LOD300 in general subject to the availability of design information and the instruction from the Employer. LOD200 should be accepted by the Employer for particular model elements / BIM objects with reasonable supporting reasons.
   b. In construction stage, model elements / BIM objects shall be modelled at minimum LOD300 in general. While for prefabricated, MiC* and DfMA* units / elements shall be modelled at minimum LOD400. For AM and facilities upkeep purpose, model elements / BIM objects shall be field verified representations in terms of size, shape, location, quantity, and orientation.
   c. Model elements / BIM objects to be built shall meet and satisfy the needs of the required BIM Uses as specified in the Scope of Works fit for purposes. Sufficient LOD shall be applied.

2. LOD-I
   a. Building information, attributes and parameters shall be embedded or linked to the model elements / BIM objects to enable AM and facilities upkeep. Discipline-specific details shall be referred to the respective CIC BIM Standards and agreed by the Employer.

The LOD of model elements / BIM objects for each discipline-specific model shall be listed in the LOD responsibility Matrix as part of the BIM Project Execution Plan. The requirement of 2D drawings shall be referred to Clause 2.4.20 Drawing Generation (Drawing Production).
2.2.3 File Size of Models
For efficient handling of models, the models 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) shall 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 be decided based on the capacity of the hardware and software and approved by the Employer.

2.2.4 Model Federation
Model federation shall be well-defined in the BIM Project Execution Plan and used as a discussion media during the regularly scheduled design coordination/project progress meetings. Federated information for both file management and collaboration activity shall be provided. The federated information shall contain a federated BIM model (a single model that combines all individual discipline/discipline-specific BIM model in the project area) that allows for the project participants, including Employer’s staff, to go through the design review, clash analysis and coordination process.

2.3 BIM Objects
All BIM objects/model elements created shall comply with the latest version of the CIC’s Production of BIM Object Guide – General Requirements. A complete library of all BIM objects of the project shall be submitted upon the completion of design stage and construction stage respectively for the approval by the Employer.

2.4 BIM Uses
2.4.1 Design Authoring
Design authoring is the process of using BIM authoring software and tools to create and develop a Building Information Model of the project which includes a database of properties, quantities, means and methods, costs and schedules. The architect, engineer, surveyor, consultant, contractor and sub-contractor shall use the BIM authoring software and tools to develop their designs and produce views and drawings including but not limited to 3D perspective, layout plan, elevation, section, detail, fabrication and shop drawings. The software and tools are also used to produce schedules (room, door, window, finishes, and panel for distribution board, etc.), the same principle applies to all types of projects and disciplines.

2.4.2 Design Reviews
Design review is a process for stakeholders to view a model, images and drawings from the models or animated walk-throughs of the project, provide feedback and validate numerous design aspects such as meeting the Employer’s requirements and previewing spaces and layouts in digital deliverables. The reviewers should check layout, sightlines, lighting, security, disabled access and egress, way finding, ergonomics, acoustics, textures and colours, etc. The review should be done by using computer software only or with special virtual mock-up facilities, such as immersive lab, etc. Virtual mock-ups should be performed at various levels of detail depending on project needs.
BIM authoring software and tools with functions such as real-time high definition rendering, user interactions and simulations should be used to facilitate the effectiveness and efficiency of the design review / presentation process and meetings. Fully rendered still shots, animated BIM renditions, fly through and walk through visualisation should be produced for design review to facilitate the coordination meeting and stakeholder engagement.

2.4.3 Existing Conditions Modelling
Existing conditions modelling is the process of creating a 3D model of the existing site conditions. The model should be developed from laser scanning, photogrammetry, conventional survey methods and record drawings. For historic graded buildings, the author shall include a heritage documentation and assessment. The existing condition models are used for design visualization and planning as well as field verification and facility management.

In the planning / design stage, 3D digital survey technology such as laser scanning shall be used to provide both point cloud and mesh model of the existing site condition to facilitate project planning and design development.

In the construction stage, 3D digital survey technology such as laser scanning shall be used to provide verification of the as-built condition for the construction works. It provides documentation of environment for future modelling, design coordination and facilitate management.

The 3D digital survey model shall be supplemented by photographic records of condition survey.

When laser scanning or equivalent technology is applied, the point cloud collected should accurately reveal the 3D as-built conditions to include topography, all man-made features and objects inclusive. Features concealed by fixed structures / covers and /or features being behind the scene when viewed from accessible locations within the development area shall be excluded. Intensity / colour information should be recorded on a per point basis at each scan position where the instrumentation allows this. Overlapping adjacent scans as percentage of scan distance shall be at least 10%. The distance accuracy of the scanner should be +/-2mm within 10 metres or better. Additional panoramic imagery shall be provided in order to ensure that laser scanned data (point cloud) are accurately interpreted for areas of low clarity. This should be in the form of 360° sequenced photography with software as agreed with the Employer. The imagery shall accurately align to the point cloud.

2.4.4 Site Analysis
Site analysis is the process to make use of BIM and Geographic Information System (GIS) tools to evaluate the site to determine the most optimal location, position and orientation for the project. The analysis shall include but not be limited to master planning, visual analysis, vantage point/ ridgeline/sight line analysis, site context analysis, terrain analysis, heritage impact, traffic impact, tree preservation analysis, sun and shadow studies, daylight analysis and solar envelope analysis etc.
2.4.5 3D Coordination

3D Coordination is the whole process of design error avoidance using federated BIM models and collaborative design environment. The goal of the coordination process is to eliminate design errors before construction of the project. The BIM coordination process shall include but not be limited to the checks for spatial and headroom requirements, working spaces for building operations and maintenance activities, installation and replacement of equipment and machines.

The procedure of clash analysis are:
1. to compare BIM models built up from design of different disciplines
2. to identify clashes and priority for actions;
3. to report to the Employer or its representatives and responsible parties;
4. to revise design information;
5. to rebuild / update BIM models; and
6. to perform another round of analysis until clashes are eliminated.

Any design conflicts, clashes and design errors identified shall be documented in the format of clash report to categorise, prioritise and compare the different clashes, record the clash analysis process and assumptions on element tolerances, areas and elements, identify any major conflict discovered in the process and generate resolution result summary.

2.4.6 Cost Estimation / 5D Modelling

Cost Estimation / 5D modelling is the process in which BIM should be used to assist in the generation of accurate quantity take-offs and cost estimates throughout the lifecycle of a project.

In design stage, the BIM models shall enable the use of the quantities extracted from the BIM models for project cost budgeting, project cost control and cost evaluation on design options, etc. as far as practicable.

In tendering stage, the BIM models shall enable the preparation of Bills of Quantities pricing documents [and the BIM models shall form part of tender information to indicate the design intent layout and the material quantities for the tenderers’ information].

In construction stage, the BIM models shall enable the use of quantities extracted from the BIM models for project cost control, cost evaluation on variation of works, cash flow forecast, spending analysis, interim payment, etc. as far as practicable. The 5D Model shall be adopted in the regular project progress meeting to indicate and compare the current cash flow status with the baseline forecast to facilitate project management.

2.4.7 Engineering Analysis

Engineering analysis is a process which uses the BIM model to analyse and optimise different design options to determine the most effective engineering solution to meet design codes and client requirements.

For structural analysis, the analytical modelling software uses the model to determine the behaviour of a given structural system including demolition, ground investigation, site formation, foundation and superstructure systems.
For lighting, ventilation, energy, thermal, mechanical, acoustic, plumbing, drainage, people movement analysis, the model should be used to predict the performance of a system which should then be compared to actual performance data such as commissioning results.

For civil engineering works, the models should be analysed for hydraulic design of water supply, sewerage and storm water drainage systems.

2.4.8 Facility Energy Analysis
Facility energy analysis is a process of using a building energy simulation programme with a model to conduct energy assessments of a project design to optimise the design to reduce life-cycle costs.

By checking the building energy standard compatibility and conducting energy assessment using Building Energy Simulation and Analysis Software, the energy model should be delivered and the predicted energy uses should be specified.

2.4.9 Sustainability Evaluation
Sustainability evaluation is a process in which a project model is evaluated based on HKBEAM, LEED or other sustainable/green building criteria. This process should occur during all stages of the facilities’ life including planning, design, construction, and operation.

This comprehensive process requires all disciplines to interact earlier by providing valuable insights. Energy simulations, calculations, and documentations should be performed within an integrative environment when responsibilities are well defined and clearly shared. As the result, sustainability evaluation status and report shall be delivered throughout the sustainability evaluation processes.

2.4.10 Space Programming
Space programming is the process of using BIM for checking Employer’s spatial requirements such as compliance with the approved schedule of accommodations, reference plot ratio for the project and site coverage of greenery for the project, and other spatial requirements relevant to the project as considered appropriate.

Space programming should be conducted by using the developed BIM model to analyse space and understand the complexity of space standards and regulations. Efficient and accurate assessment of design performance in regard to spatial requirements by the owner should be conducted. Program in digital format and reports of design conformance shall be submitted as deliverables.

2.4.11 Phase Planning (4D Modelling)
Phase Planning (4D Modelling) is a process in which a 4D model (3D models with the added dimension of time) is utilised to effectively plan the construction sequence and space requirements on a building site.

In the design stage, Phase Planning (4D Modelling) shall include construction sequence simulation for visually demonstrating and communicating project construction
sequence based on proposed design and requirements on the project. Construction activities with high to extreme risk level or other activities as the Employer/Project Manager considered appropriate shall be included. The BIM shall include all major systems and shall contain sufficient data to show planned sequential construction in animation. Any assumptions (e.g. construction programme, phasing, temporary structures, if any) shall be communicated, commented and agreed by the Employer. The 4D simulations should also include the demonstration of the sequence of construction of the prefabricated, MiC* and DfMA* elements/units from fabrication, transportation to installation on site. The swept path analysis from the port (marine transport) or factory (land transport) to the site of the above elements/units is also required.

In the construction stage, 4D Model simulations to the construction process of the construction works shall be provided to:

1. establish relationships between the programme and sequence of construction activities including the delivery of material, equipment to be carried out during the construction, operation routes and installation sequence of the major machinery & plants, site logistics, typical construction cycle, site operation, etc.;
2. demonstrate the sequences of works and site access;
3. identify potential time and spatial conflicts;
4. optimise the use of critical resources;
5. enhance safety requirements, construction process control and consider to use BIM for training to achieve Site Safety Supervision Plan (SSSP);
6. minimize disturbance to the operation of the neighbourhood;
7. better co-ordinate with affected parties and resolve interfacing issues at early stages; and
8. monitor procurement status of project materials.

In the construction stage, a 4D programme for construction progress monitoring shall be demonstrated in daily intervals, 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 4D programme shall evolve with project progression. Time and other 4D-related information within Work-in-progress (WIP) BIM shall be concurrent with the outputs. The 4D programme shall be used in the regular project progress meeting to indicate and compare the current actual construction progress with the baseline programme to facilitate project management.

The deliverables of Phase Planning (4D Modelling) shall contain the following but not be limited to:

1. description of the Phase Planning (4D Modelling), including the assumptions, time interval, construction method statement, guide for accessing the files and BIM models, etc.;
2. videos of the 4D simulations:
   The 4D walkthrough / flythrough simulation/animation videos from the BIM shall be no longer than [2] minutes each, [30] frames per second, [1080P] resolution. The videos of the 4D simulations shall be submitted in required file format viewable in standalone free viewer;
3. native and editable BIM models;
4. models for the Phase Planning (4D Modelling); and
5. linked project programme or spreadsheet or equivalent deliverable.
The deliverables of Phase Planning (4D Modelling) shall enable the further development of the deliverables as specified in the Clause of Cost Estimation / Financial Model (5D Model) of this BIM Specification.

2.4.12 Digital Fabrication
Digital Fabrication is the process for digitalizing the construction details in the BIM model for mass customised components such as metal cladding, acoustic panels, building façade panels, ceiling panels, acoustic barriers, metal structural members, etc. which are of large quantities and variety in dimensions, shapes, geometries, etc. Digital Fabrication shall be adopted for prefabricated, MiC* and DfMA* units / elements.

As far as practicable, the BIM models shall be able to transfer directly to the Computer Numeric Control (CNC) machines for fabrication and manufacturing. The BIM models should also be used for prototyping with 3D printers as part of a design intent review process.

2.4.13 Site Utilization Planning
Site utilization planning is the process of using models to graphically represent both permanent and temporary facilities on site for all of the phases of the construction process. The models should be linked to the construction schedule (4D) to review space planning, site logistics, sequencing requirements, temporary works and safety.

Site utilization planning shall be adopted in construction stage for the construction activities with high to extreme risk level or other activities as the Employer / Project Manager considered appropriate. As far as practicable, the plant/equipment/vehicle/machinery, etc. associated with the works activities should be included in the site utilization planning.

2.4.14 3D Control and Planning
3D Control and Planning is a process that utilizes a model to layout project elements such as the position of walls using a total station with survey points preassigned in the model. The process of automating the control of equipment's movement and location such as using Global Positioning System (GPS) coordinates to determine if proper excavation depth is reached.

2.4.15 As-Built Modelling for Asset Management (AM) and Facilities Upkeep
As-built Modelling for AM and Facilities Upkeep is the process used to depict an accurate representation of the physical conditions, environment, and assets of a facility, which shall be adopted in construction stage. As-built BIM model of all components shall be submitted as described in Clause of Deliverable ‘BIM Models’ of this BIM Specification.

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

The as-built BIM models shall be prepared in accordance with the guidelines as detailed in Appendix 2. As-built construction and equipment components of the project with information as listed below shall be included 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. Comprehensive materials data sheet list and completed materials/equipment warranty list;
13. Other textual information subject to agreement of AM and Facilities Upkeep at later stage;
14. As-built BIM models and 2D drawing files for building services installation;
15. Export data files, if any;
16. Folder storing the building services object files;
17. Testing and Commissioning reports;
18. Operation and Maintenance manuals;
19. Relevant statutory certificates, approval documents and forms; and
20. Other relevant project information as required.

The as-built BIM model shall be provided with animation for assemble sequence of works for the typical floor construction including both in-situ, precast, semi-precast, MiC*, DfMA* and prefabricated units sequence of works for viewing in standalone free viewers. The objective of the animation is to illustrate how to maintain the special part of the building. In general, the animation shall not be lower than LOD300 with LOD400 particularly for the MiC* units, DfMA* units and prefabricated units. The extent of the animation required will depend on the design of the building.

The required as-built BIM models and relevant documentations shall be stored under a standardised file folder structure.

2.4.16 Project Systems Analysis
Project systems analysis is the process to measure how a project performs compared to the design specifications, in order to ensure the project is operating to specified design and sustainable standards.

This shall include assessing how a mechanical system operates, how much energy a project uses, conducting lighting analysis, solar gain analysis and airflow analysis using Computational Fluid Dynamics (CFD). "What if" scenarios should be created, for example by changing different materials, throughout the project to show better or worse performance conditions.
2.4.17 Maintenance Scheduling
Maintenace Scheduling is the process in which the functionality of the building structure (walls, floors, roof, etc) and equipment serving the building (mechanical, electrical, plumbing, etc) are maintained over the operational life of a facility. A successful maintenance program will improve building performance, reduce repairs, and reduce overall maintenance costs.

It shall be adopted in construction stage in collecting and providing maintenance attributes for facility structures, fabrics and equipment in the as-built BIM models as considered appropriate. Record model shall be provided for tracking maintenance history.

2.4.18 Space Management and Tracking
Space management and tracking is the process in which BIM is utilised to effectively distribute, manage, and track appropriate spaces and related resources within a facility. The As-Built BIM model containing the facility information should allow the facility management team to analyse the existing use of the space and effectively apply transition planning management towards any applicable changes.

The As-Built BIM model should be used to assess, manage and track spaces and associated resources within a project. A BIM database should be integrated with spatial tracking software to analyse the existing use of space, apply transition planning for renovations and refurbishment projects.

2.4.19 Asset Management
Asset management is the process of bi-directionally linking an As-Built BIM Model database to an organised building management system which should be used to maintain and operate a facility and its assets. The assets shall include buildings, infrastructure, systems and equipment which should be operated, maintained and upgraded.

The process utilises the data contained in an As-Built BIM Model to populate an asset management system. The bi-directional link allows users to visualise an asset in the model before servicing it. The facility manager shall specify the data required for each element in the BIM Project Execution Plan.

2.4.20 Drawing Generation (Drawing Production)
Drawing generation is the process of using BIM to produce 2D drawings, which shall be adopted in both design stage and construction stage. In design stage, BIM shall be used for design development with statutory plan development and submission to the approving authorities of the HKSARG including Buildings Department (BD), etc. The types of statutory plan shall include but not be limited to the following items:

1. General Building Plan
2. Superstructure Plan
3. Foundation Plan
4. Excavation and Lateral Support (ELS) Plan
5. Site Formation Plan
6. Ground Investigation Plan
7. Demolition Plan (included Hoarding)
8. Drainage Plan

The following items shall also be determined with the aid of BIM:
1. Fundamental checking equivalent to the Standards as per current practice notes;
2. Checking of gross floor area;
3. Checking of means of escape;
4. Checking of sanitary fitment provision; and
5. Checking of fire compartment and fire resisting construction.

At the end of design stage, the final design BIM models and all BIM deliverables as record documents shall be provided. The final design BIM models shall be design-error free BIM models without any design conflict. The final design BIM models shall be delivered in their native and editable format and purged of all unused content including but not limited to line types, line styles, line weights, BIM objects views and drawings. All errors and warnings shall have been resolved or, if agreed to, listed on the approved BIM exception list. The detailing of 2D drawings shall be not less than the current practice used as tender drawings and working drawings. The final 2D drawings shall be generated from the BIM models and aligned with specified required standards.

In the tendering stage, the tender information for the works contracts shall include BIM models with tender drawings generated from the BIM models including but not limited to the general layout plans, elevations, sections, details and schedules of architectural drawings, framing plans, staircase sections, details and schedule of structural drawings, Combined Services Drawings (CSD) and Combined Builder's Works Drawings (CBWD), etc.

In the construction stage, drawings in the required file format shall be generated from the BIM models including but not limited to architectural drawings, structural drawings, CSD, CBWD and Reflected Ceiling Plans Drawings (RCPD), etc. to facilitate the coordination and operation for the construction works during the contract period.

As far as practicable, all 2D drawings shall be generated from the BIM authoring software and tools directly. Approval shall be sought from the Employer for the exemption of producing any drawings from BIM for example building services schematic / control logic diagrams / reinforcement rebar details / reinforced concrete details and other drawings that may solely require 2D details etc. A registration list showing the relationship between the BIM models and 2D drawings shall be created to indicate each 2D drawing that is generated from the BIM or not. Until the approval from the Employer is granted, all details with critical spatial coordination issue shall be modelled. Any 2D drawings which are produced from non-BIM authoring software or tools that shall be prepared in accordance with the standard for 2D drawings as specified in the contract documents. In case any drawing is not created natively in the BIM authoring software it should be linked to the BIM models.

2.5 Handover of BIM Deliverables

WIP file(s) shall not be counted as submission deliverable but shall be a proof of progress and for quality checking purposes. The WIP BIM shall also be presented
during the design coordination / project progress meetings to facilitate decision making and communication with project stakeholders.

All final BIM deliverables developed for the project shall become the property of the Employer and transferred to the Employer on completion of the project. All BIM deliverables shall be unconditionally transferred and handed over to the Employer upon the completion of the design stage and construction stage or as and when requested by the Employer during the project.

3. Quality Assurance

3.1 Quality Assurance Plan

Quality Assurance plan shall be included in the BIM Project Execution Plan, outlining the quality assurance for the BIM process, BIM compliance and attributes for asset entries tracking. Quality assurance plan for BIM shall be established to ensure appropriate quality control on information and data accuracy.

The quality control measures to be included in the Quality Assurance Plan shall include, but be not limited to the following contents:
1. issue management;
2. submission and approval control;
3. model compliance according to the BIM Standards and modelling methodology which are stated in the BIM Project Execution Plan;
4. model quality according to the LOD responsibility matrix which is stated in the BIM Project Execution Plan;
5. data validation;
6. clash analysis; and
7. as-built verification such as laser scanning point cloud.

3.2 Design Review

In the design stage, design review shall be coordinated for stakeholders to provide their feedbacks to validate multiple design aspects by reviewing the models. The design review shall include but not be limited to the following drawings review:
1. previewing space aesthetics and layout in a virtual environment;
2. reviewing different design options and alternatives;
3. evaluating effectiveness of design in meeting building program criteria.

3.3 Model Compliance Check

Model compliance checks shall include but not be limited to the following:
1. format and software version;
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, floor level, 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 views in final model submission; and
7. compliance with the design.

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

4. Training

4.1 Training Objectives
The training courses aim to enable the project participants to view, use and manipulate the BIM models and the BIM deliverables in a systematic and effective manner and enable the project participants to deliver the required BIM Uses.

4.2 Training Preparation
BIM training plan and training venue shall be approved [by the Employer/Consultant/Contractor*] before the training. Each attendee shall be provided with a workstation with necessary BIM authoring software and tools and licenses for efficient hands-on exercise during the training.

4.3 Project Training Requirement
1. In the early design stage, project training course shall be provided to the project team including the Employer’s staffs and the design consultants to demonstrate the information retrieval from the selected BIM authoring software, tools and Common Data Environment (CDE) and the implementation of BIM standards, workflow and processes such as design coordination.

2. In the early construction stage, project training course shall be provided to the project team including the Contractor to deliver the similar contents as stipulated in point 1 above.

3. Upon the completion of the project and handing over of the final as-built BIM models and deliverables, training course shall be provided to the Employer.

4. Training assessments shall be made and collected for revising the training materials and for the preparation of the next training classes.

4.4 Personnel Training Requirement
1. The Consultant / Contractor is required to nominate his staff or sub-consultant/sub-contractor’s staff to attend, within [6] months from the commencement of the Assignment / Contract, suitable BIM skill training courses under the pre-approved list of the Construction Innovation and
Technology Fund (CITF) managed by the CIC and ensure their successful completion of the attended training courses.

2. In case there are sub-contractor(s) / sub-consultant(s) in the Assignment / Contract, the appropriate number of staff member from the sub-consultant(s) / subcontractor(s) should attend the BIM training courses.

3. In case the nominated staff members fail to complete the BIM training course, the Consultant / Contractor / Sub-consultant / Sub-contractor shall arrange additional BIM training courses to its staff members to fulfil the contract requirements at their own cost.

4.5 Training Log

Training Log for the BIM Training shall be submitted to the Employer for record after completion of the training courses. The training log shall list out the course information, including but not be limited to, description of the training course, date, duration, venue and attendee’s name and position. The content of the training log shall be commented and agreed by the Employer. The training log shall be reviewed and updated.

5. Hardware and Software Requirement

5.1 Hardware and Software requirements

1. The hardware and software to be used shall enable the project participants to deliver the required BIM Uses in a productive and efficient manner. The specification and functional performance of the hardware shall refer to the requirements of the software to be adopted in the project.

2. Free compatible standalone BIM viewers shall be proposed for viewing BIM deliverables.

3. All BIM deliverables shall comply with the software versions approved by the Employer during the contract period and at the time of delivery. The Consultant(s) and Contractor(s) shall bear the cost if any upgrade of the software is needed during the contract period. The software with versions for the production of different BIM deliverables shall be indicated in the BIM Project Execution Plan.

5.2 File Format and Interoperability

1. The BIM authoring software for the project shall support open format (include import and export and be interoperable with other BIM authoring software commonly adopted in the Hong Kong construction industry as agreed by the Employer.

2. BIM models shall be submitted in both native editable format and open format when requested by the Employer.
3. Open format exported from BIM models shall include but not be limited to:
   • Industry Foundation Classes (.IFC)

6. Common Data Environment (CDE)

6.1 Functional Requirements of CDE

1. Provide a user-customisable access right control and management;

2. Provide a user-customisable folder structure;

3. Support uploading, downloading, navigating BIM models and retrieving the attributes and information from the BIM models in an open format (not limited to .IFC) on the CDE;

4. Provide file version/revision control;

5. Provide a feature of comparing BIM models from different versions/revisions and automated identification of differences;

6. Provide a feature of linkage between different BIM models, 2D drawings and project documents within the CDE;

7. Allow access from portable devices and web applications;

8. Contained encryption for data security;

9. Provide sufficient capacity to store all files throughout the project stages and operate properly as requested by the Employer;

10. Installed with anti-virus software and maintained with updated security patches by the operating system or environment that the CDE resides on;

11. Provide dashboards for presenting the BIM progress information to different level of users;

12. Provide a user-customisable workflow for document submission and approval;

13. Provide an issue tracking system including the issue registration, logging, update and email notification to selected user account;

14. Provide off-site backup of all project BIM models, documents and data;

15. Provide a workflow for managing information process, reference to the process as described in ISO 19650-2:2018;
16. Provide a feature of project archive that all project files and information shall be archived in Employer’s preferred media and transferred to the Employer upon the completion of the design stage and construction stage respectively or as and when requested by the Employer during the contract period;

17. Allow electronic signature (e-signature); and
18. Provide audit trail of the information stored in the CDE.

6.2 CDE approach in BIM Project Execution Plan

The CDE approach shall be expressed in the BIM Project Execution Plan which shall include, but be not limited to, the following:

1. Naming Convention.
   BIM model naming shall follow the specified CIC BIM Standards and Guidelines or as instructed by the Employer.

2. Version/Revision Control.
   All versions/revisions of files uploaded shall be recorded and stored in the CDE.

3. Folder Structure.
   The folder structure, processes and procedures to ensure proper information exchange between project stakeholders shall be proposed.

4. Access Control.
   An access control matrix shall be established that clearly specifies user access right of the folders and files.

5. BIM Collaboration Methodology and Workflow.
   The collaboration methodology and workflows shall be described including but not limited to the issue management and change management, communication protocols upon uploading, security and upload protocols (e.g. frequency and any deviations). CDE protocols and information exchange should reference to the process as described in ISO 19650-2:2018.

   A workflow of BIM information sharing to facilitate project progress and design coordination meetings shall be set up.

7. Project Archive.
   State the Employer’s preferred media for project files and information to be transferred from the CDE.

6.3 CDE Implementations

The CDE shall be implemented within [one (1)] month upon approval by the Employer, and be utilised throughout the project stages specified by the Employer. Login accounts with appropriate user permissions shall be provided to the involved project parties such as the Employer, Consultant(s) and Contractor(s).
7. BIM Standards and Guidelines

The mandatory BIM Standards and Guidelines listed as follows shall be adopted, and any updated version of which, shall be complied with:

1. Building Information Modelling Standards - General, August 2019, by the CIC;
2. Production of BIM Object Guide – General Requirements, August 2019, by the CIC;
3. Building Information Modelling Standards for Mechanical, Electrical and Plumbing, August 2019, by the CIC;
4. Building Information Modelling Standards for Underground Utilities, August 2019, by the CIC;
5. Guidelines for Using Building Information Modelling in General Building Plans Submission, 2019, by Buildings Department of the HKSARG;
6. Technical Circulars (Works) on Adoption of Building Information Modelling, by Development Bureau of the HKSARG;
7. Building Information Modelling for Asset Management (BIM-AM) Standards and Guidelines, version 2.0, 2019, by the Electrical and Mechanical Services Department (EMSD);
10. BIM Standards and Guidelines by the CIC / Buildings Department for Statutory Plan Submission such as Superstructure Plan;

In addition, a list of BIM Standards and Guidelines are in Appendix 3 as reference.
Appendix 1 Outline of BIM Project Execution Plan

The Project Execution Plan shall include but not be limited to the following chapters (subject to the BIM Uses to be required):

1. BIM Project Execution Plan Overview
2. Project Information
3. Employer BIM Requirements
   3.1. BIM Goals and Objectives
   3.2. BIM Uses Required
   3.3. BIM Interoperability
   3.4. LOD Definitions
   3.5. LOD Specification
   3.6. LOD Responsibility Matrix
   3.7. 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. Individual Discipline Modelling
   5.2. Model and Information Sharing
   5.3. Coordination and Clash Analysis
   5.4. Drawing Production
   5.5. Model Archive
   5.6. Quality Control and Quality Assurance
6. BIM Standards & Procedures
   6.1. Origin Point, Coordinate System & Orientation
   6.2. Modelling Methodology and Model Federation
   6.3. Model Structure/Hierarchy and Division
   6.4. Model Units
   6.5. File Naming Convention
   6.6. BIM Object Naming Convention
   6.7. Model Colour Scheme
7. Project Collaboration Platform, Hardware & Software
   7.1. CDE
   7.2. Software Versions
   7.3. Exchange Formats
   7.4. Data Security & Back-up
   7.5. Hardware Specifications
   7.6. IT Software Upgrade Policy
8. BIM for AM/FM
Appendix 2 Guidelines for As-built BIM Model

The As-built BIM models shall be prepared in accordance with the Employer’s BIM Guide for Facilities Upkeep if it is available, in which the BIM Guide should be provided and instructed by the Employer in the construction stage.

The As-built BIM Model and 2D as-built record drawings shall comprise customised building attributes and file structure for data submission in the format agreed and approved by the Employer.

The As-built BIM Model shall be provided with an open format for viewing and integration with the Employer’s AM/FM. The BIM models 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 the Employer).

The .IFC files shall be submitted for the Employer’s AM/FM integration under different detail levels agreed by the Employer. The original as-built BIM Model files shall also be submitted to the Employer for examination and data conversion purpose. The BIM objects of the As-built BIM Model shall contain the attributes and properties as required by the Employer. Subject to the complexity of the project, the required attributes and properties shall be fine-tuned on request by the Employer.

The As-built BIM Model shall be able to create sheet records and contain information including photographic record, 3D digital point cloud from field verification such as laser scanning and other data to meet the requirements indicated in Employer’s BIM Guide for Facilities Upkeep if it is available. For the As-built BIM Model for building services installations shall also 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.
Appendix 3 BIM Standards and Guidelines

1. Common Spatial Data Infrastructure requirements, Open Geospatial Consortium Standards CityGML and specifications, or the like published / released from the Works Departments of the HKSARG from time to time;
2. Building Information Modelling (BIM) Guide for Building Services Installation (Version 1.0) issued by Building Services Branch (BSB), Architectural Services Department;
3. BIM Guide for Facilities Upkeep (version 1) issued by Property Services Branch (PSB), Architectural Services Department;