BIM SPECIFICATION TEMPLATE FOR WORKS CONTRACTS

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July 2023

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Amendment History

Change Number	Revision Description	Sections Affected on Respective Version	Revision / Version Number	Date	Approval Reference
1	1st Draft to Survey Division	All	0.1	30.04.2021	
2	2nd Draft to Survey Division	All	0.2	30.06.2021	
3	3rd Draft to Survey Division	All	0.3	03.08.2021	
4	4th Draft - Circulation to BSWG	All	0.4	18.08.2021	
5	5th Draft - Updated according to Feedback from BSWG	All	0.5	10.09.2021	
6	6th Draft - Updated according to Feedback from LWD	All	0.6	27.09.2021	
7	7th Draft - Updated according to Feedback from LWD	All	0.7	06.10.2021	
8	8th Draft - Updated according to Feedback from GEO	All	0.8	15.10.2021	
9	Updated according to Feedback from GEO; 1st Final – Circulation to BSSG	PS clause 1.5 Section 2.1, 3.1.3.2, 3.2.2.3, 3.3 3.4.3.1, 3.4.1.1, 3.5.1.1, 3.5.2.2, 3.5.35, 3.5.4, 3.5.5	1.0	11.11.2021	
10	Updated according to new DEVB TC(W) requirements	All	1.1	xx.07.2023	

Preface

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1.1 General Guideline

1.1.1.1 The template shall be edited as necessary to suit the respective project nature. Items with brackets [ ] are editable text that the project officers may edit and reformat before sending out. Items in italics with yellow highlight are guidelines. Items with "*" means "delete as appropriate".

1.1.1.2 Project officers shall review and update the Section 3.2, Annex 1-4 according to specific requirements of the Service.

1.1.1.3 The template is developed as a reference material for project officers to develop the particular specification for ECC project at construction stage. Project officers may select and apply all or part of the relevant clauses in this template according to the nature of each project.

1.1.1.4 The template shall be used in conjunction with the departmental BIM Execution Plan (BEP) template and guideline, Modelling Manual and the LoD Specifications.

1.2 Structure

1.2.1.1 Section 1 describes the specific project BIM objectives to be achieved in the project. The template only specifies some main objectives for workflow enhancement, early collaboration, and asset management and **DO NOT** cover project specific needs. Project officers may consider adding project specific objectives in this section. All high-level objectives shall be project specific and further specified the deliverables, schedule of submission and process requirements in Section 3.

1.2.1.2 Section 2 lists the general requirements regarding schedules, standards, information management and training requirements. Project officers should review the standards according to latest development of Development Bureau, CEDD and maintenance parties of the Works.

1.2.1.3 Section 3 describes the delivery schedule, process and requirements of the project and BIM deliverables. The template lists typical examples for project officers to develop their own project deliverables. The deliverables shall be reviewed according to project objectives and the Works. The BIM deliverables shall be clear, specific and timely to support project decisions and/or generation of project deliverables.

1.2.1.4 Section 4 specifies the competence and qualification of the BIM Team. Project officers shall review the latest requirements of Development Bureau and CEDD.

1.2.1.5 Section 5 specifies the IT environment required by the *Project Manager* to operate the BIM deliverables. Project officers shall review with the Particular Specification for computing facilities.

1.2.1.6 The Annex 1 provides a template for the project officers to summary of deliverables and the expected submission schedule for interim and final deliverables.

1.2.1.7 Annex 1 allows the project officers to specify the project required deliverables, and the content and format of their related BIM deliverables, interim and final submission schedules. The Annex 1 should be **project specific and must be** updated and developed by the project officers.

1.2.1.8 The Annex 2 lists a table of content for the BIM project execution plan (BEP).

1.2.1.9 The table of content of section 5 of the BEP may be slightly different according to the deliverables required in the Works. The project officers shall review the table of content with the Departmental BIM Execution Plan (BEP) template and guideline to update the Annex 2.

1.2.1.10 The Annex 3 and Annex 4 provides a generic guideline for model federation and breakdown structure. They could vary among projects. The project officers shall review the scheme of the identified of works against the Annex 3 and 4.

1.2.1.11 The project officers may request the Consultant to propose the federation and breakdown structure in their BEP with reference to the Departmental Modelling Manual of model federation and breakdown requirement if necessary.

1.2.1.12 The Annex 4 lists a reference of LOIN requirements for the project officers. It should be used in conjunction with the Modelling Manual and LOIN Specifications. Typical examples for 4 major services areas of CEDD are listed for project officers to review.

Particular Specification
Section [1 - General]

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Building Information Modelling (BIM)

Building Information Modelling (BIM)	[1.1]	The *Contractor* shall integrate BIM process in daily operation to enhance planning and coordination, improve construction efficiency and minimize construction wastage among various project participants.
	[1.2]	The *Contractor* shall comply with the requirements in [PS Appendix X] for the details of conforming BIM model.
	[1.3]	The *Contractor* shall submit all the interim and final deliverables according to the agreed schedule of deliverables for the *Project Manager*'s acceptance. The requirement of the deliverables are specified in [PS Appendix X].
BIM Model Collaboration and Common Data Collaboration Platform for BIM (BIM CDCP)	[1.4]	The *Contractor* shall develop their BIM models of the Works in close and proactive collaboration with the whole project team and the interfacing *Contractor*s. The *Contractor* shall develop the initial Project Information Model within [3] months after the Works commencement date. This Project Information Model shall be updated progressively according to the Accepted Programme. The work in progress deliverables shall be submitted at [monthly] interval.
	[1.5]	The *Contractor* shall procure and establish a data sharing environment [within 3 months] after the commencement of the Works and shall maintain the [BIM CDCP software/platform / centralised information system] throughout the contract period until the *defects date* or the end of last *defect correction period*, whichever is later. The BIM CDCP shall be able to collaborate all the project information models and related deliverables with the entire project team as required in [Appendix X].
	[1.6]	The *Contractor* shall arrange and attend [bi-weekly] coordination meeting through the contract period to coordinate BIM works, align information and rectify deficiencies as identified during the process.
As-built BIM Model	[1.7]	The *Contractor* shall develop the as-built BIM models according to the Modelling Manual and LOIN Specifications published by the Employer. The requirements of the as-built models are specified in [PS Appendix X].
Asset Management	[1.8]	The *Contractor* shall develop the asset information model and related information export according to the asset information requirement of the maintenance parties. The requirements are specified in [PS Appendix X].

Contractor's Superintendence

BIM Team	[2.1]	Other than working-level staff, the BIM Team shall also include, but not limited to i) BIM Team Leader who shall comply with the requirements specified in [PS Appendix X]. ii) BIM Coordinator(s) who shall comply with the requirements specified in [PS Appendix X].
	[2.2]	If the BIM Team Leader fails to perform satisfactorily in discharging his/her duties, the *Project Manager* has the authority to withdraw the acceptance of the *Contractor*'s nominated BIM Team Leader. Upon and within [21 days] of notification by the *Project Manager*, the *Contractor* shall propose a replacement of the BIM Team Leader and submit the CV of nominee for the *Project Manager*'s acceptance.

Programme

Master Programme	[3.1]	The *Contractor* shall include all BIM related works content in the *Contractor*'s Master Programme to identify BIM related activities, interim and final deliverables.

End

Particular Specification
Appendix [X]
Building Information Modelling (BIM) Specifications

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LIST OF ABBREVIATION

Abbreviation	Full Expression
2D	Two Dimensional
3D	Three Dimensional
4D	Four Dimensional (i.e. Three Dimensional with Time)
5D	Five Dimensional (i.e. Three Dimensional with Time and Cost)
AB	As-Built Stage
AM	Asset Management
AIR	Asset Information Requirements
AIM	Asset Information Model
BEP	BIM Execution Plan
BIM	Building Information Modelling / Building Information Model
BQ	Bills of Quantity
CAD	Computer Aid Design
CAT	Category Code for BIM matrix model elements
CDE	Common Data Environment
BIM CDCP	Common Data Collaboration Platform for BIM
CEDD	Civil Engineering and Development Department, HKSAR Government
CIC	Construction Industry Council, Hong Kong
CITF	Construction Innovation and Technology Fund
CMMS	Computerized Maintenance Management System
CT	Construction Stage
COBie	Construction Operation Building Information Exchange
CSDI	Common Spatial Data Infrastructure
CSWP	CAD Standard for Works Projects
DD	Detailed Design Stage
DEVB	Development Bureau, HKSAR Government
EIR	Exchange Information Requirements
GIS	Geographic Information System
IFC	Industrial Foundation Class
LandsD	Lands Department, HKSAR Government
LoD	Level of Development
LoD-G	Level of Graphics
LoD-I	Level of Information
LOIN	Level of Information Need
OGCIO	Office of the Government Chief Information Officer
PIM	Project Information Model (Project BIM Model)
PIR	Project Information Requirements
QA	Quality Assurance
QC	Quality Control
SSSS	Smart Site Safety System
TC(W)	Technical Circular (Works)
WIP	Work In Progress
VR	Virtual Reality

1. INTRODUCTION

1.1 Employer's BIM Objectives

1.1.1.1 The *Contractor* shall reengineer the traditional workflow and make good use of BIM data/model for collaboration among project team members with an aim to improve productivity [of (type/area of work)], reduce abortive works [in (type/area of work)], enhance construction safety [of (type/area of work)] and/or optimise the operation efficiency and maintenance efficiency [of (type/area of work)].

The project officers shall consider adding specific area of interest inside the (area/type of works) bracket.

1.1.1.2 The *Contractor* shall progressively develop the Project Information Model (PIM) to facilitate the early collaboration of project information among all stakeholders before the construction works commence. A comprehensive process should be developed to allow the Employer / *Project Manager* to participant in the detail planning, design and construction process with interim PIMs and/or related simulation and/or visualizations. The *Contractor* shall generate the required project deliverables from the PIM as far as practicable.

1.1.1.3 The *Contractor* shall produce a comprehensive as-built BIM model for the usage of the development of the Common Spatial Data Infrastructure (CSDI), and a comprehensive Asset Information Model for the integration with the Computerized Maintenance Management System (CMMS) of the Maintenance Parties according to the agreed standards and modelling guidelines in the BEP.

*The template only specifies some main objectives for workflow enhancement, early collaboration, and asset management and **DO NOT** cover project specific needs. Project officers may consider adding project specific objectives in this section. All high-level objectives should be project specific and further specified the deliverables, schedule of submission and process requirements in Section 3.*

2. GENERAL REQUIREMENT

2.1 BIM Use Requirement

2.1.1.1 The *Contractor* shall reengineer the traditional workflow to adopt the following BIM Uses during planning, design, construction, and handover process to achieve the Employer's BIM objectives.

	BIM Use	Design	Construction
1	Design Authoring	Yes	Yes
2	Design Reviews	Yes	Yes
3	Existing Conditions Modelling	Yes	Yes
4	Site Analysis	Yes	

	BIM Use	Design	Construction
5	3D Coordination	Yes	Yes
6	Cost Estimation	[Yes/No*]	[Yes/No*]
7	Engineering Analysis	[Yes/No*]	[Yes/No*]
8	Facility Energy Analysis	[Yes/No]	[Yes/No]
9	Sustainability Evaluation	[Yes/No*]	[Yes/No*]
10	Space Programming	[Yes/No*]	
11	Phase Planning (4D Modelling)	[Yes/No*]	Yes
12	Digital Fabrication	[Yes/No*]	[Yes/No*]
13	Site Utilisation Planning		[Yes/No*]
14	3D Control and Planning		[Yes/No*]
15	As-Built Modelling		Yes
16	Project Systems Analysis		[Yes/No]
17	Maintenance Scheduling		[Yes/No*]
18	Space Management and Tracking		[Yes/No]
19	Asset Management		[Yes/No*]
20	Drawing Generation (Drawing Production)	Yes	Yes

Note:
Explanations of each of the above BIM uses shall be referred to the explanation notes given in DEVB TC(W) No. [2/2021].

** BIM uses with asterisk are mandatory subject to specific objectives/conditions. Project officers shall review the latest requirements in the DEVB TC(W) on "Adoption of BIM for Capital Works Projects in Hong Kong", in particular the notes to the BIM uses table. Project officers shall also update this table together with Section 3 and Annex 1 of this Particular Specification.*

2.2 Schedule of Delivery

2.2.1.1 The PIM shall be progressively developed with the planning, design and construction programme. A collaborative review of the scheduled and progressive submission of the PIM and the required deliverables should be adopted to enhance the project goals and achieve the BIM objectives. The *Contractor* shall submit the PIM and the interim deliverables at agreed interval before the final submission date of the BIM and project deliverables stipulated in Annex 1 of this Particular Specification Appendix.

2.2.1.2 Within [2] months from the commencement of the Contract, the *Contractor* shall agree the progressive submission schedule of the deliverables required in the Contract with the *Project Manager*.

2.2.1.3 The *Contractor* is responsible to review and update the project delivery schedule regularly according to the master programme of the Contract and agree with the *Project Manager* for updates and changes.

2.2.1.4 The *Contractor* shall document and communicate the status of all the interim deliverables as according to the section LA.4.2 and LA.4.3 of the Hong Kong Local Annex of ISO19650-2:2018 in the CIC Building Information Modelling Standards – General, Version 2.1 - 2021, using metadata in BIM CDCP or spreadsheet tables.

2.3 Reference Standard

2.3.1.1 The BIM Team shall adopt the BIM modelling guidelines and industrial best practice. Reference should be made to the relevant Technical Circular, CEDD BIM Standards, CIC BIM Standards and BS EN ISO 19650 in the following order:

- DEVB TC(W) No. [2/2021] – Adoption of BIM for Capital Works Projects in Hong Kong
- DEVB TC(W) No. [8/2021] - BIM Harmonisation Guidelines for Capital Works Projects in Hong Kong
- DEVB GC No. [01/2021] – Common Spatial Data Infrastructure for Digital Hong Kong
- BIM Harmonisation Guidelines for Works Department published by DEVB
- CEDD TC No. xx/2023
- BIM Modelling Manual published by CEDD
- LOIN Specifications published by CEDD
- Asset Information Requirement published by relevant maintenance parties
- CIC Building Information Modelling Standards – General, Version 2.1 - 2021
- CIC BIM Dictionary, 2021
- CIC Production of Building Information Modelling Object Guide General Requirements, Version 2 - 2021
- Drafting Specification for Engineering Survey, Rev. 3.0/Nov 2014 by Civil Engineering and Development Department
- BS EN ISO 19650-1:2018 Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) – Information management using building information modelling, Part 1: Concepts and principles
- BS EN ISO 19650-2:2018 Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) – Information management using building information modelling, Part 2: Delivery phase of the assets
- BS EN ISO 19650-3:2020 Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM). Information management using building information modelling.
- BS EN ISO 19650-5:2020 Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM). Information management using building information modelling.

- BS 1192-4:2014 Collaborative production of information. Fulfilling employer's information exchange requirements using COBie. Code of Practice.
- BS EN 12006-2:2015 Building construction - Organization of information about construction works - Part 2: Framework for classification

This section describes the common standard available up to the July 2023. There are known conflicts among standards from different sources. Project officers should clearly mention the priority of standards in this section and remove unnecessary standards. In general, the standards should be considered in the following sequence:

- *Policy from Development Bureau (DEVB TC(W) No. 2/2021, DEVB GC No. 1/2021 or its latest version)*
- *DEVB BIM Harmonisation Guidelines for Works Departments*
- *Departmental Standards and Guidelines (BIM Modelling Manual & LOIN Specifications published by CEDD)*
- *Asset Information Requirements published by relevant maintenance parties*
- *CIC Standards*
- *International standards/best practices*

2.4 Data Interoperability

2.4.1 3D Models

2.4.1.1 3D models include, but not limited to the progressively developing BIM/PIM models, existing condition models, [Virtual Reality models], coordination models, 4D/5D models, [engineering analysis models], As-built models, and Asset Information models.

2.4.1.2 Upon the request by the *Project Manager*, the *Contractor* shall submit the 3D model(s) in native and editable format as well as open format (e.g. IFC, exe, etc.) through exporting from 3D model(s) in the format and version agreed by the *Project Manager*. The *Contractor* shall ensure that data in the file is in order, without data loss and is in consistence with those in the native file. The *Contractor* shall ensure all the BIM deliverables comply with the approved software versions during the period of the Contract and at the time of delivery.

2.4.1.3 The *Contractor* is required to upgrade the final BIM deliverables to the version specified by the *Project Manager*. The *Contractor* shall propose the information compatibility measures and conversion procedure in the BEP (Version Updating Plan). All submitted file formats, as agreed with the *Project Manager*, shall be compatible with the platform and software currently in use by the *Project Manager*.

2.4.2 BIM Deliverables

2.4.2.1 BIM deliverables or other files shall be submitted in formats agreed by the *Project Manager* or other formats specified in the latest version of OGCIO – The HKSARG Interoperability Framework (S18); which include, but not limited to, the following:

- Native and editable BIM models and drawings
- Open BIM format (.ifc)
- Design reports, documentations, and drawings (.docx, .xlsx, .pdf)

- BIM Execution Plan, progress reports, clash reports (.docx, .xlsx, .pdf)
- Project Programme Files (.xer, .mpp)
- GIS data (.shp, .gml)
- Videos (.wmv, .mp4)
- Design Review Models (.exe, nwd)
- Laser Scanning and Point Cloud data (.las, .xyz, .asc, .e57)
- 3D Mesh Model (.cesium 3D Tiles, .s3mb, .x3d)

2.4.2.2 The *Contractor* may propose the alternative formats and versions in the BEP, if required, and shall seek agreement from the *Project Manager* before submission.

2.4.2.3 The as-built models and the related COBie files shall be submitted as according to those formats and versions specified in BIM Modelling Manual published by CEDD and in formats agreed by the *Project Manager*.

2.4.2.4 The asset information such as AIMs and COBie files shall be submitted as according to those formats and versions specified in Asset Information Requirement of the Maintenance Parties or in formats agreed by the *Project Manager*.

2.4.2.5 All models and the related files shall be submitted digitally in solid state digital storage as according to those standards specified in the BIM Modelling Manual and LoD Specifications published by CEDD and in the formats agreed with the *Project Manager*.

This section covers the format of deliverables. It is non-project specific. No changes are expected.

2.5 Ownerships and Liabilities

2.5.1 BIM model and information

2.5.1.1 The ownership of all data contained in PIM remains to the information originators, while the information originators shall grant the full ownership of all object libraries and data contained in PIM, AIM and other deliverables created, developed, and provided to the Civil Engineering and Development Department and their relevant maintenance parties.

2.5.1.2 The information originators of all data contained in PIM and other deliverables created, developed, and provided should grant the right of use to all other stakeholders involved in the project. The Information originators shall seek the consent from the Employer to reuse the BIM information created in the Service in another project.

2.5.2 Handling of Project Information

2.5.2.1 All 3D models (PIM and AIM), Virtual Reality models, 4D models and other BIM related information produced are confidential. All BIM models and information provided under the Contract are intended for use by authorized stakeholders only. At all times before commencement, during and after completion of the Contract, the authorized users are required to exercise reasonable care when handling documents relating to project

information. It is the responsibility of the *Contractor* in disseminating the information to assure that the recipient is an authorized user and to keep record of the recipients.

2.5.2.2 At all times during and after completion of the Contract, authorized users should store PIM models and related deliverables in a password protected environment. Necessary record copies for legal purposes (such as those retained by the information originators) must be safeguarded against unauthorized use for the term of retention.

2.5.2.3 Except the information originator, all project BIM information and deliverables shall be destroyed after the completion of the required works. Destruction shall be done by burning or shredding hardcopies and/or physically destroying CDs, deleting, and removing files from the electronic recycling bins, and removing material from computer hard drives using permanent erase utility or similar software. A written agreement of disposal must be provided to the *Project Manager* upon the completion of the required works.

This section covers the ownership of information and deliverables. It is non-project specific. No changes are expected.

2.6 BIM Training

2.6.1 BIM Trainings Provided by the Contractor

2.6.1.1 The *Contractor* shall, within [3] months from the commencement of the Works, provide BIM training plan in different levels to project participants, including Employer's staff members and the *Contractor*'s project team members, to enable the project participants to view, use and manipulate the BIM models and the BIM deliverables in a systematic and effective manner. The *Contractor* shall use project data as training materials or sample data with similar project nature as training materials as far as practicable. The provided training course shall include but not limited to the followings:

- [xx training places on BIM project implementation. Duration of the training is about 3 hours x 1 session];
- [xx training places on BIM fundamentals and Common Data Collaboration Platform for BIM (BIM CDCP) management. Duration of the training is about 3 hours x 2 sessions];
- [xx training places on BIM software operation (basic level). Duration of the training is about 3 hours x 10 sessions];
- [xx training places on BIM software operation (advanced level). Duration of the training is about 3 hours x 10 sessions];
- [xx training places on BIM data management - training including data quality verification processes and data exchanges. Duration of the training is about 3 hours x 3 sessions].

2.6.1.2 The *Contractor* shall provide training venue and provide each attendee with a workstation with necessary BIM software and hands-on exercise based on the Works.

2.6.1.3 After the completion of training, the *Contractor* shall submit a training log to the *Project Manager* for record. The training log should list out, but not limit to, 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 *Project Manager*. The training log should be reviewed and updated quarterly.

This template lists a full coverage of training required for the project team to plan, implement, collaborate, and audit the BIM process with recommended duration of training classes. The project officer should review the needs according to the size of the Works, knowledge of the project team, knowledge of interfacing stakeholders, quality of the Contractor team, etc. It is recommended to include the following course for the Employer's team.

- *Basic operation of design review software: 1/2 day*
- *Basic operation of BIM CDCP software: 1/2 day*

2.6.2 BIM Training Requirements for the Contractor

2.6.2.1 The *Contractor* is required to nominate his staff and sub-*Contractor*'s staff to attend, within [6] months from the commencement of the Works, suitable BIM skill training courses under the pre-approved list of the CITF managed by the CIC and ensure their successful completion of the attended training courses:

- At least [4] staff members for the *Contractor*; and
- At least [4] staff members for the engaged sub-*Contractor*(s), if any.

The BIM training requirements for the Contractor will be reviewed regularly by DEVB and project officers shall refer to the latest DEVB TC(W) on "Adoption of BIM for Capital Works Projects in Hong Kong" for update. The number of staff members to be nominated is for reference only and could be adjusted according to the project size and specific need of individual contract.

2.6.2.2 The *Contractor* shall submit the completion certificates of training courses attended by the nominated staff members to the *Project Manager* for record. In case the nominated staff members fail to complete the BIM training course, the *Contractor* / Sub-*Contractor* shall arrange additional BIM training courses to their staff members to fulfil the above-mentioned requirements at their own cost within [12 months] after the Service commence.

2.7 [Project Interfacing]

2.7.1.1 The *Contractor* is responsible for aligning the modelling conventions and practices, such as coordinate systems, units, project basepoint and naming conventions, among interfacing projects according to the agreed modelling guidelines, LOIN specifications and standards.

2.7.1.2 Interface procedures, such as regular model sharing protocol, spatial coordination procedures, role and responsibilities of interfacing zones, etc. shall be proposed in BEP and agreed among interfacing projects.

Section 2.7 is only applicable to large scale projects, which requires a consolidation of BIM models from different parties. It is critical to align the modelling standards and practices among all projects to avoid additional cost of model integration.

3. DELIVERABLES

3.1 Management Deliverables

3.1.1 BIM Execution Plan (BEP)

3.1.1.1 The *Contractor* shall [review the design stage BEP and] develop the BIM Execution Plan (BEP) according to the contents in Annex 2. The BEP must be submitted to the *Project Manager* for approval within 1 month after the commencement of the Works.

3.1.1.2 The BEP is formal document to propose the approaches of project information delivery and provide the baseline for Quality Check and Quality Control of all deliverables. The BEP shall confirm the role and responsibility of all involved parties, schedule of software, hardware, BIM CDCP, IT infrastructures, delivery schedules, modelling standards and procedures agreed with the *Project Manager*. It is the *Contractor*'s obligation to fully implement the BEP agreed by the *Project Manager*.

3.1.1.3 The *Contractor* shall deploy a document change management process during the regular review/updating of the BEP.

3.1.1.4 The Contactor shall propose the LOIN of the interim and final PIM according to the requirements of the deliverables in Annex 1 and minimum LOIN requirement in Annex 4 in the BEP and agreed with the *Project Manager*.

The LOIN requirements of each object element can be different and subjected to different deliverables, key dates, and design scheme. Subject to the availability of information, the Contractor may not be able to establish a LoD-G 400 model for all object elements even in the final construction/as-built model. This is the reason why the proposed LOIN for each model elements shall be defined clearly and agreed in the BEP. Project officers may filter the elements from the Annex 4 to establish the minimum requirement of the Works of each deliverable. Project officers may specify the LOIN with reference to the LoD Specifications published by CEDD.

3.1.1.5 During the commissioning stage of the Contract, the *Contractor* shall update the BEP to document the final model federation, breakdown structure, and LOIN of the PIM and AIM. The finalized BEP shall be submitted with the final as-built BIM model [and the Asset Information Model].

3.1.2 Progress Report and Meeting

3.1.2.1 The *Contractor* shall setup [monthly/quarterly] progress meeting with the *Project Manager* to facilitate information sharing, review critical clashes/issues, report and monitor the progress. The [monthly/quarterly] submitted progress reports and WIP models shall be reviewed in the meeting to facilitate the discussion.

3.1.2.2 The progress meeting shall review the schedule of deliverables. The *Contractor* shall summarize the progress of deliverables and updated delivery schedule in the progress meeting.

3.1.2.3 The *Contractor* shall submit the progress report [Monthly/Quarterly] to the *Project Manager* to review the status of PIM and its deliverables.

3.1.2.4 The progress report shall include but not limited to the following information:

- Summary of current and upcoming activities
- A set of latest versions of WIP models
- LoD Documentation of the released/shared WIP models
- Information history summary, changes and model update history
- Clash/issue Summary
- Availability and challenges to update drawings / information, Coordination Information into the WIP model against the Delivery Schedules
- Progress summary against the proposed project delivery schedule

3.1.3 Quality Assurance

3.1.3.1 The *Contractor* is responsible for ensuring the integrity of the PIM, drawings, and BIM deliverables, as well as the compliance with the agreed format and standards in the BEP, and/or any agreed BIM standards. A quality assurance plan shall be proposed in the BEP.

3.1.3.2 The *Contractor* shall carry out appropriate quality check [every 3/6 months] [and submit the quality check report] to the *Project Manager*.

3.1.3.3 The quality check process shall include but not limited to the following:

- Consistency among shared/published models/drawings against the information registers.
- Modelling standard compliance check against agreed modelling guidelines and standards, such as formats, versions, naming conventions, model setup, coordination systems and configuration, etc.
- Modelling Methodology compliance check against proposed in BEP, such as model federation, break down structure, tools, categories, constraints.
- Modelling completeness, geometry, and information accuracy against agreed LOIN, and project delivery schedule in the BEP.
- Model presentation settings against agreed modelling guidelines and standards, such as model view cleansing, objects and drawings presentation styles, symbols, annotations, and layers settings, etc.
- File sharing requirement check against the proposed in BEP, such as version, format, extension, resolutions, etc.

Section 3.1 describes the management deliverables from the Contractor's BIM Team including BEP, Progress report and Quality Check Report to demonstrate the Contractor's ability to plan, implement, deliver and audit BIM deliverables required in this project.

BEP, Progress report and Quality Check Report are deliverables to support planning and management of BIM deliverables. The project officers are advised to review the submission frequency of progress report [and quality Check report] based on the project size and Key Dates.

3.2 Project Information Model

3.2.1 Existing Condition Model

3.2.1.1 The *Contractor* shall base on the specified project boundary to submit an existing conditions model [in LoD-G 250 minimum / according to the requirement in Annex 4] to support the development of deliverables required in the Contract. The *Contractor* shall propose the model breakdown structure and respective LOIN in the BEP and agree with the *Project Manager*.

3.2.1.2 The existing conditions model shall be progressively developed according to the site condition and information availability. The existing condition model must be completed [6 months] before the design and/or construction works of the related portions of site. The *Contractor* shall propose and justify the submission schedule in the BEP for the approval of the *Project Manager*.

All projects require an existing condition model to support the generation of other BIM deliverables. The modelling objects and their LOIN required in the Existing Condition Model may vary according to offices and project nature. For example:

- *Land and Infrastructure Services: Higher LoD-G (250) requirement for road objects such as barrier, man-holes, kerbs, underground utilities, but lower LoD-G (100) for on-slope features*
- *Geotechnical Services: Lower LoD-G (100) for street furniture, but higher LoD-G (250) for U-channel, Staircases, access ladders, flexible barriers, soil nails, etc on the slopes.*
- *Port and Marine Services: High LoD-G (300) for shoreline, bathymetry, but Lower LoD-G (200) for other features*
- *Environmental and Sustainability Service: High LoD-G (300) for land boundary, (250) for man-holes, but lower LoD-G (100) for street furniture*

The project officers may update the Table 4.5 in annex 4 to specify the LOIN requirement of the existing condition model of the project.

3.2.1.3 The *Contractor* shall agree the accuracy and reliability of survey and available spatial data with the *Project Manager* before they are passed to BIM Team for the development of project deliverables. The final surveying data shall be organized, agreed, and submitted in required formats after the completion of existing condition survey. [Besides, existing conditional model shall be supplemented with photographic records.]

3.2.1.4 The *Contractor* shall propose the data collection, surveying, and/or 3D digital scanning strategies in the BEP.

3.2.2 Project Information Model (Design Authoring)

3.2.2.1 The PIM shall always be up to date to support the project team to develop other project deliverables. The *Contractor* shall progressively develop and submit the PIM regularly according to the agreed delivery schedule with reference to the Annex 1. The *Contractor* shall ensure the deployment of adequate resources to update and submit the PIM in 14 calendar days under the instruction of the *Project Manager*.

3.2.2.2 The *Contractor* shall [update/make reference to] the design stage BIM model and BEP to develop the Construction stage PIM as far as practical. The *Contractor* shall report and liaise with the design team to resolve/clarify the illogical issues, non-compliance issues, if any, in the design stage BIM model within the 90 days from the project commencement at its own costs. The design stage BIM and BEP shall be handed over to the *Contractor* after the project has commenced.

Section 3.2.2.2 is applicable when a design stage BIM model is available for e-tendering projects. The As built Model and BEP should be handover to the Contractor after the service commence. Project officers shall always hand over the known issues and/or the approved BIM exception list to the Contractors together if available.

3.2.2.3 The *Contractor* shall organize coordination workshops [regularly / "on need basis"] to communicate and resolve inter-disciplinary clashes. The agreed solution shall be documented and updated to the PIM within 1 month.

3.2.2.4 The *Contractor* shall progressively develop the PIM and submit the interim PIM with project deliverables according to the *Contractor*'s Master Programme and the delivery schedule required in Annex 1.

3.2.2.5 The PIM shall be maintained in the project BIM CDCP [as far as practicable]. The related drawings, coordination reports, approval history, information originator, state and status shall be always traceable from the project BIM CDCP.

3.2.2.6 The *Contractor* shall establish the modelling strategies to create, maintain and update the PIM according to the model federation structure requirement in Annex 3 and the LOIN requirement in Annex 4. The *Contractor* shall update model federation structure and LOIN of each PIM generated deliverable with the *Project Manager* in the BEP if necessary.

3.2.2.7 Unless agreed with the *Project Manager*, the *Contractor* shall follow the BIM Modelling Manual and LOIN Specifications published by CEDD to create, update, and maintain the PIM. The *Contractor* shall follow the AIR published by the maintenance parties to update the PIM to As-built Model and AIM. The *Contractor* shall propose and justify the amendments to the modelling standards and requirement published by CEDD in the BEP if necessary.

3.2.2.8 The *Contractor* shall follow the master model federation strategies in the Annex 3 and the BIM Modelling Manual published by CEDD to create, update, and maintain the PIM. The *Contractor* shall propose further federation in the BEP to ensure the effective operation of

the disciplinary models/sub-models if applicable. For each federated disciplinary model, the *Contractor* shall clearly propose and justify the model breakdown structure in the BEP according to the required LOIN and project deliverables.

3.2.2.9 The *Contractor* shall follow the LOIN in Annex 4 and the delivery schedule in Annex 1 to propose the attributes/share parameters in the BIM objects to support the direct generation of project deliverables from the PIM models. The *Contractor* shall propose and agree the attributes (LoD-I) with the *Project Manager* in the BEP.

Depending on the size and complexity of the works, the modelling elements will be different. The project officer may refer to the model federation and model breakdown in annex 3 and annex 4 as the baseline reference to define the minimum requirement in the consultancy.

- *Land and Infrastructure Services: Section 3.1 in Annex 3 and Section 4.1 in Annex 4*
- *Geotechnical Services: Section 3.2 in Annex 3 and Section 4.2 in Annex 4*
- *Port and Marine Service: Section 3.3 in Annex 3 and Section 4.3 in Annex 4*
- *Environmental and Sustainability Services: Section 3.4 in Annex 3 and Section 4.4 in Annex 4*

3.2.2.10 The modelling methodologies include the selection of modelling software, selection of modelling functions, classification categories, modelling parameters and constraints. The object elements should be modelled in true size to reflect their behavior, relationship, physical and functional performance in real world as far as practical. Envelope objects should be used to occupy estimated dimension of physical room and space if necessary.

3.2.2.11 The *Contractor* shall propose the modelling methodologies in the BEP and agree with the *Project Manager*. The *Contractor* shall ensure the proposed methodologies support the *Project Manager* to efficiently reproduce the project deliverables and required analysis according to the required BIM use.

3.2.2.12 The *Contractor* shall carry out compliance check against design standards, headroom issues and illogical arrangement before sharing or publishing the model for the generation of other deliverables. The *Contractor* shall share or publish the WIP model with LOIN documentation of all the object elements.

3.2.3 [EDMS/DWSS/SSSS Integration]

3.2.3.1 The *Contractor* shall create and maintain a unique ID coding system for each type of object element to support the linkage to Digital Works Supervision System (DWSS), Smart Site Safety System (SSSS) and/or other systems deployed during construction stage.

3.2.3.2 The *Contractor* shall maintain and update the attributes to ensure the linkage of the as-built model to the DWSS, SSSS and/or other systems agreed with the *Project Manager*, including but not limited to Electronic Document Management System (EDMS) and the correspondent documents in the BIM CDCP.

Implementation of unique object ID is only required for large scale project (over 30M) that required 3D Control and Planning (Digital Layout for DWSS integration). The project officer shall review with the DWSS/SSSS specification and the latest DEVB TC(W) on DWSS/SSSS from Development Bureau.

The object ID is essential for linking the BIM model objects with other management systems, such as DWSS, SSSS, EDMS, IoT, AI camera, CMMS, etc. Project officers shall consider including this requirement if there are other requirements to establish BIM integrated centralised management portal(s) in the construction stage.

3.2.4 BIM Objects

3.2.4.1 All BIM objects package (including the BIM object, BIM object Sheets and Object Check Form) shall comply with the BIM Modelling Manual published by CEDD [and support the specific BIM Use requirement of the Works].

3.2.4.2 The *Contractor* shall submit the project specific BIM objects created in the PIM in native and editable format to the Employer for reproducing the PIM or deliverables in the platform currently in use by the Employer.

3.2.5 As-built Model

3.2.5.1 The *Contractor* shall develop the as-built BIM model from the PIM by carrying on-site verification and inspection using traditional survey, and/or 3D scanning technologies. The *Contractor* shall carry out as-built survey/inspection regularly to capture the as-built condition and update the geometry and attributes of the PIM progressively based on the agreed tolerance and as-built records.

3.2.5.2 The *Contractor* shall develop the as-built BIM model of existing Underground Utilities progressively by carrying onsite traditional survey, and/or 3D scanning technologies for all opened-up area within the site boundary. The existing underground utilities shall be separated from the as-built underground utilities model of the Works and provided to the maintenance parties.

3.2.5.3 All the as-built records shall be agreed with the *Project Manager* before they are used for the development/validation of the as-built model.

3.2.5.4 The *Contractor* shall include all the attributes/information required in the LoD-I required in Annex 3. The *Contractor* shall refer to the BIM Modelling Manual to develop the as-built model, whenever applicable. The LoD-I requirement of each type of model objects shall be proposed in the BEP and agreed with the *Project Manager* / maintenance parties.

3.2.5.5 The *Contractor* shall update the values of the attributes/parameters in the model according to the as-built records, including, but not limited to, those related to unique identification, geometry, locations, specification, conditions etc.

3.2.5.6 The "provisional" as-built model of each portion/zone/area shall be submitted to the *Project Manager* within 3 months after the substantial completion of the portion of the construction works with the agreed as-built records for validation and checking. The "final" as-built BIM model shall be submitted to the *Project Manager* on or before issuance of [maintenance certificate/defects certificate/final certificate]. The as-built BIM model shall be consistent with the agreed as-built records within the agreed tolerances. The *Contractor* shall also facilitate the Employer to submit these as-built BIM models to CEDD BIM Data Repository (BIMDR) and LandsD's Government BIM Data Repository (GBDR) in accordance with the CEDD TC No. xx/2023 and "Guidelines for Submission of Design and As-built BIM Models to Lands Department" respectively.

3.2.5.7 The *Contractor* shall propose the as-built survey schedules and methodologies, validation tools and tolerance, WIP as-built models submission schedule in the BEP. These should be agreed with the *Project Manager* within 12 months after the commencement of the Works.

3.2.5.8 Unless otherwise agreed with the *Project Manager*, the *Contractor* shall always develop the as-built model and related IFC and COBie files according to the BIM Modelling Manual published by CEDD and the operation and maintenance departments. The *Contractor* shall propose any necessary alternatives in the BEP and agree with the *Project Manager*.

The as-built BIM model shall be submitted and validated as soon as possible to maximize the potential benefits on coordination of upcoming construction activities. Meanwhile, an early submission of the as-built BIM model usually allows more windows for onsite checking and model rectification. Project officers shall consider a reason period around 2-6 months after the completion of that part of the construction works (Section 3.2.5.4).

The existing UU may not be fully surveyed/properly identified during the UU survey in the trial pits. It is highly recommended to separate the existing UU models from the as-built UU model in the Works. (Section 3.5.2)

3.2.6 Asset Information Model

3.2.6.1 The *Contractor* shall develop AIM from the approval as-built BIM model by updating/extracting the relevant information required by each maintenance party. The AIMs shall be developed according to the AIRs from the maintenance parties [in Annex 5], including, but not limited to, the geometrical, informational, and documentary requirements.

3.2.6.2 [Any changes to the final AIM model federation, LOIN, information exchange standard (e.g. COBie, IFC, etc.) shall be proposed in the BEP and agreed with the *Project Manager* and maintenance parties / The *Contractor* shall propose the final AIM model federation, LOIN, information exchange standard (e.g. COBie, IFC, etc.) in the BEP and agree with the *Project Manager* and maintenance parties] within 12 months after the commencement of the Works.

3.2.6.3 The AIM shall be modelled to meet the requirements of maintenance scheduling and enable the linking of asset management system of maintenance parties. The *Contractor* shall ensure the quality and accuracy of the geometry and asset data of the object elements.

3.2.6.4 The AIM shall be submitted in native editable format and convert to those formats specified in the AIR of the maintenance parities. The *Contractor* shall ensure the integrity of the information among the submitted deliverables.

3.2.6.5 The AIM shall be submitted to the *Project Manager* and maintenance parties for validation within [2 months after the approval] of the part of the as-built BIM model. The *Contractor* shall ensure the resources to merge and finalize the AIM until the final acceptance of the maintenance parties.

3.2.6.6 Operation and Maintenance (O&M) Manuals, Product Catalogues and Operating Data shall be submitted in softcopy [and hardcopy] within 1 months upon the completion of the Works. The *Contractor* shall ensure the softcopy information are linked with the AIM and the [COBie/asset] worksheet.

The AIM is different with the as-built BIM model to support the operation needs of different maintenance parties. AIM should be always created from the as-built model according to the AIR of the maintenance parties. The AIR may not be available from all maintenance parties. Project officers shall identify the Maintenance Parties during the tendering stage and update section 3.2.6.1 and 3.2.6.2 if the AIR is not yet available.

Asset Management model is mandatory for underground utilities, while Maintenance Scheduling is mandatory for facilities structure, fabrics and equipment. Project officers shall contact maintenance parties before tender stage to communicate the requirements and collect the AIRs as far as possible.

The AIR should be attached with the tender specification in Annex 5 as far as possible.

3.3 Collaboration, Version and Revision Control

3.3.1 General

3.3.1.1 A Common Data Collaboration Platform for BIM (BIM CDCP) is a single repository to support information management. The *Contractor* shall setup the BIM CDCP to provide (i) a single version of traceable true information, (ii) review and approval processes and workflows, and (iii) an audit trail of documents and process [as far as practicable].

3.3.1.2 The *Contractor* shall setup the BIM CDCP [within 3 months] after commencement of the Works. The BIM CDCP shall be configured to share and store information securely with the following metadata:

- Files identification (file properties, names, drawing numbers, titles)
- Document Versioning (Version and Revision)
- State code and Status code[1]
- [Approval status and history, as well as related model copy]
- Ownership / Information Originator

[1] Refer to section LA.4.2 and LA.4.3 of the Hong Kong Local Annex of ISO19650-2:2018 in the CIC Building Information Modelling standards – General, Version 2

3.3.1.3 The *Contractor* shall maintain a change register of the records on the BIM CDCP using the audit trail features or separated spreadsheets to trace the relationship of files/models in the BIM CDCP. The *Contractor* shall propose and agree the format and content of the change register with the *Project Manager*.

3.3.1.4 The *Contractor* shall maintain the BIM CDCP until [the *defects date* or the end of last *defect correction period*, whichever is later*]. The *Contractor* shall hand over an offline digital copy of all SHARED and PUBLISH models/data, deliverables, meta data, review and approval history, audit trail, etc. on the BIM CDCP to the Employer at the end of the Works.

**Updated with the general specification clause 1.5*

3.3.1.5 The *Contractor* shall deploy necessary measures to ensure the system availability, security and redundancy of the data stored in the BIM CDCP. The *Contractor* shall propose and justify the backup and security strategies in the BEP and agree with the *Project Manager*.

3.3.1.6 The *Contractor* shall provide briefing sessions to all stakeholders to introduce the major processes and functions in carrying out their duties on reviewing and commenting the interim and final deliverables through the BIM CDCP.

3.3.2 Collaboration Process

3.3.2.1 The *Contractor* shall always upload the work-in-progress (WIP) information to the BIM CDCP, [or a centralised information system] [weekly/bi-weekly] to allow the *Project Manager* to monitor the progress of the Works. The *Contractor* shall carry out quality check and clean up the WIP model before sharing the model for interdisciplinary coordination, design evaluation/review, or approval at [monthly/quarterly] interval. The version and revision history of the WIP, SHARED, PUBLISH models shall be maintained in the BIM CDCP platform.

3.3.2.2 [The *Contractor* shall publish statuary and contractual deliverables with the proposed BIM CDCP, [or a centralised information system] using workflows and/or transmittal functions to document the deliverables version, stakeholder's review, and approval history.]

3.3.2.3 [The proposed BIM CDCP, [or a centralised information system] should be configured to notify other stakeholder by email during the sharing and/or assignment of information by authorized information provider.]

3.3.2.4 The *Contractor* shall propose the review and approval process and respective workflow settings, such as change tracking, sharing frequency, security settings, and communication protocols in the BEP, and agree with the *Project Manager*.

3.3.3 Common Data Environment Platform

3.3.3.1 The *Contractor* shall propose the [BIM CDCP software/platform / centralised information system] in the BEP to support collaboration, versioning, and revision control requirement according to the best practices in BS EN ISO19650-2 and the naming conventions in BIM Modelling Manual published by CEDD.

3.3.3.2 The infrastructure of the [BIM CDCP software/platform / centralised information system] shall be hosted with business continuity measures, servers, connection, and power redundancy to provide system availability of not less than 99.5%.

3.3.3.3 The [BIM CDCP software/platform / centralised information system] shall comply with Security Regulations, and the Baseline IT security Policy of the Employer's IT policy. The hosting environment shall be configured, deployed and managed to meet the data confidentiality , integrity, availability and privacy aspect in the compliance with the globally recognised industrial security standard, e.g. TIA-942 certified data center, ISO27001, or OGCIO Circular No. 2/2016.

3.3.3.4 The [BIM CDCP software/platform / centralised information system] shall provide the following document management features:

- User-configurable folder structure
- Addition of user-configurable metadata
- Uploading, downloading, version control [and version comparison of BIM models]
- Authentication and Access rights settings and control
- Sufficient capacity to store all project models, deliverables, and files throughout the project period.

3.3.3.5 The [BIM CDCP software/platform / centralised information system] shall provide the following BIM Collaboration features:

- [Support online review and navigation of BIM models, including relevant attributes and objects, directly through standard web browsers]
- [Provide an issue tracking workflow system for the registering, mark up, review, tracking, and coordination of issues.]
- Generation of issue registrar and audit trail

3.3.3.6 [The [BIM CDCP software/platform / centralised information system] shall provide the following correspondence and workflow management features:]

- [Allow users to setup workflows for submission, review, and approval process.]
- [Record and track the status and review history of the correspondence and submissions.]
- [Auto-generated email notification of action items]

3.3.3.7 The [BIM CDCP software/platform / centralised information system] should provide the following security control features:

- Transport Layer Security v1.2
- AES-256 advanced encryption of all uploaded files
- Role-based, user-based, and/or folder-based security control settings
- User audit trail

[BIM CDCP software/platform / centralised information system] is used to facilitate the effective collaboration of information in a centralize share environment among all

stakeholders. This section describes the IT infrastructure, functional features, and security requirements of the BIM CDCP with reference to the CIC BIM Standards (2021) Chapter 4.

3.3.3.8 The [BIM CDCP software/platform / centralised information system] shall provide Application Programming Interface (API) to allow third party developers to download the model files, retrieve review and approval history, as well as their metadata.

API is usually required for sharing BIM models or information in the information system to another management system. The Project officers shall consider include 3.3.3.8 if any integration portal, inter-CDCP data sharing is required in the works

3.3.3.9 The *Contractor* shall provide [25 nos. of user licenses] of [BIM CDCP software/platform / centralised information system]for the *Project Manager*'s staff to carry out the required BIM uses, reviewing and auditing of the BIM deliverables as an individual.

It is recommended to provide a unique ID/login for each stakeholder in the Works to allow effective tracking of project history. Project officers shall review the number of licenses required for carrying the review and collaboration process during the Works.

3.4 Coordination Process

3.4.1 Interdisciplinary 3D Coordination

3.4.1.1 The *Contractor* shall carry out inter-disciplinary coordination at [bi-weekly/monthly interval/ "on need basis"] based on the shared models from various disciplinary modellers/designers. All major conflicts should be resolved prior to the construction by identifying and resolving temporary and spatial conflicts required by different disciplines, such as equipment delivery, construction and installation, headroom and clearance, temporary stockpile, temporary works, traffic redirection, as well as future operation and maintenance access, etc.

3.4.2 Coordination Process

3.4.2.1 The coordination process should include, but not limited to, the following procedure:

i Compare [the design models and/or working drawings] to ensure the integrity of information
ii Identify missing information and/or illogical arrangements
iii Compare selected objects from the shared models according to the sequences agreed in coordination matrix
iv Identify and visualize spatial conflicts and/or illogical arrangements.
v Filter false alarm, group and organize the issues.
vi Prepare clash reports (if applicable)
vii Document the issues in the clash/issue summary
viii Resolve the issues via coordination meetings, sketches, or Employer's Agent's instructions.
ix Update the clash/issue summary
x Update the WIP model and uploaded to the BIM CDCP
xi Perform another round of analysis until all major issues are resolved.

3.4.2.2 The *Contractor* shall develop a systematic sequence and coordination matrix to detect, group and resolve major conflicts among different disciplines. The *Contractor* shall propose the detection methodologies, rules, tolerance, resolutions workflow/sequence, tools, duration, owners, roles, and responsibility in the BEP. The coordination status and result should be submitted with the progress report.

3.4.2.3 The *Contractor* shall maintain a clash/issue summary to trace the updated information, contractual correspondents against the updating disciplinary models. The clash/issue summary should at least include:

- A summary of the clash statistic among discipline(s) / clash detection matrix
- Version and revision of WIP PIM
- General description of the issues, locations, discipline, tolerance, 3D close-up images, status, solutions, and owners
- Reference drawings (if applicable)

3.4.3 Coordination Meeting

3.4.3.1 The *Contractor* shall setup coordination meeting with all involved stakeholders at [regular interval / on need basis] to review design options and resolve critical issues.

3.4.3.2 The *Contractor* shall issue the clash report(s) [and/or] the PIM to the involved stakeholders [1 week] before the meeting. The clash report should include, but not limited to, the following:

- General description of the Clashes/issues
- Locations and disciplines involved.
- Screen capture of the Clashes/Issues (plans and or section views if applicable)
- Versions of the Drawings / site sketches / coordinating disciplinary models
- Tolerance settings
- Version/Revision of the disciplinary PIM / Drawings
- Reference to drawings (if applicable)
- Latest version of clash/issue summary

3.4.3.3 The *Contractor* shall update and maintain the clash/issue summary with the solutions, findings, action items, and/or agreement made in the coordination meeting for each conflict.

Section 3.4 describe the process to generate deliverables for 3D Coordination. The process and history (Clash register) of detecting and resolving temporal, spatial and constructability issues are usually more important than the submission of "Clash-free Report". CEDD project officers shall review and update the frequency of coordination meeting against the Key dates and schedule of interim WIP deliverables in Annex 1.

The Coordination process in Construction stage usually start with identification of missing/illogical information from the design drawings. The coordination process and report will be slightly different than the design stage.

3.5 Detail Design and Planning

The deliverables listed for BIM Uses (i.e. Design Review, Cost Estimation, Engineering Analysis, Sustainability Evaluation, phase planning, site utilisation planning) in Section 3.5 are usually project specific and may only be applicable to specific contract types and objectives. This template may list examples of deliverables that may not related to the Works. Project officers shall review and update the deliverables in Works specific detail.

The development and review process of these deliverables with BIM are more important than the final deliverables. Project officers shall specify the schedule of interim deliverables in Annex 1 to encourage the early collaboration of findings.

3.5.1 General

3.5.1.1 The *Contractor* shall utilise the PIM to carry out design review, cost estimation (as far as practicable), [engineering analysis, sustainability evaluation], phase planning and site utilization planning to plan and review the detail arrangement of construction activities, temporary works, temporary traffic arrangement, site logistics, construction methodologies, payment schedule, etc. in terms of cost, feasibility, constructability.

3.5.1.2 The *Contractor* shall avoid the use of automated scripts and third parties' plugins to generate the BIM deliverables. In case of unavoidable circumstances, the *Contractor* shall ensure the automated scripts and third parties' plugins are made available for the Employer to reproduce the PIM or deliverables in the platform currently in use by the Employer.

3.5.1.3 The *Contractor* shall utilise the progressively developed PIM to generate simulation and design analysis report for the required pre-construction planning, such as proposed traffic redirection and construction sequence simulation video (Phase Planning), detailed site logistics and construction methodologies (Site Utilization Planning), variation of material quantities estimation (Cost Estimation), as well as analysis of temporary works design proposal, such as storm drainage analysis, structural analysis, solar analysis, and swept path analysis (Engineering Analysis).

Clause 3.5.1.3 refers to the requirements in adopting the BIM use "Sustainability Evaluation". It is applicable to the design and construction of Building works only and may not suitable for GEO.

3.5.1.4 [The *Contractor* shall fully integrate BIM into the daily coordination of design and construction teams, carry out construction cost estimation, development of construction sequence, as well as development of asset information model for facility management to compile with BIM integration (IDCM 16) assessment in the BEAM Plus for New Buildings Version 2.0[2].]

Section 3.5.1.4 refers to the requirements in adopting the BIM use "Sustainability Evaluation".

[2] https://www.hkgbc.org.hk/eng/beam-plus/file/BEAMPlus_New_Buildings_v2_0.pdf

3.5.1.5 The *Contractor* shall describe the tools and workflow to generate the construction planning deliverables from the PIM in the BEP and provide the necessary tools to enable the *Project Manager* to carry out necessary analysis, validation and/or checking.

3.5.1.6 In additional to the method statement, drawings and/or animated visualisation, the *Contractor* shall always submit the related WIP PIM, simulated/analysis models with the raw and editable format for the *Project Manager* to carry out necessary analysis, validation and/or checking.

3.5.1.7 The *Contractor* shall submit the related models in Interactive Visualization Model to allow the Employer to carry out design reviews and visual inspection by means of interactive walk-through and measurements in 3D model viewers before the Key Dates.

3.5.1.8 The *Contractor* shall propose the delivery schedules of interim deliverables to ensure several rounds of necessary design review and coordination process before the Key Dates or construction works. The schedule of the delivery of the interim deliverables should be proposed in the BEP and agreed with the *Project Manager*. The *Contractor* shall propose and justify the LOIN and submission schedule of interim deliverables in the BEP for the approval of the *Project Manager*.

3.5.1.9 The interim deliverables of the construction planning shall be shared with progress report during method statement submissions, review, and discussion meetings to allow the *Project Manager* to carry out progressive review process based on the agreed objectives. The *Contractor* shall propose the delivery schedule of interim deliverables in the BEP according to the Annex 1 and agree with the *Project Manager*.

3.5.2 Design Review

3.5.2.1 The *Contractor* shall always enhance the PIM(s) / Design model(s) into Interactive Visualization Models to allow the *Project Manager* to carry out visual inspection at regular interval by means of interactive walk-through and measurements in 3D model viewers.

3.5.2.2 The *Contractor* shall enhance the PIM / Design Models to develop Interactive Visualization Models by addition of true colour and/or material textures [as far as practicable]. The *Contractor* shall propose the colour convention and material mapping scheme in the BEP [to achieve the *project specific visualization requirements].

**Visualization in Construction stage is mainly used for enhancing public relationship in Community Liaison Centre, safety training and project teams communications. It may be more applicable for large scale (M4) Land and Infrastructure services, but less applicable for Geotechnical Services, Port and Marine Services, Environmental and sustainability services during construction stage.*

3.5.2.3 The *Contractor* shall ensure the compatibility of the submitted Interactive Visualization Models , proposed free model viewers, and the proposed VR equipment.

3.5.2.4 The Contractor shall ensure the compatibility of the submitted Interactive Visualization Models , proposed free model viewers [and the proposed VR equipment] within [3 months] after the commencement of the Works.

3.5.2.5 [The Interactive Visualization Models shall be exported/rendered in a Virtual Reality Environment to allow the Employer's Agent to review the PIM in an immersive VR environment. The Contractor shall supplied the VR equipment with the minimum configuration:-]
[Refer to the latest hardware specification guideline by the BIM Unit]

3.5.2.6 The Interactive Visualization Models of the latest combined WIP models shall be submitted with the progress report to allow the *Project Manager* to review the overall progress of the Works.

Interactive Visualization Models refers to an PIM rendered with texture/materials to enable an interactive walk-through and measurement in a 3D model viewer. The exporting/rendering in an immersive 3D VR environment is optional. The project officer shall mandate section 3.5.2.4 and review with the particular specification of computer equipment if an immersive VR environment is required.

3.5.3 Phase Planning (4D Model)

3.5.3.1 The *Contractor* shall develop Phase Planning models by incorporating the latest construction programme with the PIM to allow the *Project Manager* to review the construction progress and temporal coordination by means of interactive walk-through, sectioning, measurements, time selecting in free viewers.

3.5.3.2 The *Contractor* shall develop the initial phase planning model by linking the *Contractor*'s Master Construction Programme with the PIM using the unique Activity IDs and progressively enhanced the 4D model with the construction programme.

3.5.3.3 The *Contractor* shall also update the phase planning model with the actual construction schedule to allow the *Project Manager* to review the deviation of the progress of the Works and should be always submitted with the [monthly/quarterly] progress report.

3.5.3.4 The contractor shall propose the tools and workflow to generate the phase planning model and schedule of deliverables in the BEP and agree with the *Project Manager*.

3.5.3.5 The phase planning model shall be submitted with *Contractor*'s Master Construction Programme and its revisions. The *Contractor* shall clearly describe the version of the PIM, outstanding model objects and version of the construction programme in the phase planning model in the submission report. The *Contractor* shall submit the Phase Planning (4D Modelling) containing the following but not limited to:

- Description of the Phase Planning (4D Modelling), including the assumptions, time interval, guide for accessing the files and BIM…etc.
- [Video(s) of the simulation(s)]

- Native and editable BIM
- Interactive 4D Models(s) for the Phase Planning
- Linked project programme or Excel spreadsheet

3.5.3.6 The *Contractor* shall submit the phase planning model with free viewer format to allow the *Project Manager* to review the construction progress and [*temporal coordination] by means of interactive walk-through, sectioning, measurements, and time selections by free viewers.

**Phase planning is mainly used for evaluation of coordination temporary site arrangement of during the construction process. The project officer may consider the following temporal coordination:*

- *Land and Infrastructure Services: i) Temporary Traffic Arrangement; ii) Excavation and Lateral Support works; iii) underground utilities redirection*
- *Geotechnical Services: Temporary Traffic Arrangement*
- *Port and Marine Services: Excavation and Lateral Support works*
- *Environmental and Sustainability Service: Excavation and Lateral Support works*

3.5.3.7 The *Contractor* shall also submit the phase planning model in native and editable format to allow the *Project Manager* to carry out necessary checking, validation, and analysis. The *Contractor* shall provide the necessary tools to ensure the *Project Manager* to modify and update the phase planning model.

A phase planning model allow the planning and review of progress deviation. In additional to free viewer version, the native and editable model is necessary to carry out validation and analysis.

3.5.4 [Construction Method Simulation]

3.5.4.1 The *Contractor* shall develop the construction method simulation by incorporating the proposed construction method statement with the PIM. The major construction plant, equipment, temporary works, traffic arrangement, and material and equipment delivery arrangements shall be included to demonstrate the feasibility and effectiveness of the *Contractor*'s proposed method statement.

3.5.4.2 The *Contractor* shall collaborate with the *Project Manager* to review the proposed construction methodologies and installation sequence in terms of the feasibility, constructability, and buildability through coordination meetings, storyboards and preliminary animations, etc. The *Contractor* shall adopt the latest WIP model and enhance the LOIN, material textures, and the contents of the construction method simulation agreed with the *Project Manager* during collaboration and review meetings. The *Contractor* should agree the PIM versions, contents, views, etc. of the detailed Construction Method Simulation video with the *Project Manager* with a storyboard before the generation of the simulation videos.

3.5.4.3 The final construction method simulation video should be submitted and approved by the *Project Manager* [2 weeks] before the construction commences. The *Contractor* shall

propose the delivery schedules of interim deliverables to ensure several rounds of necessary design review and coordination process before the development of the final Construction Method Simulation video. The schedule of the delivery of the interim deliverables should be proposed in the BEP and agreed with the *Project Manager*.

3.5.4.4 The *Contractor* shall develop detailed Construction Method Simulation video at Full FD 1080p resolution (1920 x 1080) with not less than 15 frames per seconds for the following construction works:

- [Overall Construction sequence: not less than 300 seconds]
- [Construction of footbridge: not less than 120 seconds]

The Site Utilisation planning is considered as a detailed phase planning model with non-linear time scales and LoD-G 200 plant and machineries to demonstrate the proposed method statement.

Project officers shall clearly specify the area of concern, duration requirement, format requirement of the construction method simulation video in clause 3.5.4.4.

3.5.5 [Cash Flow Analysis]

3.5.5.1 The *Contractor* shall utilise the WIP PIM to estimate the cost of material in the Works by extracting the quantities of cost significant items, including but not limited to Volume of Concrete, Volume of earthworks (hard and soft material), [Weight of steelworks, Length of pipe works, number of manholes], etc. [as far as practicable] after the acceptance of the initial PIM.

3.5.5.2 The *Contractor* shall update the quantities of material with the 4D model [every 3 months/6 months] to develop a financial model of cost significant materials for the *Project Manager* to carry out cash flow / material quantities analysis [as far as practicable].

3.5.5.3 The *Contractor* shall propose the software, format, and content of the analysis report in the BEP and agree with the *Project Manager*.

3.5.5.4 The *Contractor* shall also submit the financial model in native and editable format to allow the *Project Manager* to carry out necessary checking, validation, and analysis. The *Contractor* shall provide the necessary tools to ensure the *Project Manager* to modify and update the financial model.

There are known technical limitations to extract a "SMM-compatible" BQ directly from the BIM model. Yet, material quantities of concrete volume, steel weight, length of pipe, earthwork volumes, number of man-holes, etc. could be easily extracted from BIM model to enable a high-level cost estimation to support logistic/financial planning. Project officers shall review the Service and update the Section 3.5.5.1 with the "works-related" materials.

Lots of the 4D simulation software, such as Navisworks, Fuzor, Synchro also support 5D functions for financial model / cash flow analysis. This section should be updated with section 5.3.1.2 regarding the software requirements.

3.5.6 [Cost Estimation on Compensation Event (as far as applicable)]

3.5.6.1 Upon Compensation Events, the *Contractor* shall utilise the WIP PIM / design model to estimate a high-level cost of material variation against the original design, and/or various design options to justify the proposed change of design / materials / construction sequence / the use of plant and equipment, etc. The *Contractor* shall include the material variation schedule during the notification of a Compensation Events and/or the Early Warning as early as possible.

3.5.7 [Alternative Design/Temporary works Design Validation (Engineering Analysis)]

3.5.7.1 The *Contractor* shall develop a design BIM model to carry out model-based engineering analysis to ensure the integrity, standard compliance, and operability of the proposed design, such as [alignment integrity and compliance check, swept path analysis, line of sight analysis, storm drainage/sewerage capacity analysis, structural stability/load analysis, lighting simulation, etc.]

**Design Validation in planning and design stage is mainly used for integrity checking of design against standards and operation requirements. The project officer may consider the following applications for design and build projects only:*

- *Land and Infrastructure Services: i) integrity compliance to Transport Planning and Design Manual; ii) Swept path and line of sight analysis; iii) storm drainage/sewerage capacity analysis*
- *Geotechnical Services: i) storm drainage/sewerage capacity analysis*
- *Port and Marine Services: i) Structural stability/load analysis; ii)Lighting simulation*
- *Environmental and Sustainability Service: i) Structural stability/load analysis*

3.5.7.2 The *Contractor* shall develop workflow to extract the design/engineering parameters from the proposed design BIM model and import into the specific analysis software during the engineering analysis process as far as practicable. The analysis result shall be used to update the WIP PIM to optimise the design proposal. The tools and workflow process should be proposed in the BEP for the agreement of the *Project Manager*.

3.5.7.3 The *Contractor* shall enhance the WIP design BIM model into Interactive Visualization Models [within 1 month upon the request of the *Project Manager* / 2 weeks before the design review/evaluation meeting] to allow the *Project Manager* to carry out visual inspection by means of interactive walk-through and measurements in 3D model viewer.

3.5.7.4 The final optimized design model shall be incorporated and submitted as part of the WIP PIM, as-built model and asset information model.

The deliverables of Section 3.5.7.1 are related to the nature of the Works. Project officers should update the analysis requirements and deliverables in section 3.5.6.1 as far as possible.

Engineering Analysis is mandatory for building projects. Project officers shall include this section for all design and built project as far as practical.

3.5.8 [Greenery Coverage Validation (Space Programming)]

3.5.8.1 The *Contractor* shall utilise the PIM to check the site coverage of greenery requirement to ensure the compliance to the *Project Manager* space programming requirement. The proposed design model and the analysis results shall be submitted with each design scheme submission and shared during the design review/evaluation process.

Space Programming is not required in Construction Stage. Project officers may consider including this section for design and built project only.

3.5.9 [Digital Fabrication Model]

3.5.9.1 The *Contractor* shall enhance the PIM of [noise enclosure panels, structural steel framing, manholes and chambers, street furniture, bridge segments, structural reinforcement, etc.] into LoD 400 to support the modularized construction and cost-effective offsite/onsite prefabrication, site delivery and installation.

3.5.9.2 The *Contractor* shall enhance the model federation, model breakdown structure and LOIN based on Annex 3 and Annex 4 to support the digital fabrication modelling, as well as the generation of the data / report / drawings [including factory machines code (BVBS), etc.] required by the offsite/onsite prefabrication.

3.5.9.3 The *Contractor* shall complete and submit the digital fabrication models and related data / report / drawings for the *Project Manager* to validate [at least 4 weeks] before the offsite/onsite prefabrication commences. The *Contractor* shall update the submission schedule of Annex 1 in the BEP and agree with the *Project Manager*.

3.5.9.4 The *Contractor* shall propose the tools and process to develop the digital Fabrication model and relevant data / report / drawings in the BEP and agree with the *Project Manager*.

3.5.9.5 The final digital fabrication model shall be incorporated and submitted as part of the WIP PIM, as-built model and asset information model.

Project officers shall specify the modular construction units according to the Works and update Section 3.5.9.1.

Project officers shall specify the reports and data export formats required by the fabrication factory as specific as possible in Section 3.5.9.2. BVBS is a format commonly used for the steel/rebar fabrication.

3.6 Site Sketches and Drawings

3.6.1 Drawing Production

3.6.1.1 The *Contractor* shall use the [SHARED/PUBLISHED] PIM and as-built model to produce the site sketches, [drawings/shop drawings], and as-built drawings as far as practical. The

Contractor shall always generate the layout plans and sections of as-built drawings according to the BIM Modelling Manual published by CEDD and the annotations, object tags, presentation styles, data-driven objects requirements in the Statutory Submission Guide and Modelling Object Guide by CIC. The 2D annotation and schedules of the drawings shall be always linked with the BIM objects to ensure the live update upon changes.

3.6.1.2 [The *Contractor* may propose the alternative solutions for site sketches, such as 3D views and respective drawing standards in the BEP and agree with *Project Manager* according to the efficiency and specific limitations of the Works if applicable.]

3.6.1.3 The *Contractor* shall utilise the PIM and as-built model to generate the schedules and drawings. The *Contractor* shall produce, but not limited to, the following drawings:

- General layout plans
- Schedules and Setting out plans
- [Superstructure plans]
- [Foundation plans]
- [Demolition plans]
- [Excavation and Lateral Support (ELS) plans]
- [Site formation plans]
- [Ground Investigation plans]
- [Drainage plans]

3.6.1.4 The *Contractor* shall always update the PIM before the drawing revision process. Typical sections and standard drawings are not required to be generated from the PIM. The *Contractor* shall refer to the Annex 1 to develop a drawing list in the BEP to propose the list of BIM and non BIM-generated drawings/schedules/site sketches and agree with the *Project Manager*.

3.6.1.5 The site sketches, [drawings/shop drawings], and as-built drawings should be submitted together with respective SHARED/PUBLISHED PIM, associated non-BIM generated 2D CAD drawing, drawing production files, exported drawings, and drawing register to the *Project Manager* [at least 2 weeks] before the agreed Key Dates. The *Contractor* shall refer to the Annex 1 to develop a submission schedule in the BEP to summarize the tentative drawing/site sketches submission schedule and agree with the *Project Manager*.

Drawings is commonly used for Civil Infrastructure projects, while shop drawings is used for building works projects.

3.6.2 Drawing Integrity

3.6.2.1 The *Contractor* must ensure the integrity between the models and the drawings during PIM update, such as using BIM CDCP, sharing non-editable format, model referencing, etc. The *Contractor* shall propose the drawing production and control process in the BEP and agree with the *Project Manager*.

3.6.2.2 The *Contractor* shall maintain and submit the drawing register [monthly/quarterly] to document the linkage between the disciplinary PIMs and the published site sketches/drawings. The register shall record the view/sheet names, related disciplinary models, versions, status, date, DIS/DAN number, etc. The *Contractor* shall propose and agree the format of the drawing register with the *Project Manager* in the BEP. The combined PIM, drawing production files, export drawings and drawing register shall be submitted with the drawing submission.

3.6.2.3 The *Contractor* shall produce the as-built drawings from the final design BIM model as far as practicable according to the above drawing production requirement. The final as-built model, updated BEP, and the as-built drawings should be submitted together to the *Project Manager* [within 8 weeks] after the acceptance of the as-built model.

3.6.2.4 The *Contractor* shall ensure the as-built drawings from the as-built BIM model are correctly presented and consistent with the actual fieldworks done. The as-built drawings shall be submitted with the as-built BIM model according to the drawing production requirement agreed in the BEP.

Section 3.6 describes the process and supporting deliverables for managing the drawing production BIM Use requirement. There are known limitation of producing drawing from BIM model. The BIM generated drawings may not full complied with the traditional CAD standards (Drafting Specification for Engineering Survey specified in section 2.3). CEDD project officers are recommended to consider if these requirements could be released during the production of interim deliverables, such as, site sketches in Section 3.6.1.2.

Project officers shall list out the drawings required to be generated directly from BIM model in Section 3.6.1.4. In general, the CIC BIM Standards for Preparation of Statutory Plan Submission (Dec 2020) guideline have documented the standard and process to generate statutory plan.

4. BIM TEAM REQUIREMENTS

4.1 Role and Responsibility of Project Team

4.1.1.1 The role and responsibility of all parties involved in this Service does not change during the adoption of BIM technologies. All parties are responsible to provide up-to-date information to the BIM Team to facilitate the BIM delivery ahead of the Key Dates/site construction.

4.1.1.2 The BIM Team shall provide the following services:

a. to coordinate all parties including but not limited to different design disciplines, sub-consultants, specialist sub-*Contractor*s, specialist *Contractor*s, suppliers, *Project Manager* and his representatives, Government Departments/Employer and utility undertakings and collecting suitable information and data from them.
b. 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 model production and to resolve such difficulties with relevant parties.

c. to utilise BIM for avoidance of risks and minimisation of changes, to monitor project costs and programmes in various stages, and to support optimal design for construction and operation.

d. 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 design and construction works; to ensure the updated BIM models are coordinated and always kept ahead of the Key Dates/site construction to allow early review of the project delivery process through BIM adoption.

e. 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.

f. to provide technical support and guidance to the *Project Manager* and his representatives in using the BIM models, managing the BIM database, and resolving potential construction difficulties.

4.2 BIM Team Structure

4.2.1.1 The *Contractor* shall propose and establish a BIM Team that is appropriate for the scale and complexity of the Works, highlighting key roles and responsibilities of each position, within [4 weeks] after commencement of the Works. 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 to complete all BIM tasks, BIM and project deliverables specified in the Contract. Notwithstanding, the BIM Team shall comprise at least [1] BIM Team leader, [1 BIM Coordinator and 3 BIM Modellers] with proven experience in relevant disciplines.

Project officers shall review Clause 4.2.1.1 to specify the minimum resources required for the BIM Team. Some general guidelines below for reference:

Mini. Ratio of modellers to Coordinators/Manager	*- 3 :1*
Number of BIM modellers	*- at least 1 for 2 disciplines*
Size of the project	*- at least 2 modellers for M3 project*
No. animation/simulation required	*- add 1 coordinator for over 2 animations per year.*

4.3 BIM Team Leader

4.3.1.1 BIM Team Leader shall be a CIC-Certified BIM Manager (CCBM) with proven experience on similar projects.

Project officers shall review the latest requirements of BIM Team Leader in the DEVB TC(W) on "Adoption of BIM for Capital Works Projects in Hong Kong" and update Section 4.3.1.1 and 4.3.1.2 accordingly.

4.3.1.2 The BIM Team Leader shall be responsible for the overall BIM management and BIM process controls, such as:

a. lead and manage the BIM Team and shall be responsible for the overall BIM management and provide control to ensure the deliverables are issued on time
b. coordinate with the *Project Manager* and his representatives
c. plan, develop and manage the project BIM standard and implementation strategy.
d. maintain the integrity of information among all parties and deliverables.
e. provide quality control and checking procedures.
f. schedule and ensure all the deliverables are issued on time
g. provide advice/guidance to the *Project Manager* in
   - reviewing BIM modelling formats/protocol and co-ordination,
   - reviewing analysis and findings on application by using different software such as the clash detection and resolving the clashes,
   - providing technical support to the *Project Manager* regarding modelling enquiries.

4.4 BIM Coordinator

4.4.1.1 The BIM Team Leader shall delegate BIM Coordinator(s) for collaboration of detailed design and construction information among the *Contractor*'s or Sub-contractor's engineering design and planning teams with all stakeholders to ensure the information integrity in the BIM models.

4.4.1.2 The BIM Coordinator is responsible to

a. maintain all information register against the information incorporated in the models
b. report, record and coordinate all clashes reported from the stakeholders until they are resolved.
c. carry out quality check of all deliverables and prepare the quality check report
d. establish, operate and manage the common data environment

4.4.1.3 The BIM Coordinator(s) shall have (i) a minimum of three years relevant construction project experience; and (ii) a minimum of one-year practical experience in BIM projects; and (iii) shall complete the CIC-accredited BIM Coordinator course with effect from 1 July 2022 if the engaged BIM Coordinator are not CIC-Certified BIM Coordinator (CCBC); or shall be a CCBC.

For construction works tenders to be invited on or after 1 January 2024, the BIM Coordinator(s) shall be a CIC-Certified BIM Coordinator (CCBC) or CIC-Certified BIM Coordinator (Associate) but with at least half of the BIM Coordinators attained the qualification of CCBC in the BIM Team. Project officers shall review the latest requirements of BIM Coordinator in the DEVB TC(W) on "Adoption of BIM for Capital Works Projects in Hong Kong" and update Section 4.4.1.3 accordingly.

4.5 [BIM Modellers]

4.5.1.1 [Within 6 months from the commencement of the Works, the BIM modellers shall be or shall have been certified with the basic modelling course of the proposed BIM modelling, design review and coordination software.]

4.6 Staff Movement Arrangement

4.6.1.1 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 *Project Manager* within 2 weeks for approval.

4.7 Subcontracting of BIM Services

4.7.1.1 If the *Contractor* does not have the necessary expertise, the *Contractor* shall engage a sub-consultant/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 *Project Manager* 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.

Section 4 is a general description on the requirement of the project team structure and subject to change according to the size and scope of the Works. Project officers shall review the latest technical circular from Development Bureau for latest requirement.

5. BIM TOOLS REQUIREMENT

5.1 General

5.1.1.1 The *Contractor* shall propose the list of tools to be adopted in the project to prepare the BIM Deliverables and other output as required. The *Contractor* is required to describe and justify the functionalities of tools in terms of the BIM use requirement, compatibility, and interoperability in the BEP. The *Contractor* shall also propose the version upgrade frequency, policy, and quality checking procedures in the BEP for the approval by the *Project Manager*.

5.2 BIM Hardware

5.2.1.1 The *Contractor* shall provide the *Project Manager* with workstations for operating the BIM. [The *Contractor* shall also provide VR equipment including headsets and sensors, etc. for carrying out the design review process in an immersive virtual reality environment.] Reference shall be made to PS Appendix [X] on [Schedule of Contract Computer Facilities for the *Project Manager*].

The specification of BIM workstations (Type I for viewing and commenting model; Type II for building model; and Type III for CPU-demanding task like 3D animation creation) could be referred to the latest version of "Departmental Technical Specification for Contract Computer Facilities" available at CEDD Bulletin Board – Technical Brach – Computer Service Unit – Contract Computer Facilities – Hardware and Software Specification.

5.3 BIM Software

5.3.1.1 The *Contractor* shall propose the list of all authoring and analysis tools to be adopted in the Works to prepare the BIM Deliverables and other outputs as required for the acceptance by the *Project Manager*. The *Contractor* is required to describe and justify the functionalities of the tools/ applications' in terms of compatibility and interoperability for the *Project Manager*'s acceptance.

5.3.1.2 The *Contractor* shall provide the *Project Manager* with software for operating, updating and validation of all 3D models, [and] Phase Planning (4D Modelling) [*and financial model (cost estimation model)]. The *Contractor* shall also propose free compatible software viewers for viewing all 3D models, [and] Phase Planning (4D Modelling) [*and financial Model (Cost estimation model)]. Reference shall be made to PS Appendix [X] on [Schedule of Contract Computer Facilities for the *Project Manager*].

** To be reviewed with the section 3.5.5*
The specification of BIM software should be performance and function based and specific brand names/models should not be stated. Sample specification of common BIM software is noted below for reference.

- *BIM capable software with editing function for structural engineering and fabrication (e.g. rebar detailing) for Windows 10, latest version.*
- *BIM capable software with editing function for civil infrastructure works design (e.g. road works design involving alignment computation and corridor modelling) for Windows 10, latest version.*
- *Software for performing quality assurance checks of BIM models (including but not limited to clash detections and collaboration of multiple discipline models) and Phase Planning (4D Modelling) for Windows 10, latest version.*

Annex 1: Deliverables and Submission Programme

No	Clause in Contract	Project Deliverables (BIM USE)	BIM Deliverables	Status[3]	Format/Content	Schedule
1			BIM Execution Plan	S3	DOC/PDF	1 month after the project commence.
				S6	DOC/PDF	3 months after the project commence
2		Site Condition Model (Existing Condition Modelling)	Existing site Model [by portion/ zone]	S4	Interactive Visualization Model	[3 months] before the construction [of the portion/zone] commerce
3		Progress PIM Model (Design Authoring) (Design Review)	WIP PIM model WIP Existing Condition Model	S2	Interactive Visualization Model	With Progress Report
				S4	Interactive Visualization Model	12 weeks before Construction
4		Coordinated Construction Programme (Phase Planning)	4D Model	S2	4D Model	With Progress Report
				S3	4D Model	1 month before programme submission
				S4	4D Model	With Programme submission
5		Utilities clash free report (3D Coordination)	Combined underground utilities model	S1	Interactive Visualization Model, clash report	2 weeks before coordination events
				S4	Interactive Visualization Model, clash report	1 months before construction commence
				S6	Interactive Visualization Model	2 weeks before construction commence

[3] Refer to section LA.4.2 and LA.4.3 of the Hong Kong Local Annex of ISO19650-2:2018 in the CIC Building Information Modelling standards – General, Version 2

No	Clause in Contract	Project Deliverables (BIM USE)	BIM Deliverables	Status[3]	Format/Content	Schedule
6		Road design report (engineering analysis) (Drawing Production)	Interim Road PIM	S2	Interactive Visualization Model	3 months before [Key Dates 1]
			Setting out Schedule	S3	Interactive Visualization Model, Drawings	2 months before [Key Dates 2]
			Construction Stage Model, Working Drawings	S6	Interactive Visualization Model, Drawings	At [Key Dates 2]
7		Earthwork Estimation (Cost Estimation) (Drawing Production)	Interim Site Formation PIM	S2	Interactive Visualization Model	6 months before [Key Dates 1]
			Schedule of Materials and layout plans	S3	Interactive Visualization Model, Drawings	2 months before [Key Dates 2]
			Construction Stage Model	S6	Interactive Visualization Model, Drawings	At [Key Dates 2]
8		Construction method statement (CMS) of the bridge (Phase Planning)	Interim Bridge PIM	S2	Interactive Visualization Model	6 months before [Key Dates 2]
			Storyboard for Visualization/Animation	S3	Storyboard document	4 months before [Key Dates 2]
			CMS Animation	S3	CMS animations video	1 month before construction
			CMS Animation	S4	Final CMS animation	2 weeks before construction
9		As-built Drawings (As-Built Modelling) (Drawing Production)	As-Built BIM Model	S2	Interactive Visualization Model	2 months after [the portion] completed

No	Clause in Contract	Project Deliverables (BIM USE)	BIM Deliverables	Status[3]	Format/Content	Schedule
			Zonal As-built BIM Model	S3	Interactive Visualization Model	1 month after [the zone] completed
			Zonal As-built model, as-built drawings	S4	Interactive Visualization Model, Drawings	2 months after [the zone] completed
			As-built drawings	S5	Interactive Visualization Model, Drawings	3 months after [the zone] completed
10		Asset Information Model (Asset Management) (Maintenance Scheduling)	Asset Information Model	S3	Interactive Visualization Model	2 months after the as-built model approved
			Asset Information Model	S4/S5	Interactive Visualization Model	3 months after the as-built model approved
			Asset Information Model exports	S6	Native model, COBie and IFC format	1 months after the AIM approved

Notes:
S0 – Initial Status or WIP
S1 – Shared for Coordination
S2 – Shared for Information
S3 – Shared for Lead Consultant Review and Comment
S4 – Shared for Lead Consultant Comment and Approval
S5 – Shared for Employer Review, Comment and Approval
S6 – Shared for PIM stage Authorisation

- *This table is an example only. Annex 1 must be specified by the project officer according to size, complexity and key dates of the Works. All deliverables required in the Section 3 should be listed in the table of Annex 1.*
- *Project officers should include the requirement of interim deliverables (e.g. S1 and S2) of each submission to allow few rounds of review process before the key dates.*

Annex 2: Contents of BIM Execution Plan

The BIM Execution Plan (BEP) is a live document to describe the means and methodology for the Consultant to deliver the project deliverables with BIM technology. It should be reviewed regularly and approved by the *Project Manager*. The BEP shall include but not limited to the following sections:

1. **Overview**
   - 1.1. Introduction
   - 1.2. BIM Scope/Goal
2. **Project Information**
   - 2.1. Project Background
   - 2.2. Project Key Dates
3. **BIM Management**
   - 3.1. Project Organisation
     - 3.1.1. Organisation Chart
     - 3.1.2. Role, Responsibility and Authority
     - 3.1.3. BIM Team Resources and Competency
   - 3.2. Management Deliverables
     - 3.2.1. BIM Project Execution Plan (BEP)
     - 3.2.2. Progress Reporting
     - 3.2.3. Quality Control Report
   - 3.3. Information/Security Management Plan
     - 3.3.1. Information Security Roles and Responsibility
     - 3.3.2. Human Resource Security
     - 3.3.3. Asset Management
     - 3.3.4. Information Access Control
     - 3.3.5. User Access Control
     - 3.3.6. Physical and Environmental Security
     - 3.3.7. Operational Procedure
     - 3.3.8. Backup and Recovery
     - 3.3.9. Usage Monitoring
   - 3.4. Quality Control and Quality Assurance Plan
     - 3.4.1. Scope of Quality Check
     - 3.4.2. Checking Methodologies and Frequency
   - 3.5. Training and Development Plan
     - 3.5.1. [BIM Fundamental Training course]
     - 3.5.2. [BIM operation of design review software course]
4. **Project BIM Requirements**
   - 4.1. Application of BIM uses
     - 4.1.1. Design Authoring
     - 4.1.2. Design Review
     - 4.1.3. Existing Condition Modelling
     - 4.1.4. 3D Coordination

The project officers shall update the Annex 2 according to the project deliverable and specifications. It should be already read with the BEP template guideline.

Annex 3 : Template for Model Federation structure

Model Federation refers to a systematic organization of modelling objects into model files to facilitate effective information sharing. The *Contractor* shall follow the CEDD Modelling Guideline and further breakdown the model federation structure according to the below framework if necessary. The *Contractor* shall propose the final structure in BEP and agree with the *Project Manager*.

- *This annex should be always read with annex 4. The annex 3 describes the model federation structure for the 4 service areas identified during the consultancy and the CEDD BIM Modelling Manual – Model Naming Convention. This federation system targets to establish a centralise system to support the storage and management of all CEDD BIM data.*
- *Project officers shall select the Federation Structure of their service area and encourage the Contractor to adopt this structure as far as practicable. Project officers may also remove federated models that will not be included in their Works. In case of necessary, the Contractor may further federate the model under this structure.*
- *Project officers shall read this Annex with the CEDD Modelling Guideline.*

3.1 Model Federation for Land and Infrastructure Services

PROJECT MODEL	1ST LEVEL FEDERATION	2ND LEVEL FEDERATION (DISCIPLINARY MODELS)	3RD LEVEL FEDERATION	DESCRIPTION
Project Information Model	Existing Condition Model	Existing Site Topography	N/A	Topology (Digital Terrain Model) of the site area, include GI data and bore hole data
		Existing Street Furniture	N/A	Relevant existing planters, traffic sign, road markings, railings, street lighting, barriers, kerbs etc
		Existing Structure	N/A	All existing above ground and underground structures of the Service area
		Existing Underground Utilities	N/A	All existing underground utilities systems of the Service area
	Proposed Works Model	Geotechnical Slope Model	N/A	Site boundary, Geological elements, Slope works and related stabilisation system
		Roadworks Model	N/A	Road works systems including traffic systems and related dwarf wall and slope works
		Landscape Model	N/A	Outdoor landscape systems including planting, parks, recreation facilities, etc
		Sewerage Model	N/A	Proposed/Rediverted Sewerage network of the Service
		Stormwater Model	N/A	Proposed/Rediverted Stormwater network of the Service
		Water Supplies Model	N/A	Proposed/Rediverted freshwater supplies network of the Service
		Telecommunications Model	N/A	Proposed/Rediverted Telecommunication system of the Services
		Electrical Power Supply Model	N/A	Proposed/Rediverted Power supply system of the Services
		Gas Supply Model	N/A	Proposed/Rediverted Gas Supply system of the Services
		Highway Structure Model	Sub Structure Model	Underground structure for foundation supports
			Super Structure Model	Above ground structure of highways
			Concrete Structure Model	Other structure such as Tunnel linings
		Specialised Systems Model	Tunnel Ventilation system	Tunnel Ventilation system
			Tunnel Fire Service System	Tunnel Fire Services System
			TCSS	Traffic Control and Surveillance System
		Architectural Model	N/A	Architectural elements of each building / plant room /etc

PROJECT MODEL	1ST LEVEL FEDERATION	2ND LEVEL FEDERATION (DISCIPLINARY MODELS)	3RD LEVEL FEDERATION	DESCRIPTION
	Proposed Building(s) Model	Structural Model	N/A	Structure elements of each building / plant room /etc
		Building Services Model	N/A	MEP elements of each building / plant room /etc

- *The 3rd level federation should be adopted at larger scale (M4) project. For in-house smaller scale projects, project officers may consider to adopt level 1 and level 2 federation only*
- *Building(s) Model should be federated based on each building / plants / facility. For example, there should be two architectural models if the Service includes one administration building and one ventilation building.*
- *The building services elements may required further federated for large size building works. Project officers may refer to the BIM Modelling Manual of CEDD.*

3.2 Model Federation for Port and Marine Services

PROJECT MODEL	1ST LEVEL FEDERATION	2ND LEVEL FEDERATION (DISCIPLINARY MODELS)	DESCRIPTION
Project Information Model	Existing Condition Model	Existing Site Topography	Topology (Digital Terrain Model) of the site area, include GI data and bore hole data
		Existing Street Furniture	Relevant existing planters, traffic sign, road markings, railings, street lighting, barriers, kerbs etc
		Existing Structure	All existing above ground and underground structures of the Service area
		Existing Underground Utilities	All existing underground utilities systems of the Service area
	Proposed Works Model	Fender System Model	Fender systems and related object elements
		Marine Civil Model	Furnitures within marine facilities, including Site boundary, proposed topologies and bathymetry
		Marine Structural Model	Structural elements classified by PWD
		Building Services Model	E&M equipment and related systems and concrete works
		Architectural Model	Architectural elements/fixtures within marine facilities

3.3 Model Federation for Geotechnical and Engineering Services

PROJECT MODEL	1ST LEVEL FEDERATION	2ND LEVEL FEDERATION (DISCIPLINARY MODELS)	DESCRIPTION
Project Information Model	Existing Condition Model	Existing Site Topography	Topology (Digital Terrain Model) of the site area, include GI data and bore hole data
		Existing Street Furniture	Relevant existing planters, traffic sign, road markings, railings, street lighting, barriers, kerbs etc
		Existing Structure	All existing above ground and underground structures of the Service area
		Existing Underground Utilities	All existing underground utilities systems of the Service area
	Proposed Works Model	Geotechnical Slope Model	Site boundary, Geological elements, Slope works and related stabilisation system
		Geotechnical Structure Model	Concrete structures, foundations and access elements
		Stormwater Model	Proposed Stormwater systems of the Services area
		Landscape Model	Vegetation, planters, and recreation elements

3.4 Model Federation for Environmental and Sustainability Services

PROJECT MODEL	1ST LEVEL FEDERATION	2ND LEVEL FEDERATION (DISCIPLINARY MODELS)	DESCRIPTION
Project Information Model	Existing Condition Model	Existing Site Topography	Topology (Digital Terrain Model) of the site area, include GI data and bore hole data
		Existing Street Furniture	Relevant existing planters, traffic sign, road markings, railings, street lighting, barriers, kerbs etc
		Existing Structure	All existing above ground and underground structures of the Service area
		Existing Underground Utilities	All existing underground utilities systems of the Service area
	Proposed Works Model	Geotechnical Slope Model	Site boundary, Geological elements, Slope works and related stabilisation system
		Stormwater Model	Proposed Stormwater systems of the Services area
		Sewerage Model	Proposed Sewerage systems of the Service area
		Water Supply Model	Proposed Water Supply systems of the Service area
	Proposed Building Model	Architectural Model	Architectural Elements, finishes of the Service
		Structural Model	Structural Elements of the Service
		Mechanical Model	Plant/Specialised Mechanical Elements of the Service
		Building Services Model	MEP systems of the Service

Annex 4 : Level of Information Need (LOIN) (to be developed by project officer)

Level of Information Needed is used to describe the geometrical, information and documentation requirement of specific model elements for a specific purpose. The *Contractor* shall refer to the below minimum LOIN requirements and the CEDD LOIN Specifications[4] to develop the project required deliverables. The *Contractor* may further develop the LOIN and breakdown structure according to the project condition and requirements in the CEDD Modelling Manual.

The *Contractor* are required to propose the Model Federation, Model breakdown structure and the LOIN in the BEP based on the below structure and agree with the *Project Manager*.

- *This Annex should be always read with Annex 3. Project officers should select the disciplinary model breakdown structure according to the selection made in Annex 3.*
- *These tables are the basic object elements required in each disciplinary model. They may not include all modelling elements in the Works. Project officers should select the review if any project specific objects are not listed /not required in the Service.*
- *This Annex should read with the LOIN Specification of CEDD. CEDD project officer shall review the latest CEDD LOIN specification to update the CAT code of the selected modelling objects*
- *Project officers shall update the LoD requirement for Detail design and Planning to LoD-G 400 support the requirement of digital fabrication.*
- *Project officers shall add "unique_ID" in the additional information need to support the requirement of DWSS integration (3D control and setting out)*
- *Project officers shall add "Activities_ID" in the additional information need to support the requirement for phase planning.*
- *LoD-G 350 and 500 is no longer applicable according to the CIC standard released in Dec 2020*
- *LoD-G 250 is specified by CEDD to support the modelling of existing object elements. Project officers shall refer to the CEDD LOIN Specification for more details.*
- *The LoD-G of as-built model shall align with the LoD-G requirement of the asset maintenance parties as far as possible.*

[4] Please refer to the CEDD LOIN Specifications on the CAT Code requirements.

4.1 LOIN for Land and Infrastructure Services

4.1.1 Proposed Geotechnical Slope Model

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
1	Baffle	GSM	300	300	300	300	300	300	300	300	300	300	
2	Earthwork (cut/fill) (for slopeworks)	SUS	300	300	300	300	300	300	300	300	300	300	
3	Flexible barrier net, shackle for net, round clip	GSM	300	300	300	300	300	300	300	300	300	300	
4	Flexible Barrier Post, Base plate, Footing, shackle on post, running wheel	GSM	300	300	300	300	300	300	300	300	300	300	
5	Flexible barrier cable rope, rope clip, braking element	GSM	300	300	300	300	300	300	300	300	300	300	
6	Man-made slope (Registered)	GSM	300	300	300	300	300	300	300	300	300	300	
7	Natural slope	GSM	300	300	300	300	300	300	300	300	300	300	
8	Raking Drains	GSM	300	300	300	300	300	300	300	300	300	300	
9	Rigid barrier	GSM	300	300	300	300	300	300	300	300	300	300	
10	Soil Nail	GSM	300	300	300	300	300	300	300	300	300	300	
11	Site/Slope Boundary Polygon	LOT	200	200	200	200	200	200	200	200	200	200	
12	Terrain (Site formation)	DTM	200	200	200	200	200	200	200	200	200	200	
13	Geological model												
13a	Borehole	GEO	300	300	300	300	300	300	300	300	300	300	
13b	Fill	GEO	200	200	200	200	200	200	200	200	200	200	
13c	Compacted Fill	GEO	200	200	200	200	200	200	200	200	200	200	

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
13d	Design Groundwater profile	GEO	200	200	200	200	200	200	200	200	200	200	
14	Ground anchors	GSM	300	300	300	300	300	300	300	300	300	300	
15	Gabion for Rigid Barrier	GSM	300	300	300	300	300	300	300	300	300	300	
16	Cushioning Material for Rigid Barrier	GSM	300	300	300	300	300	300	300	300	300	300	
17	Steel Grating for Rigid Barrier	GSM	300	300	300	300	300	300	300	300	300	300	
18	Tree Ring	GSM	300	300	300	300	300	300	300	300	300	300	
19	Erosion Control Mat	GSM	300	300	300	300	300	300	300	300	300	300	
20	Wire Mesh	GSM	300	300	300	300	300	300	300	300	300	300	

4.1.2 Proposed Roadworks Model

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
1	Earthwork (Cut/Fill)	SUS	300	200	300	200	300	200	300	200	300	300	
2	Kerb	RKB	300	200	300	200	300	200	300	200	300	300	
3	Man-made slope (for road construction)	SRS/SUS	250	200	250	200	250	200	250	200	250	300	
4	Pavement												
4a	Carriage way	RCW	300	200	300	200	300	200	300	200	300	300	
4b	Cycle Track	RCT	300	200	300	200	300	200	300	200	300	300	
4c	Foot path	RFW	300	200	300	200	300	200	300	200	300	300	
5	Retaining Structure	SFD	300	300	300	300	300	300	300	300	300	300	
6	Road Marking	RMK	200	N/A	200	N/A	200	N/A	200	N/A	200	N/A	
7	Site Boundary Polygon	LOT	300	300	300	300	300	300	300	300	300	300	
8	Traffic Island-Other	RIO	300	300	300	300	300	300	300	300	300	300	
9	Traffic Island-Refuge Island	RIR	300	300	300	300	300	300	300	300	300	300	
10	Terrain (Roadworks)	DTM	300	300	300	300	300	300	300	300	300	300	

4.1.3 **Proposed Landscape Model**

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
1	Barrier	FBF	300	200	300	200	300	200	300	200	300	300	
2	Bollard	FBL	300	200	300	200	300	200	300	200	300	300	
3	Hard Surface Cover (e.g. shotcrete)	GSM	300	200	300	200	300	200	300	200	300	300	
4	Lighting	LSL	200	N/A	200	N/A	200	N/A	200	N/A	200	300	
5	Planter (including planter for slope)	LTW	300	200	300	200	300	200	300	200	300	300	
6	Railing / Handrail	FRA	300	200	300	200	300	200	300	200	300	300	
7	Recreation area/facilities	LOT	200	200	300	200	300	200	300	200	300	300	
8	Retaining Wall Finishes	DTL	200	200	300	200	300	200	300	200	300	300	
9	Signage / Traffic Sign	FTW	200	200	300	200	300	200	300	200	300	300	
10	Sign Gantry	VRS	200	200	300	200	300	200	300	200	300	300	
11	Tree (New plant)	LTP	200	200	300	200	300	200	300	200	300	300	
12	Vegetation Surface Cover	GSM	200	200	300	200	300	200	300	200	300	300	

4.1.4 **Proposed Sewerage Model**

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
1	Box Culvert (Sewerage)	FBP	300	200	300	200	300	400	300	200	300	300	
2	Chamber	FCH	300	200	300	200	300	400	300	200	300	300	
3	Rising Main	FRM	300	200	300	200	300	400	300	200	300	300	
4	Sewerage Manhole	FMH	300	200	300	200	300	400	300	200	300	300	
5	Sewerage Manhole Cover	FMC	300	200	300	200	300	400	300	200	300	300	
6	Sewerage Gravity Sewer	FWD	300	200	300	200	300	400	300	200	300	300	
7	Special Manhole	FSH	300	200	300	200	300	400	300	200	300	300	
8	Terminal Manhole	FLH	300	200	300	200	300	400	300	200	300	300	
9	Tunnel (Sewerage)	FTP	300	200	300	200	300	400	300	200	300	300	

4.1.5 **Proposed Stormwater Model**

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
1	Box Culvert	SBP	300	200	300	200	300	200	300	200	300	200	
2	Catchpit	SCH	300	200	300	200	300	200	300	200	300	200	
3	Chamber	SBH	300	200	300	200	300	200	300	200	300	200	
4	Decked Nullah	SDP	300	200	300	200	300	200	300	200	300	200	
5	Inlet	SIH	300	200	300	200	300	200	300	200	300	200	
6	Nullah	SNP	300	200	300	200	300	200	300	200	300	200	
7	Outlet	SNF	300	200	300	200	300	200	300	200	300	200	
8	Gully	GUL	300	200	300	200	300	200	300	200	300	200	
9	Gully Pipe	SWD	300	200	300	200	300	200	300	200	300	200	
10	Sand Trap	SPH	300	200	300	200	300	200	300	200	300	200	
11	Stepped Channel	SSP	300	200	300	200	300	200	300	200	300	200	
12	Stormwater Manhole cover	SMC	300	200	300	200	300	200	300	200	300	200	
13	Stormwater Manhole	SMH	300	200	300	200	300	200	300	200	300	200	
14	Stormwater pipe	SWD	300	200	300	200	300	200	300	200	300	200	
15	Terminal manhole	SLH	300	200	300	200	300	200	300	200	300	200	
16	U-Channel/ Covered U-Channels	SUP	300	200	300	200	300	200	300	200	300	200	
17	Concrete Cover for Channels	SUP	300	200	300	200	300	200	300	200	300	200	
18	Cast Iron Grating for Channels	SUP	300	200	300	200	300	200	300	200	300	200	

4.1.6 Proposed Water Supply Model

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
1	Fresh watermain	WSD	300	200	300	200	300	400	300	200	300	300	
2	Salt Watermain	SSD	300	200	300	200	300	400	300	200	300	300	
3	Chamber /Pump Pit	SBH	300	200	300	200	300	400	300	200	300	300	
4	Fittings	PPF	300	200	300	200	300	400	300	200	300	300	
5	Valve	PPA	300	200	300	200	300	400	300	200	300	300	
6	Thrust Block	THB	300	200	300	200	300	400	300	200	300	300	
7	Fire Hydrant	FS_	200	200	200	200	200	300	200	200	200	300	

4.1.7 Proposed Gas Supply Model

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
1	Gas Pipe	GAP	100	200	100	200	100	300	100	200	100	300	
2	Gas Inspection pit	GIP	300	200	300	200	300	300	300	200	300	300	
4	Gas Value	PPA	100	200	200	200	200	300	200	200	200	300	

4.1.8 Proposed Electric Power Supply Model

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
1	Electric Box	ELQ	300	200	300	200	300	300	300	200	300	300	
2	Electric Inspection pit	EIP	300	200	300	200	300	300	300	200	300	300	
3	Electric Manholes	EMH	300	200	300	200	300	300	300	200	300	300	
4	Power Cables/lines	EPD	100	200	100	200	100	300	100	200	100	300	
5	Transformers	ETR	300	200	300	200	300	300	300	200	300	300	

4.1.9 Proposed Telecommunication Model

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
1	Telecommunication lines	TED	100	200	200	200	100	300	100	200	200	300	
2	Tel Inspection pit	TIP	300	200	300	200	300	300	300	200	300	300	
3	Tel Manholes / Drawpits	TMN	300	200	300	200	300	300	300	200	300	300	

4.1.10 **Proposed Highways Structural Model**

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
1	Super structure model: Bridge												
1a	Abutment	TBR	200	200	200	200	200	300	200	200	200	300	
1b	Bearings	TBR	300	300	300	300	N/A	N/A	300	300	300	300	
1c	Deck/Segment	TBR	200	200	200	200	200	300	200	200	200	300	
1d	Girder/main beams/webs	TBR	200	200	200	200	200	300	200	200	200	300	
1e	Pier/Column/Soffit	TBR	200	200	200	200	200	300	200	200	200	300	
2	Noise Enclosure systems												
2a	Noise Enclosure	TNE	300	300	300	300	300	300	300	300	200	300	
2b	Noise Barrier	TNB	300	300	300	300	300	300	300	300	200	300	
3	Super structure model: Footbridge												
3a	Abutment	TFB	200	200	200	200	200	300	200	200	200	300	
3b	Bearings	TFB	300	300	300	300	N/A	N/A	300	300	300	300	
3c	Deck/Segment	TFB	200	200	200	200	200	300	200	200	200	300	
3d	Girder/main beams/webs	TFB	200	200	200	200	200	300	200	200	200	300	
3e	Pier/Column/Soffit	TFB	200	200	200	200	200	300	200	200	200	300	
3f	Staircases (bridge)	TFB	200	200	200	200	200	300	200	200	200	300	
3g	Pier/Column/Soffit	TFB	200	200	200	200	200	300	200	200	200	300	
3h	Lift Tower (Bridge)	TLT	200	200	200	200	200	300	200	200	200	300	
4	Sub- Structure Model												
4a	Pile	SFD	300	200	300	200	300	300	300	200	300	300	
4b	Pile Cap	SFD	300	200	300	200	300	300	300	200	300	300	
4c	Cable Trench	CTF	300	200	300	200	300	200	300	200	300	200	

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
4d	Excavation and refill for sub-structure	EXL	200	200	200	200	N/A	N/A	200	200	200	200	
4e	Foundation	Multiple*	300	200	300	200	300	200	300	200	300	300	
5	Other Structural elements												
5a	Diaphragm Wall	EXL	300	300	300	300	300	300	300	300	200	300	
5b	Lining	UCL	300	200	300	200	300	200	300	200	300	300	
5c	Tunnel Structure Segments	TIS	300	300	300	300	300	300	300	300	200	300	
5d	Panel Wall	UPL	300	200	300	200	N/A	N/A	300	200	300	300	
5e	Temp. Support Structure	EXL	200	200	200	200	N/A	N/A	300	200	300	200	

4.1.11 **Specialised Systems Model**

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
1	TCSS	SPQ	200	200	200	200	N/A	N/A	200	200	200	300	
2	Tunnel Ventilation System	UFC	200	200	200	200	200	200	200	200	200	200	

4.1.12 **Proposed Architectural Model**

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
1	Access Ladders and Catwalks	ALA	300	200	300	200	N/A	N/A	300	200	300	300	
2	Architectural Wall	TWL	300	200	300	200	N/A	N/A	300	200	300	300	
3	Blue Colour Paint	MAO 5	300	200	300	200	N/A	N/A	300	200	300	300	
4	Ceiling	CEL	300	200	300	200	N/A	N/A	300	200	300	300	
5	Curtain wall/ glass wall	CTP	300	200	300	200	N/A	N/A	300	200	300	300	
6	Door/Entrance	ADO	300	200	300	200	N/A	N/A	300	200	300	300	
7	Elevator / Lift Shaft space	MCO	300	200	300	200	N/A	N/A	300	200	300	300	
8	Finishes	DTL	300	200	300	200	N/A	N/A	300	200	300	300	
9	Floor, Slab	TLA	300	200	300	200	N/A	N/A	300	200	300	300	
10	Furniture	FUR	300	200	300	200	N/A	N/A	300	200	300	300	
11	Gate	AGT	300	200	300	200	N/A	N/A	300	200	300	300	
12	Louvers	WDW	300	200	300	200	N/A	N/A	300	200	300	300	
13	Mass concrete fill	SFD	300	200	300	200	N/A	N/A	300	200	300	300	
14	Non-Slip Yellow Nosing	MAO	300	200	300	200	N/A	N/A	300	200	300	300	
15	Precast Facade	TWL	300	200	300	200	N/A	N/A	300	200	300	300	
16	Railing, handrail	FRA	300	200	300	200	N/A	N/A	300	200	300	300	
17	Ramp	TPD	300	200	300	200	N/A	N/A	300	200	300	300	
18	Roof / Architectural Roof	Multiple*	300	200	300	200	N/A	N/A	300	200	300	300	
19	Roof Gutter		300	200	300	200	N/A	N/A	300	200	300	300	
20	Skylight	WDW	300	200	300	200	N/A	N/A	300	200	300	300	

[5] [Note: To facilitate the review purpose, the codes not available in the BIM harmonisation guideline are highlighted in Yellow]

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
21	Stairs	TTE	300	200	300	200	N/A	N/A	300	200	300	300	
22	Tactile Warning strip	FWS	300	200	300	200	N/A	N/A	300	200	300	300	
23	Window	WDW	300	200	300	200	N/A	N/A	300	200	300	300	

4.1.13 Proposed Structural Model

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
1	Base Plates, Blots, clip angles, fixing etc.	SFM	300	200	300	200	N/A	N/A	300	200	300	300	
2	Beams	TBS	300	200	300	200	300	300	300	200	300	300	
3	Columns	SCL	300	200	300	200	300	300	300	200	300	300	
4	Foundation (Pile, pile cap, ground beams & Footings)	SFD	300	200	300	200	300	300	300	200	300	300	
5	Mass concrete fill	SFD	300	200	300	200	N/A	N/A	300	200	300	300	
6	Slabs	TLA	300	200	300	200	300	300	300	200	300	300	
7	Ramp	TPD	300	200	300	200	300	300	300	200	300	300	
8	Stairs	TTE	300	200	300	200	N/A	N/A	300	200	300	300	
9	Structural Wall	TWL	300	200	300	200	300	300	300	200	300	300	
10	Tank structures	SFD	300	200	300	200	300	300	300	200	300	300	

4.1.14 **Proposed Building Services Model**

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
1	MVAC System												
1a	Exhaust (extract) air duct	BDU	200	200	200	200	200	300	200	200	200	300	
1b	Fresh air duct	BDU	200	200	200	200	200	300	200	200	200	300	
1c	Return air duct	BDU	200	200	200	200	200	300	200	200	200	300	
1ed	Supply air duct	BDU	200	200	200	200	200	300	200	200	200	300	
1e	Access panel	AAP	200	200	200	200	200	300	200	200	200	300	
1f	Air handling unit	BAC	200	200	200	200	200	300	200	200	200	300	
1g	Chillers	MCQ	200	200	200	200	200	300	200	200	200	300	
1h	Chilled water supply pipe	MCQ	200	200	200	200	200	300	200	200	200	300	
1i	Chilled water return pipe	MCQ	200	200	200	200	200	300	200	200	200	300	
1j	Condensate drainpipe	MPI	200	200	200	200	200	300	200	200	200	300	
1k	Damper	BDA	200	200	200	200	200	300	200	200	200	300	
1l	Diffuser, air-boot, air grill, air filter, register	BDI	200	200	200	200	200	300	200	200	200	300	
1m	Fan	BFA	200	200	200	200	200	300	200	200	200	300	
1n	Fan Coil Unit	BFC	200	200	200	200	200	300	200	200	200	300	
1o	Fire damper	BDA	200	200	200	200	200	300	200	200	200	300	
1p	Insulation	PIS	200	200	200	200	200	300	200	200	200	300	
1q	Primary air unit	BAC	200	200	200	200	200	300	200	200	200	300	
1r	Silencer	BSI	200	200	200	200	200	300	200	200	200	300	
1s	Smoke extraction system	MCQ	200	200	200	200	200	300	200	200	200	300	

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
1t	Variable control damper	BDA	200	200	200	200	200	300	200	200	200	300	
1u	Dynamic envelope in MVAC model	DNE	100	100	100	100	N/A	N/A	100	100	100	100	
2	Plumbing System												
2a	Flush water piping	PLM	200	200	200	200	200	400	200	200	200	400	
2b	Fresh water piping (water supplies)	WSD	200	200	200	200	200	400	200	200	200	400	
2c	Tap, faucet	PLM	200	200	200	200	200	400	200	200	200	400	
2d	Valve	MV A	200	200	200	200	200	400	200	200	200	400	
2e	Dynamic envelope in plumbing & water supply model	DNE	100	100	100	100	N/A	N/A	100	100	100	100	
3	Drainage and Sewerage												
3a	Floor drain	DTH	200	200	200	200	200	200	200	200	200	200	
3b	Gully, sealed trapped gully, clean outs and vent	GUL	200	200	200	200	200	200	200	200	200	200	
3c	Kitchen waste pipe work including floor drain, open trapped	MPA	200	200	200	200	200	200	200	200	200	200	
3d	Rainwater, storm water pipe, storm drain	STP	200	200	200	200	200	200	200	200	200	200	
3e	Rainwater outlet	SNF	200	200	200	200	200	200	200	200	200	200	
3f	Surface channel,	SUP	200	200	200	200	200	200	200	200	200	200	

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
	slot channel, external drainage												
3g	Sewerage pipe, foul sewer drains	FWD	200	200	200	200	200	200	200	200	200	200	
3h	Vent pipe	MPI	200	200	200	200	200	200	200	200	200	200	
3i	Dynamic envelope in drainage & sewage model	DNE	100	100	100	100	N/A	N/A	100	100	100	100	
4	Fire Services System												
4a	Fire Alarm Control Panel	BFP	300	200	300	200	200	200	200	200	200	200	
4b	Fire Alarm Audio/ Visual	BFS	300	200	300	200	200	200	200	200	200	200	
4c	Fire Alarm Devices	ALM	300	200	300	200	200	200	200	200	200	200	
4d	Break glass unit	BFB	300	200	300	200	200	200	200	200	200	200	
4e	Fire detection system, heat or smoke detectors	BFD	300	200	300	200	200	200	200	200	200	200	
4f	Fire hydrant/hose reel system	BFH	300	200	300	200	200	200	200	200	200	200	
4g	Sprinkler pipe work	SRK	300	200	300	200	200	200	200	200	200	200	
4h	Sprinkler head	SRK	200	200	200	200	N/A	N/A	200	200	200	200	
4i	Sprinkler valve & flow switch	SRK	200	200	200	200	N/A	N/A	200	200	200	200	
4j	Dynamic envelope fire services model	DNE	100	100	100	100	N/A	N/A	100	100	100	100	
5	Electrical System / MEP System for Marine and Ports												
5a	Cable Draw pit	ECD	200	200	200	200	N/A	N/A	200	200	200	200	
5b	CCTV Camera	BCA	200	200	200	200	N/A	N/A	200	200	200	200	

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
5c	Corrosion Monitoring Pit	CSE	200	200	200	200	N/A	N/A	200	200	200	200	
5d	Corrosion Monitoring Terminal Box	CSE	200	200	200	200	N/A	N/A	200	200	200	200	
5e	Directional Exit Sign	BFX	200	200	200	200	N/A	N/A	200	200	200	200	
5f	Earthing and Lightning equipment	Multi ple*	200	200	200	200	N/A	N/A	200	200	200	200	
5g	Electrical Cable tray, cable containment, power feed, cable ducting	CTF	200	200	200	200	N/A	N/A	200	200	200	200	
5h	Emergency lighting	BLF	200	200	200	200	N/A	N/A	200	200	200	200	
5i	Exit sign	BFX	200	200	200	200	N/A	N/A	200	200	200	200	
5j	GovWifi equipment	CSE	200	200	200	200	N/A	N/A	200	200	200	200	
5k	ICCP Transformer Rectifier	ETR	200	200	200	200	N/A	N/A	200	200	200	200	
5l	Inspection manhole	UM H	200	200	200	200	N/A	N/A	200	200	200	200	
5m	Light fitting/Lighting	BLF	200	200	200	200	N/A	N/A	200	200	200	200	
5n	Panel board, motor control center	ECP	200	200	200	200	N/A	N/A	200	200	200	200	
5o	Pillar box (including ICCP AC power supply pillar box and electric pillar box)	ETR	200	200	200	200	N/A	N/A	200	200	200	200	
5p	Sensors	CSE	200	200	200	200	N/A	N/A	200	200	200	200	
5q	Solar Panel	CSE	200	200	200	200	N/A	N/A	200	200	200	200	

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
5r	Trucking, bus duct, busbar, busway	CTF	200	200	200	200	N/A	N/A	200	200	200	200	
5s	Dynamic envelope electrical model	DNE	100	100	100	100	N/A	N/A	100	100	100	100	

4.2 LOIN for Port and Marine Services

4.2.1 Proposed Fender System Model

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
1	Capping (Rubber or Timber)	FEN	300	200	300	200	300	200	300	200	300	300	PWD_Code
2	Chain for Fender System	FEN	300	200	300	200	300	200	300	200	300	300	PWD_Code
3	Eye blot for Fender System	FEN	300	200	300	200	300	200	300	200	300	300	PWD_Code
4	Frontal Pad	FEN	300	200	300	200	300	200	300	200	300	300	PWD_Code
5	Horizontal Fender (plastic, timber, rubber)	FEN	300	200	300	200	300	200	300	200	300	300	PWD_Code
6	Horizontal/Inclined fender wailing	FEN	300	200	300	200	300	200	300	200	300	300	PWD_Code
7	Rubber Buffer	FEN	300	200	300	200	300	200	300	200	300	300	PWD_Code
8	Step Block (Rubber or Timber)	FEN	300	200	300	200	300	200	300	200	300	300	PWD_Code
9	Steel Bracket	FEN	300	200	300	200	300	200	300	200	300	300	PWD_Code
10	Steel Plate for Wailing system	FEN	300	200	300	200	300	200	300	200	300	300	PWD_Code
11	Vertical Fender (plastic, timber, rubber)	FEN	300	200	300	200	300	200	300	200	300	300	PWD_Code

4.2.2 **Proposed Marine Civil Model (General)**

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
1	Access/Cat Ladder	ALA	300	200	300	200	300	200	300	200	300	300	PWD_Code
2	Terrain (Proposed Profile or Tunnel Seabed Levels)	DTM	200	200	200	200	200	200	200	200	200	300	PWD_Code
3	Barrier Bollard	SIT	300	200	300	200	300	200	300	200	300	300	PWD_Code
4	Bench	SIT	300	200	300	200	300	200	300	200	300	300	PWD_Code
5	Concrete Plinth	SFD	300	200	300	200	300	200	300	200	300	300	PWD_Code
6	Fence	SIT	300	200	300	200	300	200	300	200	300	300	PWD_Code
7	Gate	SIT	300	200	300	200	300	200	300	200	300	300	PWD_Code
8	Lifebuoy	SIT	300	200	300	200	300	200	300	200	300	300	PWD_Code
9	Marine Notice Board	SIT	300	200	300	200	300	200	300	200	300	300	PWD_Code
10	Mooring eye	FEN	300	200	300	200	300	200	300	200	300	300	PWD_Code
11	Mooring Bollard	FEN	300	200	300	200	300	200	300	200	300	300	PWD_Code
12	Navigation Light Post	SIT	300	200	300	200	300	200	300	200	300	300	PWD_Code
13	Pier Notice board	SIT	300	200	300	200	300	200	300	200	300	300	PWD_Code
14	Terrain (Site formation)	DTM	300	200	300	200	300	200	300	200	300	300	PWD_Code
15	Railing/Handrail	FRA	300	200	300	200	300	200	300	200	300	300	PWD_Code
16	Signage/information plate (include landing /structural no. plate, pier)	SIT	300	200	300	200	300	200	300	200	300	300	PWD_Code
17	Step iron	FEN	300	200	300	200	300	200	300	200	300	300	PWD_Code
18	Site Boundary Polygon	LOT	300	200	300	200	300	200	300	200	300	300	
19	Tidal Gauge House	SIT	300	200	300	200	300	200	300	200	300	300	PWD_Code
20	Tidal Gauge Tubes	SIT	300	200	300	200	300	200	300	200	300	300	PWD_Code

4.2.3 **Proposed Marine Structural Model**

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
1	Terrain (Shoreline / Beach Finish Level)	DTM	300	200	300	200	300	200	300	200	300	300	
2	Pile Cap	MSF	300	200	300	200	300	200	300	200	300	300	PWD_Code
3	Pile Foundation	MSF	300	200	300	200	300	200	300	200	300	300	PWD_Code
4	Concrete Foundation for Beacon	MSF	300	200	300	200	300	200	300	200	300	300	PWD_Code
5	Anchor Blot/Post	MSF	300	200	300	200	300	200	300	200	300	300	PWD_Code
6	Structural Beam (Concrete Beam, Steel Beam and Tie Beam)	MSF	300	200	300	200	300	200	300	200	300	300	PWD_Code
7	Structural Column (Concrete Column, Steel Column and Post)	MSO	300	200	300	200	300	200	300	200	300	300	PWD_Code
8	Bracing (Horizontal/Vertical)	MSF	300	200	300	200	300	200	300	200	300	300	PWD_Code
9	Slab/Pier Deck	MSO	300	200	300	200	300	200	300	200	300	300	PWD_Code
10	Precast Beam Slab Panel	MSO	300	200	300	200	300	200	300	200	300	300	PWD_Code
11	Ramp	MSO	300	200	300	200	300	200	300	200	300	300	PWD_Code
12	Corbel/Concrete Bracket for Pier	MSO	300	200	300	200	300	200	300	200	300	300	PWD_Code
13	Structural wall / retaining wall	MSO	300	200	300	200	300	200	300	200	300	300	PWD_Code
14	Concrete structure for Beacon, Dolphin, vertical seawall, and a solid pier	MSF	300	200	300	200	300	200	300	200	300	300	PWD_Code
15	Steel structure for Beacon	MSO	300	200	300	200	300	200	300	200	200	300	PWD_Code
16	Access Structure	MSO	300	200	300	200	300	200	300	200	300	300	PWD_Code

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
17	Landing Platform	MSO	300	200	300	200	300	200	300	200	300	300	PWD_Code
18	Landing Staircase Structure	MSO	300	200	300	200	300	200	300	200	300	300	PWD_Code
19	Landing Step	MSO	300	200	300	200	300	200	300	200	300	300	PWD_Code
20	Concrete Coping	MSF	300	200	300	200	300	200	300	200	300	300	PWD_Code
21	Gabion Wall	MSO	300	200	300	200	300	200	300	200	300	300	PWD_Code
22	Wave Absorption Chamber	MSO	300	200	300	200	300	200	300	200	300	300	PWD_Code
23	Precast Concrete Block (include seawall block, solid pier concrete block, wave wall/barrier)	MSO	300	200	300	200	300	200	300	200	300	300	PWD_Code
24	Rock Armour for seawall and breakwater	MSO	200	200	200	200	N/A	N/A	200	200	200	300	PWD_Code
25	Rock Fill	MSO	200	200	200	200	N/A	N/A	200	200	200	300	PWD_Code
26	Berm Stone	MSO	200	200	200	200	N/A	N/A	200	200	200	300	PWD_Code
27	Bagged Concrete	MSO	200	200	200	200	N/A	N/A	200	200	200	300	PWD_Code
28	Levelling Stone	MSO	200	200	200	200	N/A	N/A	200	200	200	300	PWD_Code
29	Pell Mell Rubble	MSO	200	200	200	200	N/A	N/A	200	200	200	300	PWD_Code

4.2.4 **Proposed Building Services Model**

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
1	MVAC System												
1a	Exhaust (extract) air duct	BDU	200	200	200	200	200	300	200	200	200	300	
1b	Fresh air duct	BDU	200	200	200	200	200	300	200	200	200	300	
1c	Return air duct	BDU	200	200	200	200	200	300	200	200	200	300	
1ed	Supply air duct	BDU	200	200	200	200	200	300	200	200	200	300	
1e	Access panel	AAP	200	200	200	200	200	300	200	200	200	300	
1f	Air handling unit	BAC	200	200	200	200	200	300	200	200	200	300	
1g	Chillers	MCQ	200	200	200	200	200	300	200	200	200	300	
1h	Chilled water supply pipe	MCQ	200	200	200	200	200	300	200	200	200	300	
1i	Chilled water return pipe	MCQ	200	200	200	200	200	300	200	200	200	300	
1j	Condensate drainpipe	MPI	200	200	200	200	200	300	200	200	200	300	
1k	Damper	BDA	200	200	200	200	200	300	200	200	200	300	
1l	Diffuser, air-boot, air grill, air filter, register	BDI	200	200	200	200	200	300	200	200	200	300	
1m	Fan	BFA	200	200	200	200	200	300	200	200	200	300	
1n	Fan Coil Unit	BFC	200	200	200	200	200	300	200	200	200	300	
1o	Fire damper	BDA	200	200	200	200	200	300	200	200	200	300	
1p	Insulation	PIS	200	200	200	200	200	300	200	200	200	300	
1q	Primary air unit	BAC	200	200	200	200	200	300	200	200	200	300	
1r	Silencer	BSI	200	200	200	200	200	300	200	200	200	300	
1s	Smoke extraction system	MCQ	200	200	200	200	200	300	200	200	200	300	

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
1t	Variable control damper	BDA	200	200	200	200	200	300	200	200	200	300	
1u	Dynamic envelope in MVAC model	DNE	100	100	100	100	N/A	N/A	100	100	100	100	
2	Plumbing System												
2a	Flush water piping	PLM	200	200	200	200	200	400	200	200	200	400	
2b	Fresh water piping (water supplies)	WSD	200	200	200	200	200	400	200	200	200	400	
2c	Tap, faucet	PLM	200	200	200	200	200	400	200	200	200	400	
2d	Valve	MV A	200	200	200	200	200	400	200	200	200	400	
2e	Dynamic envelope in plumbing & water supply model	DNE	100	100	100	100	N/A	N/A	100	100	100	100	
3	Drainage and Sewerage												
3a	Floor drain	DTH	200	200	200	200	200	200	200	200	200	200	
3b	Gully, sealed trapped gully, clean outs and vent	GUL	200	200	200	200	200	200	200	200	200	200	
3c	Kitchen waste pipe work including floor drain, open trapped	MPA	200	200	200	200	200	200	200	200	200	200	
3d	Rainwater, storm water pipe, storm drain	STP	200	200	200	200	200	200	200	200	200	200	
3e	Rainwater outlet	SNF	200	200	200	200	200	200	200	200	200	200	
3f	Surface channel,	SUP	200	200	200	200	200	200	200	200	200	200	

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
	slot channel, external drainage												
3g	Sewerage pipe, foul sewer drains	FWD	200	200	200	200	200	200	200	200	200	200	
3h	Vent pipe	MPI	200	200	200	200	200	200	200	200	200	200	
3i	Dynamic envelope in drainage & sewage model	DNE	100	100	100	100	N/A	N/A	100	100	100	100	
4	Fire Services System												
4a	Fire Alarm Control Panel	BFP	300	200	300	200	200	200	200	200	200	200	
4b	Fire Alarm Audio/ Visual	BFS	300	200	300	200	200	200	200	200	200	200	
4c	Fire Alarm Devices	ALM	300	200	300	200	200	200	200	200	200	200	
4d	Break glass unit	BFB	300	200	300	200	200	200	200	200	200	200	
4e	Fire detection system, heat or smoke detectors	BFD	300	200	300	200	200	200	200	200	200	200	
4f	Fire hydrant/hose reel system	BFH	300	200	300	200	200	200	200	200	200	200	
4g	Sprinkler pipe work	SRK	300	200	300	200	200	200	200	200	200	200	
4h	Sprinkler head	SRK	200	200	200	200	N/A	N/A	200	200	200	200	
4i	Sprinkler valve & flow switch	SRK	200	200	200	200	N/A	N/A	200	200	200	200	
4j	Dynamic envelope fire services model	DNE	100	100	100	100	N/A	N/A	100	100	100	100	
5	Electrical System / MEP System for Marine and Ports												
5a	Cable Draw pit	ECD	200	200	200	200	N/A	N/A	200	200	200	200	
5b	CCTV Camera	BCA	200	200	200	200	N/A	N/A	200	200	200	200	

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
5c	Corrosion Monitoring Pit	CSE	200	200	200	200	N/A	N/A	200	200	200	200	
5d	Corrosion Monitoring Terminal Box	CSE	200	200	200	200	N/A	N/A	200	200	200	200	
5e	Directional Exit Sign	BFX	200	200	200	200	N/A	N/A	200	200	200	200	
5f	Earthing and Lightning equipment	Multi ple*	200	200	200	200	N/A	N/A	200	200	200	200	
5g	Electrical Cable tray, cable containment, power feed, cable ducting	CTF	200	200	200	200	N/A	N/A	200	200	200	200	
5h	Emergency lighting	BLF	200	200	200	200	N/A	N/A	200	200	200	200	
5i	Exit sign	BFX	200	200	200	200	N/A	N/A	200	200	200	200	
5j	GovWifi equipment	CSE	200	200	200	200	N/A	N/A	200	200	200	200	
5k	ICCP Transformer Rectifier	ETR	200	200	200	200	N/A	N/A	200	200	200	200	
5l	Inspection manhole	UM H	200	200	200	200	N/A	N/A	200	200	200	200	
5m	Light fitting/Lighting	BLF	200	200	200	200	N/A	N/A	200	200	200	200	
5n	Panel board, motor control center	ECP	200	200	200	200	N/A	N/A	200	200	200	200	
5o	Pillar box (including ICCP AC power supply pillar box and electric pillar box)	ETR	200	200	200	200	N/A	N/A	200	200	200	200	
5p	Sensors	CSE	200	200	200	200	N/A	N/A	200	200	200	200	
5q	Solar Panel	CSE	200	200	200	200	N/A	N/A	200	200	200	200	

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
5r	Trucking, bus duct, busbar, busway	CTF	200	200	200	200	N/A	N/A	200	200	200	200	
5s	Dynamic envelope electrical model	DNE	100	100	100	100	N/A	N/A	100	100	100	100	

4.2.5 **Proposed Architectural Model**

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
1	Access Ladders and Catwalks	ALA	300	200	300	200	N/A	N/A	300	200	300	300	
2	Architectural Wall	TWL	300	200	300	200	N/A	N/A	300	200	300	300	
3	Blue Colour Paint	MAO 6	300	200	300	200	N/A	N/A	300	200	300	300	
4	Ceiling	CEL	300	200	300	200	N/A	N/A	300	200	300	300	
5	Curtain wall/ glass wall	CTP	300	200	300	200	N/A	N/A	300	200	300	300	
6	Door/Entrance	ADO	300	200	300	200	N/A	N/A	300	200	300	300	
7	Elevator / Lift Shaft space	MCO	300	200	300	200	N/A	N/A	300	200	300	300	
8	Finishes	DTL	300	200	300	200	N/A	N/A	300	200	300	300	
9	Floor, Slab	TLA	300	200	300	200	N/A	N/A	300	200	300	300	
10	Furniture	FUR	300	200	300	200	N/A	N/A	300	200	300	300	
11	Gate	AGT	300	200	300	200	N/A	N/A	300	200	300	300	
12	Louvers	WDW	300	200	300	200	N/A	N/A	300	200	300	300	
13	Mass concrete fill	SFD	300	200	300	200	N/A	N/A	300	200	300	300	
14	Non-Slip Yellow Nosing	MAO	300	200	300	200	N/A	N/A	300	200	300	300	
15	Precast Facade	TWL	300	200	300	200	N/A	N/A	300	200	300	300	
16	Railing, handrail	FRA	300	200	300	200	N/A	N/A	300	200	300	300	
17	Ramp	TPD	300	200	300	200	N/A	N/A	300	200	300	300	
18	Roof / Architectural Roof	Multiple*	300	200	300	200	N/A	N/A	300	200	300	300	
19	Roof Gutter		300	200	300	200	N/A	N/A	300	200	300	300	
20	Skylight	WDW	300	200	300	200	N/A	N/A	300	200	300	300	

[6] [Note: To facilitate the review purpose, the codes not available in the BIM harmonisation guideline are highlighted in Yellow]

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
21	Stairs	TTE	300	200	300	200	N/A	N/A	300	200	300	300	
22	Tactile Warning strip	FWS	300	200	300	200	N/A	N/A	300	200	300	300	
23	Window	WDW	300	200	300	200	N/A	N/A	300	200	300	300	

4.3 LOIN for Geotechnical and Engineering Services

4.3.1 Proposed Geotechnical Slope Model

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
1	Baffle	GSM	300	300	300	300	300	300	300	300	300	300	
2	Earthwork (cut/fill) (for slopeworks)	SUS	300	300	300	300	300	300	300	300	300	300	
3	Flexible barrier net, shackle for net, round clip	GSM	300	300	300	300	300	300	300	300	300	300	
4	Flexible Barrier Post, Base plate, Footing, shackle on post, running wheel	GSM	300	300	300	300	300	300	300	300	300	300	
5	Flexible barrier cable rope, rope clip, braking element	GSM	300	300	300	300	300	300	300	300	300	300	
6	Man-made slope (Registered)	GSM	300	300	300	300	300	300	300	300	300	300	
7	Natural slope	GSM	300	300	300	300	300	300	300	300	300	300	
8	Raking Drains	GSM	300	300	300	300	300	300	300	300	300	300	
9	Rigid barrier	GSM	300	300	300	300	300	300	300	300	300	300	
10	Soil Nail	GSM	300	300	300	300	300	300	300	300	300	300	
11	Site/Slope Boundary Polygon	LOT	200	200	200	200	200	200	200	200	200	200	
12	Terrain (Site formation)	DTM	200	200	200	200	200	200	200	200	200	200	
13	Geological model												
13a	Borehole	GEO	300	300	300	300	300	300	300	300	300	300	
13b	Fill	GEO	200	200	200	200	200	200	200	200	200	200	
13c	Compacted Fill	GEO	200	200	200	200	200	200	200	200	200	200	

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
13d	Design Groundwater profile	GEO	200	200	200	200	200	200	200	200	200	200	
14	Ground anchors	GSM	300	300	300	300	300	300	300	300	300	300	
15	Gabion for Rigid Barrier	GSM	300	300	300	300	300	300	300	300	300	300	
16	Cushioning Material for Rigid Barrier	GSM	300	300	300	300	300	300	300	300	300	300	
17	Steel Grating for Rigid Barrier	GSM	300	300	300	300	300	300	300	300	300	300	
18	Tree Ring	GSM	300	300	300	300	300	300	300	300	300	300	
19	Erosion Control Mat	GSM	300	300	300	300	300	300	300	300	300	300	
20	Wire Mesh	GSM	300	300	300	300	300	300	300	300	300	300	

4.3.2 Proposed Geotechnical Structure Model

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
1	Foundation (pile)	SFD	300	200	300	200	300	200	300	200	300	200	
2	Foundation (pile cap)	SFD	300	200	300	200	300	200	300	200	300	200	
3	Foundation (ground beam)	SFD	300	200	300	200	300	200	300	200	300	200	
4	Footing	SFD	300	200	300	200	300	200	300	200	300	200	
5	Mass Concrete Infill (including No-fines Concrete)	GSM	300	200	300	200	300	200	300	200	300	200	
6	Retaining Wall on Slope	SUS	300	200	300	200	300	200	300	200	300	200	
7	Structural concrete beam	GSM	300	200	300	200	300	200	300	200	300	200	
8	Structural concrete wall	GSM	300	200	300	200	300	200	300	200	300	200	
9	Structural concrete column	GSM	300	200	300	200	300	200	300	200	300	200	
10	Structural concrete slab	GSM	300	200	300	200	300	200	300	200	300	200	
11	Structural steel column, post	GSM	300	200	300	200	300	200	300	200	300	200	
12	Steel access ladder	GSM	300	200	300	200	300	200	300	200	300	200	
13	Temporary work, temporary structure, platform	GSM	200	200	200	200	200	200	200	200	200	200	
14	Steel Handrailing (to Maintenance Stairway on Slope)	GSM	300	200	300	200	300	200	300	200	300	200	
15	Steel Staircase	GSM	300	200	300	200	300	200	300	200	300	200	
16	Steel Gate	GSM	300	200	300	200	300	200	300	200	300	200	
17	Maintenance Access (incl. Concrete Stairway/Berm)	GSM	300	200	300	200	300	200	300	200	300	200	

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
18	Foundation (Other)	SFD	300	200	300	200	300	200	300	200	300	200	
19	Chain Link Fence on Slope	GSM	300	200	300	200	300	200	300	200	300	200	
20	Skin Wall	GSM	300	200	300	200	300	200	300	200	300	200	

4.3.3 Proposed Stormwater Model

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
1	Box Culvert	SBP	300	200	300	200	300	200	300	200	300	200	
2	Catchpit	SCH	300	200	300	200	300	200	300	200	300	200	
3	Chamber	SBH	300	200	300	200	300	200	300	200	300	200	
4	Decked Nullah	SDP	300	200	300	200	300	200	300	200	300	200	
5	Inlet	SIH	300	200	300	200	300	200	300	200	300	200	
6	Nullah	SNP	300	200	300	200	300	200	300	200	300	200	
7	Outlet	SNF	300	200	300	200	300	200	300	200	300	200	
8	Gully	GUL	300	200	300	200	300	200	300	200	300	200	
9	Gully Pipe	SWD	300	200	300	200	300	200	300	200	300	200	
10	Sand Trap	SPH	300	200	300	200	300	200	300	200	300	200	
11	Stepped Channel	SSP	300	200	300	200	300	200	300	200	300	200	
12	Stormwater Manhole cover	SMC	300	200	300	200	300	200	300	200	300	200	
13	Stormwater Manhole	SMH	300	200	300	200	300	200	300	200	300	200	
14	Stormwater pipe	SWD	300	200	300	200	300	200	300	200	300	200	
15	Terminal manhole	SLH	300	200	300	200	300	200	300	200	300	200	
16	U-Channel/ Covered U-Channels	SUP	300	200	300	200	300	200	300	200	300	200	
17	Concrete Cover for Channels	SUP	300	200	300	200	300	200	300	200	300	200	
18	Cast Iron Grating for Channels	SUP	300	200	300	200	300	200	300	200	300	200	

4.3.4 **Proposed Landscape Model**

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
1	Barrier	FBF	300	200	300	200	300	200	300	200	300	300	
2	Bollard	FBL	300	200	300	200	300	200	300	200	300	300	
3	Hard Surface Cover (e.g. shotcrete)	GSM	300	200	300	200	300	200	300	200	300	300	
4	Lighting	LSL	200	N/A	200	N/A	200	N/A	200	N/A	200	300	
5	Planter (including planter for slope)	LTW	300	200	300	200	300	200	300	200	300	300	
6	Railing / Handrail	FRA	300	200	300	200	300	200	300	200	300	300	
7	Recreation area/facilities	LOT	200	200	300	200	300	200	300	200	300	300	
8	Retaining Wall Finishes	DTL	200	200	300	200	300	200	300	200	300	300	
9	Signage / Traffic Sign	FTW	200	200	300	200	300	200	300	200	300	300	
10	Sign Gantry	VRS	200	200	300	200	300	200	300	200	300	300	
11	Tree (New plant)	LTP	200	200	300	200	300	200	300	200	300	300	
12	Vegetation Surface Cover	GSM	200	200	300	200	300	200	300	200	300	300	

4.4 LOIN for Environmental and Sustainability Services

4.4.1 Proposed Geotechnical Slope Model

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
1	Baffle	GSM	300	300	300	300	300	300	300	300	300	300	
2	Earthwork (cut/fill) (for slopeworks)	SUS	300	300	300	300	300	300	300	300	300	300	
3	Flexible barrier net, shackle for net, round clip	GSM	300	300	300	300	300	300	300	300	300	300	
4	Flexible Barrier Post, Base plate, Footing, shackle on post, running wheel	GSM	300	300	300	300	300	300	300	300	300	300	
5	Flexible barrier cable rope, rope clip, braking element	GSM	300	300	300	300	300	300	300	300	300	300	
6	Man-made slope (Registered)	GSM	300	300	300	300	300	300	300	300	300	300	
7	Natural slope	GSM	300	300	300	300	300	300	300	300	300	300	
8	Raking Drains	GSM	300	300	300	300	300	300	300	300	300	300	
9	Rigid barrier	GSM	300	300	300	300	300	300	300	300	300	300	
10	Soil Nail	GSM	300	300	300	300	300	300	300	300	300	300	
11	Site/Slope Boundary Polygon	LOT	200	200	200	200	200	200	200	200	200	200	
12	Terrain (Site formation)	DTM	200	200	200	200	200	200	200	200	200	200	
13	Geological model												
13a	Borehole	GEO	300	300	300	300	300	300	300	300	300	300	
13b	Fill	GEO	200	200	200	200	200	200	200	200	200	200	
13c	Compacted Fill	GEO	200	200	200	200	200	200	200	200	200	200	

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
13d	Design Groundwater profile	GEO	200	200	200	200	200	200	200	200	200	200	
14	Ground anchors	GSM	300	300	300	300	300	300	300	300	300	300	
15	Gabion for Rigid Barrier	GSM	300	300	300	300	300	300	300	300	300	300	
16	Cushioning Material for Rigid Barrier	GSM	300	300	300	300	300	300	300	300	300	300	
17	Steel Grating for Rigid Barrier	GSM	300	300	300	300	300	300	300	300	300	300	
18	Tree Ring	GSM	300	300	300	300	300	300	300	300	300	300	
19	Erosion Control Mat	GSM	300	300	300	300	300	300	300	300	300	300	
20	Wire Mesh	GSM	300	300	300	300	300	300	300	300	300	300	

4.4.2 Proposed Stormwater Model

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
1	Box Culvert	SBP	300	200	300	200	300	200	300	200	300	200	
2	Catchpit	SCH	300	200	300	200	300	200	300	200	300	200	
3	Chamber	SBH	300	200	300	200	300	200	300	200	300	200	
4	Decked Nullah	SDP	300	200	300	200	300	200	300	200	300	200	
5	Inlet	SIH	300	200	300	200	300	200	300	200	300	200	
6	Nullah	SNP	300	200	300	200	300	200	300	200	300	200	
7	Outlet	SNF	300	200	300	200	300	200	300	200	300	200	
8	Gully	GUL	300	200	300	200	300	200	300	200	300	200	
9	Gully Pipe	SWD	300	200	300	200	300	200	300	200	300	200	
10	Sand Trap	SPH	300	200	300	200	300	200	300	200	300	200	
11	Stepped Channel	SSP	300	200	300	200	300	200	300	200	300	200	
12	Stormwater Manhole cover	SMC	300	200	300	200	300	200	300	200	300	200	
13	Stormwater Manhole	SMH	300	200	300	200	300	200	300	200	300	200	
14	Stormwater pipe	SWD	300	200	300	200	300	200	300	200	300	200	
15	Terminal manhole	SLH	300	200	300	200	300	200	300	200	300	200	
16	U-Channel/ Covered U-Channels	SUP	300	200	300	200	300	200	300	200	300	200	
17	Concrete Cover for Channels	SUP	300	200	300	200	300	200	300	200	300	200	
18	Cast Iron Grating for Channels	SUP	300	200	300	200	300	200	300	200	300	200	

4.4.3 Proposed Sewerage Model

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
1	Box Culvert (Sewerage)	FBP	300	200	300	200	300	400	300	200	300	300	
2	Chamber	FCH	300	200	300	200	300	400	300	200	300	300	
3	Rising Main	FRM	300	200	300	200	300	400	300	200	300	300	
4	Sewerage Manhole	FMH	300	200	300	200	300	400	300	200	300	300	
5	Sewerage Manhole Cover	FMC	300	200	300	200	300	400	300	200	300	300	
6	Sewerage Gravity Sewer	FWD	300	200	300	200	300	400	300	200	300	300	
7	Special Manhole	FSH	300	200	300	200	300	400	300	200	300	300	
8	Terminal Manhole	FLH	300	200	300	200	300	400	300	200	300	300	
9	Tunnel (Sewerage)	FTP	300	200	300	200	300	400	300	200	300	300	

4.4.4 Proposed Water Supply Model

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
1	Fresh watermain	WSD	300	200	300	200	300	400	300	200	300	300	
2	Salt Watermain	SSD	300	200	300	200	300	400	300	200	300	300	
3	Chamber /Pump Pit	SBH	300	200	300	200	300	400	300	200	300	300	
4	Fittings	PPF	300	200	300	200	300	400	300	200	300	300	
5	Valve	PPA	300	200	300	200	300	400	300	200	300	300	
6	Thrust Block	THB	300	200	300	200	300	400	300	200	300	300	
7	Fire Hydrant	FS_	200	200	200	200	200	300	200	200	200	300	

4.4.5 Proposed Architectural Model

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
1	Access Ladders and Catwalks	ALA	300	200	300	200	N/A	N/A	300	200	300	300	
2	Architectural Wall	TWL	300	200	300	200	N/A	N/A	300	200	300	300	
3	Blue Colour Paint	MAO 7	300	200	300	200	N/A	N/A	300	200	300	300	
4	Ceiling	CEL	300	200	300	200	N/A	N/A	300	200	300	300	
5	Curtain wall/ glass wall	CTP	300	200	300	200	N/A	N/A	300	200	300	300	
6	Door/Entrance	ADO	300	200	300	200	N/A	N/A	300	200	300	300	
7	Elevator / Lift Shaft space	MCO	300	200	300	200	N/A	N/A	300	200	300	300	
8	Finishes	DTL	300	200	300	200	N/A	N/A	300	200	300	300	
9	Floor, Slab	TLA	300	200	300	200	N/A	N/A	300	200	300	300	
10	Furniture	FUR	300	200	300	200	N/A	N/A	300	200	300	300	
11	Gate	AGT	300	200	300	200	N/A	N/A	300	200	300	300	
12	Louvers	WDW	300	200	300	200	N/A	N/A	300	200	300	300	
13	Mass concrete fill	SFD	300	200	300	200	N/A	N/A	300	200	300	300	
14	Non-Slip Yellow Nosing	MAO	300	200	300	200	N/A	N/A	300	200	300	300	
15	Precast Facade	TWL	300	200	300	200	N/A	N/A	300	200	300	300	
16	Railing, handrail	FRA	300	200	300	200	N/A	N/A	300	200	300	300	
17	Ramp	TPD	300	200	300	200	N/A	N/A	300	200	300	300	
18	Roof / Architectural Roof	Multiple*	300	200	300	200	N/A	N/A	300	200	300	300	
19	Roof Gutter		300	200	300	200	N/A	N/A	300	200	300	300	

[7] [Note: To facilitate the review purpose, the codes not available in the BIM harmonisation guideline are highlighted in Yellow]

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
20	Skylight	WDW	300	200	300	200	N/A	N/A	300	200	300	300	
21	Stairs	TTE	300	200	300	200	N/A	N/A	300	200	300	300	
22	Tactile Warning strip	FWS	300	200	300	200	N/A	N/A	300	200	300	300	
23	Window	WDW	300	200	300	200	N/A	N/A	300	200	300	300	

4.4.6 Proposed Structural Model

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
1	Base Plates, Blots, clip angles, fixing etc.	SFM	300	200	300	200	N/A	N/A	300	200	300	300	
2	Beams	TBS	300	200	300	200	300	300	300	200	300	300	
3	Columns	SCL	300	200	300	200	300	300	300	200	300	300	
4	Foundation (Pile, pile cap, ground beams & Footings)	SFD	300	200	300	200	300	300	300	200	300	300	
5	Mass concrete fill	SFD	300	200	300	200	N/A	N/A	300	200	300	300	
6	Slabs	TLA	300	200	300	200	300	300	300	200	300	300	
7	Ramp	TPD	300	200	300	200	300	300	300	200	300	300	
8	Stairs	TTE	300	200	300	200	N/A	N/A	300	200	300	300	
9	Structural Wall	TWL	300	200	300	200	300	300	300	200	300	300	
10	Tank structures	SFD	300	200	300	200	300	300	300	200	300	300	

4.4.7 **Proposed Building Services Model**

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
1	MVAC System												
1a	Exhaust (extract) air duct	BDU	200	200	200	200	200	300	200	200	200	300	
1b	Fresh air duct	BDU	200	200	200	200	200	300	200	200	200	300	
1c	Return air duct	BDU	200	200	200	200	200	300	200	200	200	300	
1ed	Supply air duct	BDU	200	200	200	200	200	300	200	200	200	300	
1e	Access panel	AAP	200	200	200	200	200	300	200	200	200	300	
1f	Air handling unit	BAC	200	200	200	200	200	300	200	200	200	300	
1g	Chillers	MCQ	200	200	200	200	200	300	200	200	200	300	
1h	Chilled water supply pipe	MCQ	200	200	200	200	200	300	200	200	200	300	
1i	Chilled water return pipe	MCQ	200	200	200	200	200	300	200	200	200	300	
1j	Condensate drainpipe	MPI	200	200	200	200	200	300	200	200	200	300	
1k	Damper	BDA	200	200	200	200	200	300	200	200	200	300	
1l	Diffuser, air-boot, air grill, air filter, register	BDI	200	200	200	200	200	300	200	200	200	300	
1m	Fan	BFA	200	200	200	200	200	300	200	200	200	300	
1n	Fan Coil Unit	BFC	200	200	200	200	200	300	200	200	200	300	
1o	Fire damper	BDA	200	200	200	200	200	300	200	200	200	300	
1p	Insulation	PIS	200	200	200	200	200	300	200	200	200	300	
1q	Primary air unit	BAC	200	200	200	200	200	300	200	200	200	300	
1r	Silencer	BSI	200	200	200	200	200	300	200	200	200	300	
1s	Smoke extraction system	MCQ	200	200	200	200	200	300	200	200	200	300	

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
1t	Variable control damper	BDA	200	200	200	200	200	300	200	200	200	300	
1u	Dynamic envelope in MVAC model	DNE	100	100	100	100	N/A	N/A	100	100	100	100	
2	Plumbing System												
2a	Flush water piping	PLM	200	200	200	200	200	400	200	200	200	400	
2b	Fresh water piping (water supplies)	WSD	200	200	200	200	200	400	200	200	200	400	
2c	Tap, faucet	PLM	200	200	200	200	200	400	200	200	200	400	
2d	Valve	MV A	200	200	200	200	200	400	200	200	200	400	
2e	Dynamic envelope in plumbing & water supply model	DNE	100	100	100	100	N/A	N/A	100	100	100	100	
3	Drainage and Sewerage												
3a	Floor drain	DTH	200	200	200	200	200	200	200	200	200	200	
3b	Gully, sealed trapped gully, clean outs and vent	GUL	200	200	200	200	200	200	200	200	200	200	
3c	Kitchen waste pipe work including floor drain, open trapped	MPA	200	200	200	200	200	200	200	200	200	200	
3d	Rainwater, storm water pipe, storm drain	STP	200	200	200	200	200	200	200	200	200	200	
3e	Rainwater outlet	SNF	200	200	200	200	200	200	200	200	200	200	
3f	Surface channel,	SUP	200	200	200	200	200	200	200	200	200	200	

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
	slot channel, external drainage												
3g	Sewerage pipe, foul sewer drains	FWD	200	200	200	200	200	200	200	200	200	200	
3h	Vent pipe	MPI	200	200	200	200	200	200	200	200	200	200	
3i	Dynamic envelope in drainage & sewage model	DNE	100	100	100	100	N/A	N/A	100	100	100	100	
4	Fire Services System												
4a	Fire Alarm Control Panel	BFP	300	200	300	200	200	200	200	200	200	200	
4b	Fire Alarm Audio/ Visual	BFS	300	200	300	200	200	200	200	200	200	200	
4c	Fire Alarm Devices	ALM	300	200	300	200	200	200	200	200	200	200	
4d	Break glass unit	BFB	300	200	300	200	200	200	200	200	200	200	
4e	Fire detection system, heat or smoke detectors	BFD	300	200	300	200	200	200	200	200	200	200	
4f	Fire hydrant/hose reel system	BFH	300	200	300	200	200	200	200	200	200	200	
4g	Sprinkler pipe work	SRK	300	200	300	200	200	200	200	200	200	200	
4h	Sprinkler head	SRK	200	200	200	200	N/A	N/A	200	200	200	200	
4i	Sprinkler valve & flow switch	SRK	200	200	200	200	N/A	N/A	200	200	200	200	
4j	Dynamic envelope fire services model	DNE	100	100	100	100	N/A	N/A	100	100	100	100	
5	Electrical System / MEP System for Marine and Ports												
5a	Cable Draw pit	ECD	200	200	200	200	N/A	N/A	200	200	200	200	
5b	CCTV Camera	BCA	200	200	200	200	N/A	N/A	200	200	200	200	

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
5c	Corrosion Monitoring Pit	CSE	200	200	200	200	N/A	N/A	200	200	200	200	
5d	Corrosion Monitoring Terminal Box	CSE	200	200	200	200	N/A	N/A	200	200	200	200	
5e	Directional Exit Sign	BFX	200	200	200	200	N/A	N/A	200	200	200	200	
5f	Earthing and Lightning equipment	Multi ple*	200	200	200	200	N/A	N/A	200	200	200	200	
5g	Electrical Cable tray, cable containment, power feed, cable ducting	CTF	200	200	200	200	N/A	N/A	200	200	200	200	
5h	Emergency lighting	BLF	200	200	200	200	N/A	N/A	200	200	200	200	
5i	Exit sign	BFX	200	200	200	200	N/A	N/A	200	200	200	200	
5j	GovWifi equipment	CSE	200	200	200	200	N/A	N/A	200	200	200	200	
5k	ICCP Transformer Rectifier	ETR	200	200	200	200	N/A	N/A	200	200	200	200	
5l	Inspection manhole	UM H	200	200	200	200	N/A	N/A	200	200	200	200	
5m	Light fitting/Lighting	BLF	200	200	200	200	N/A	N/A	200	200	200	200	
5n	Panel board, motor control center	ECP	200	200	200	200	N/A	N/A	200	200	200	200	
5o	Pillar box (including ICCP AC power supply pillar box and electric pillar box)	ETR	200	200	200	200	N/A	N/A	200	200	200	200	
5p	Sensors	CSE	200	200	200	200	N/A	N/A	200	200	200	200	
5q	Solar Panel	CSE	200	200	200	200	N/A	N/A	200	200	200	200	

Item	Object Name	CAT Code	Initial PIM		3D Coordination		Design Evaluation		Drawing Production		As built Model		Additional Information Needed
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	
5r	Trucking, bus duct, busbar, busway	CTF	200	200	200	200	N/A	N/A	200	200	200	200	
5s	Dynamic envelope electrical model	DNE	100	100	100	100	N/A	N/A	100	100	100	100	

Annex 5: ASSET INFORMATION REQUIREMENTS

Project officers shall include the AIR collected from the Maintenance Parties in this Annex as far as possible.