

Appendix A

Sample BIM Execution Plan

Version Control History					
Change Number	Revision Description	Pages Affected on Respective Version	Revision / Version Number	Date	Approval Reference
1	XXXX	All	0.1	DD.MM.YY	

LIST OF ABBREVIATION

<u>Abbreviation</u>	<u>Full Expression</u>
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 Project Execution Plan
BIM	Building Information Modelling / Building Information Model
BQ	Bills of Quantity
CAD	Computer Aided 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
LoD	Level of Development
LoD-G	Level of Graphics
LoD-I	Level of Information
LOIN	Level of Information Need
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

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OVERVIEW

1.1 Introduction

- 1.1.1.1 This BEP documents the goals and requirements of the project NE12345 – Construction of Slip Road
- 1.1.1.2 The process and standards to be deployed are proposed in this BEP.
- 1.1.1.3 The format and the LOIN of each deliverable is proposed in this BEP.

1.2 BIM Scope/Goal

- 1.2.1.1 To progressive develop a single source of Project Information Model to facilitate the early collaboration of project information among all stakeholders before the construction works commence.
- 1.2.1.2 To adopt BIM data/model for the collaboration among project team members with an aim to improve productivity, reduce abortive works, enhance construction safety and/or optimise operation efficiency.
- 1.2.1.3 To provide 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.

2. PROJECT INFORMATION

2.1 Project Background

2.1.1.1 The project information is summarized in the below table:

Agreement / Contract* No:	
Agreement / Contract* Type:	
Project Owner:	
Project Title:	
Consultant / Contractor*:	
Agreement / Contract* No:	
Brief Project Description:	<ul style="list-style-type: none"> a. Construction of 200m bridge A and associated slip road b. Detail design and construction of Noise Enclosure for bridge A c. Provisioning of watermain and sewerages
Project Key Plan	

2.2 Key Dates

2.2.1.1 The key dates and key activities are summarized below:

Project Stage / Key Activities	Start Date	Completion Date	Related BIM Deliverables
1. Approval of Master Programme			
a. Master Programme			i. Initial 4D phase planning model
b. Detail Programme			i. Monthly WIP 4D plan/actual construction schedule model
2. Approval of Design			
a. Detail design of Noise Enclosure			<ul style="list-style-type: none"> i. Design Report ii. VR Models iii. Material estimation iv. Working Drawings v. LoD 400 Model
b. Watermain and Sewerage			<ul style="list-style-type: none"> vi. Clash coordination vii. Material/Cost Estimate
3. Approval of Method statement			
a. Noise Enclosure installation			<ul style="list-style-type: none"> i. Construction Method Simulation ii. Shop drawings for Noise Enclosure
4. Construction			
a. Progress Monitoring			<ul style="list-style-type: none"> i. Monthly WIP 4D plan/actual construction schedule model ii. DWSS inspection record linkage

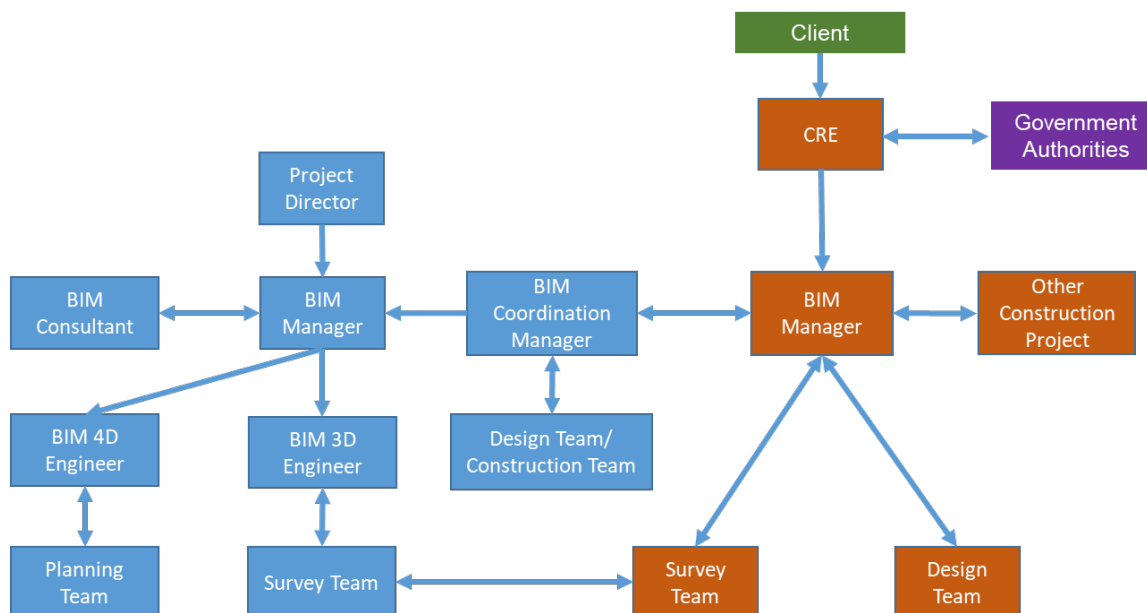
Project Stage / Key Activities	Start Date	Completion Date	Related BIM Deliverables
			iii. Bi-monthly existing condition model by 3D scanning
b. As-built inspection/survey			i. Verified As-built model
5. Handover and Commission			
a. As-built records			i. Final As-built model ii. Existing Underground Utilities model iii. As-built drawings for existing underground utilities iv. As-built drawings for constructed underground utilities v. Asset Information Model vi. COBie Export vii. O&M documents

3. BIM MANAGEMENT

3.1 Project Organisation

3.1.1 Organisation Chart

3.1.1.1 The proposed organization chart of the project team are shown as follow:



3.1.2 Role, Responsibility and Authority

Role	Responsibility	Authority
BIM Coordination Manager from the Contractor	The BIM coordination manager is overall responsible for coordinating all BIM related activities among the construction and planning team. The BIM coordination manager will coordinate workshops with Engineer's team and construction team to explain, coordinate and resolve construction conflicts, as well as ensuring the timely and accuracy of sharing relevant information/records to the BIM modelling team.	Project Manager of (Contractor)
Planning and Construction	The planning and construction team will be responsible to prepare and design the construction sequence and logistic to support the CMS and 4DMS activities.	Assistant Construction manager of (Contractor's Civil works team)
Designer for AD/CSD	The design team will be responsible to support the BIM Team regarding the constructability and clash analysis review during the modelling.	Project Manager of (Contractor)
BIM Team Leader	The BIM Team Leader manages and supervises the BIM modelling team and model production, attend coordination workshops, establish Project standards, BIM project execution plan and assist the Employer to deploy systems and procedure for incorporating BIM data into Employer's system	BIM Team Leader of appointed Sub-consultant
BIM Modelling team	The BIM modelling team shall be responsible to prepare and deliver all the BIM deliverables specified in the project execution plan and ensure the quality of the deliverables in a timely manner.	BIM modellers of appointed Sub-consultant

Role	Responsibility	Authority
...	

3.1.3 BIM Team Resource and Competency

- 3.1.3.1 The BIM modelling team should consist of a BIM Team Leader and at least three BIM Engineers (BIM 3D Engineer, BIM 4D Engineer, and BIM Simulation Engineer). They are allocated to the Civil team, building team and simulation team throughout contract period. The exact allocation varies during the project execution phases.

Name	Role	Qualification / Accreditation	Course / Certification
[...]	BIM team leader	CCBM [Registration No]	• [Professional Certificate for Building Information Modelling (BIM) Manager]
[...]	BIM 3D Engineer	CCBC [Registration No]	• [...]
[...]	BIM 4D Engineer	N/A	• [...]
[...]	BIM Simulation Engineer	N/A	• [...]

- 3.1.3.2 The proposed BIM Team Leader is CIC certified BIM Manager (CCBM) and professional member of HKIBIM. (MHKIBIM)
- 3.1.3.3 The proposed BIM modellers hold relevant software certifications and are CIC certified BIM coordinators. (CCBC)
- 3.1.3.4 The CV of the core BIM Team members are submitted in separated submission.

3.2 Management Deliverables

3.2.1 BIM Project Execution Plan (BEP)

- 3.2.1.1 The BEP is developed for the project stakeholders to oversee the resources, activities, information requirement and key decision dates.
- 3.2.1.2 The BEP propose the process, deliverables, and standards according to specified project goals. The quantity, quality, and delivery schedule of the deliverables between the stakeholders are proposed and agreed with the BEP.
- 3.2.1.3 The BEP will be updated every 6 months according to the variation of Contractor's Master Programme and the construction works. The version, revision and change history will be managed by the BIM CDCP environment, by uploading all the BEP to the BIM CDCP using the review and approval cycle describe in the BIM CDCP section.
- 3.2.1.4 The BEP will be updated and submitted with the final as-built model.

3.2.2 Progress Report

- 3.2.2.1 Progress report will be submitted at the end of each calendar month from the first month after the appointment of the BIM Team Leader to record the progress of works, including the status of the TQ raised, completed tasks, upcoming tasks, technological restriction encounter and work around plan.
- 3.2.2.2 The WIP PIM, the LOIN documentation, as well as the WIP 4DMS model will be submitted with the monthly progress report.
- 3.2.2.3 The format and table of content of the progress report, TQ report, and LOIN summary tables will be submitted with a separated submission.
- 3.2.3 Quality Control Report
- 3.2.3.1 Quality Control report will be submitted with the major publication of the BIM model. Detail quality audit procedures are listed in section 3.4.
- 3.2.3.2 The format and the table of content of the quality control report will be submitted with a separated submission.

3.3 Information/Security Management plan

3.3.1 Information Security Roles and Responsibility

- 3.3.1.1 All the BIM data shall be hoisted and maintained by the Proposed BIM CDCP. The following table summarize the responsible for the BIM CDCP:

Role	Responsibility	Authority
Information Users	<ul style="list-style-type: none"> • Maintaining the confidentiality of all passwords • Complying with controls established by Information/System Owners • Reporting suspected information security violation to the IT manager • Following the information security policies, procedures, and guidelines • Using BIM information and resources for authorised purposes only 	Contractor's Project Managers, Design managers, engineers, Consultant's engineers, surveyors, Client's project manager, engineers.
System Owner/ Administrator	<ul style="list-style-type: none"> • Ensuring security controls are in place • Approving access to the system and the associated resource • Reviewing and ensuring the access rights • Determining information retention requirements • Determining backup and recovery requirements • Endorsing changes to system in production • Taking appropriate action on security violations 	BIM Team Leader
Security auditor	<ul style="list-style-type: none"> • appraising the adherence to the information security policy 	Contractor's IT manager, Consultant's IT manager
Information Owners	<ul style="list-style-type: none"> • Assigning information classification level of information • Ensuring the classification is current • Ensuring the security controls commensurate to the classification are in place • Determining who has access to the information • Reviewing and ensuring the currency of access rights • Determining information retention requirements 	Information Originator, Client's project manager

3.3.2 Human Resource Security

3.3.2.1 All team members shall be advised of their security responsibility upon being assigned a new post. The BIM Team Leader shall provide system security briefing sessions to all stakeholders during the project commence, and within 2 weeks after a new stakeholder is added.

3.3.2.2 All team members shall not publish, make private copies of, or communicate to unauthorised persons any document or information obtained in his capacity without the approval/instruction of the Project Manager. The "need to know" principle should be applied to all information, which should be provided only to the person who require it for the efficient discharge of their work and who have authorised access. If in any doubt as to whether an officer has authorised access to a particular document or classification or information, the Project Manager should be consulted

3.3.2.3 Information security responsibilities and duties that remain valid after termination or change of employment, which shall be communicated to all the team member by the BIM Team Leader during the briefing session.

3.3.2.4 Team members who contravene provision of this Policy may be subjected to disciplinary action depending on the severity of the breach.

3.3.3 Asset Management

3.3.3.1 All BIM information in this project is non-classified and shall be shared through a centralised Common Data Collaboration Platform for BIM as far as practicable. Any information classified as "Restricted", "Confidential" or "Strictly Confidential" will not be uploaded to the BIM CDCP. It will be only shared by physical media upon the approval of Information Originators only. The information will be destroyed after the completion of the required works.

3.3.3.2 The BIM Team Leader shall separately store and encrypt the restricted/confidential/strictly confidential information in a separated information system if necessary.

3.3.4 Information Access Control

3.3.4.1 Holders of information shall ensure intended recipients have the right to know that information before it can be transferred. The right to know principle can be equated to a justifiable business case. If the user needs access to the information to fill a bona fide business need and is determined that he has the "right to know" the information, then that user should be given access.

3.3.4.2 The BIM Team Leader shall grant access on a right to know basis, as required by job functions or under the instruction of the Project Manager. It is the responsibility of the BIM Team Leader to grant data access to the approved parties with a justified business case.

3.3.4.3 The Information Owner and the BIM Team Leader shall remove access or request the appropriate personnel to remove access to information as soon as that access is no longer needed. It is the responsibility of both the Users and the Information Owner to see that access privileges are aligned with the needs of the business and are assigned on a right to know basis.

3.3.5 User Access Control

- 3.3.5.1 All project devices (such as desktop workstations, mobile computers, tablet or mobile devices) shall be controlled by an authentication method involving a minimum of a user-ID/password combination.
- 3.3.5.2 Personal devices are not authorised to access the project information without approval from the Project Manager / BIM Team Leader.
- 3.3.5.3 For users with similar duties, groups or role-based access controls shall be used to assign permissions and accesses to the individual accounts where implementation of practice is applicable and feasible.
- 3.3.5.4 User IDs shall be explicitly assigned to an individual. Group or shared accounts are not permissible unless they are suitable for the work carried out with minimal risk resulted or there are compensating controls to mitigate the risks, and only if they are approved by the System Owner and the Client. Users must not share their passwords with anyone else.
- 3.3.5.5 The administrator should assign an initial password at random to each user profile that is created.
- 3.3.5.6 Unique user-IDs shall not be reused for other individuals, even after termination of the original employee.
- 3.3.5.7 Application and system administrators shall create initial passwords with a minimum of eight characters (8) in length and are comprised of letters, numbers, and special characters to the extent possible.
- 3.3.6 Physical and Environmental Security
 - 3.3.6.1 Data centres and computer rooms shall have good physical security and strong protection from disaster and security threats, whether natural or caused by other reasons, to minimize the extent of loss and disruption.
 - 3.3.6.2 Data centres shall be certified with to ISO27001, while computer rooms shall conform to (at least) Level II security required by the Security Bureau.
 - 3.3.6.3 A list of persons who are authorised to gain access to data centres, computer rooms or other areas supporting critical activities, where computer equipment and data are located or stored, shall be kept up-to-date and be reviewed periodically.
 - 3.3.6.4 All access keys, cards, passwords, etc. for entry to any of the computer rooms and networks shall be physically secured or subject to well-defined and strictly enforced security procedures.
 - 3.3.6.5 All visitors to data centres or computer rooms shall be always monitored by an authorised staff. A visitor access record shall be kept and properly maintained for audit purpose.
- 3.3.7 Operational Procedure
 - 3.3.7.1 BIM CDCP shall be managed using the principle of least functionality with all unnecessary services or components removed or restricted.
 - 3.3.7.2 Anti-malware protection shall be enabled on all local area network servers, personal computers, mobile devices, and computers connecting to the BIM CDCP.

- 3.3.7.3 All software and files downloaded from the Internet shall be screened and verified with anti-malware solution.
- 3.3.7.4 Security patches of all information production software/systems shall be applied within 1 weeks after the release.
- 3.3.8 Backup and Recovery
 - 3.3.8.1 Local backups of the BIM CDCP shall be carried out at every 3 months intervals. Backup restoration test shall be conducted annually.
 - 3.3.8.2 Backup media should also be protected against unauthorised access, misuse, or corruption.
- 3.3.9 Usage Monitoring
 - 3.3.9.1 All systems supporting time synchronisation or real-time clocks will be set to local Hong Kong Time to provide consistency of system data.
 - 3.3.9.2 The versions and revisions will be tracked and recorded with the functions and features in the proposed BIM CDCP system. An audit trail could be extracted on need basis.
 - 3.3.9.3 Audit logs recording exceptions and other security-related events should be produced and kept in the Archive folder for investigative purposes and access control monitoring.

3.4 Quality Control and Quality Assurance Plan

- 3.4.1 Scope of Quality Checks
 - 3.4.1.1 Quality control measures will be applied to ensure the completeness, reliability, reusability and payment process of the BIM deliverables in information contents, information standards and information integrity.
 - 3.4.1.2 The information content includes geometrical accuracy and detail, as well as the attributes contents. These items will be checked again the proposed LOIN table and delivery schedule in Appendix B, and the LOIN Specification proposed in the Section 6 of this BEP.
 - 3.4.1.3 The information standards refer to the naming convention, colour conventions, data sharing formats, and modelling methodologies. The deliverables will be checked against the reference standards and Modelling Guidelines proposed in Section 6 of this BEP.
 - 3.4.1.4 The information integrity refers to the traceability of deliverables and information source. A cloud based BIM CDCP is proposed in this project to share/collaborate information. The information integrity will be managed with the functions and features in the BIM CDCP.
- 3.4.2 Auditing Methodologies and Frequency
 - 3.4.2.1 The following table summarizes the propose auditing methodologies, frequency/occurrence:

Checks	Definitions	Responsible Parties	Methodologies	Frequency
LOD-G Proposed	Ensure the geometry of the object elements are	BIM Modellers	Visual check of 3% of modelled objects	Bi-Monthly

Checks	Definitions	Responsible Parties	Methodologies	Frequency
	modelled to the proposed	BIM Team Leader	Visual check of 5% of modelled objects	Before the major submission stage of the deliverables
LOD-I Proposed	Ensure the attributes of the object elements are created/entered to the proposed format and contents	BIM Modellers	Visual check of 3% of modelled objects using exported table	Bi-Monthly
		BIM Team Leader	Visual check of 5% of modelled objects using exported table	Before the major submission stage of the deliverables
Geometrical accuracy and engineering standard compliance	Ensure the objects are modelled to the exact size, location and orientation according to the LoD-G proposed.	BIM Modellers	Overlay of design drawings, and random annotation of XYZ positions.	Bi-Monthly
		Design Engineers	Random check on design dimension and engineering requirements	Before the major submission stage of the deliverables
Naming Convention	Ensure the file name, non-system object names follow the proposed standard	BIM Modellers	Visual Check	Monthly
File format	Ensure the BIM models are created with the proposed file format and version	BIM Modellers	Random file checks	Monthly
Modelling Methodologies	Ensure the BIM objects are created with the proposed modelling methodologies in appendix B	BIM modellers	Visual check of 3% of modelled objects	Bi-Monthly
		BIM Team Leader	Visual check of 5% of modelled objects using exported table	Before the major submission stage of the deliverables
Project Basepoints	Ensure the reference point of each model comply to the proposed in section 5.3.1	BIM Team Leader	Visual check of project basepoints	First week after the model file is created

3.5 Training and Development Plan

3.5.1 BIM fundamental training course

- 3.5.1.1 A half day introduction presentation is proposed for the stakeholders to understand the general BIM process, role and responsibility of each stakeholders in the project. Sample deliverables of each required BIM use will be discussed to demonstrate the requirements of the DevB technical circular.
- 3.5.1.2 The venue, date of the training, as well as the CV of the trainer will be submitted in separated submission.
- 3.5.2 Basic operation of design review software
 - 3.5.2.1
- 3.5.3 Basic operation of common data collaboration platform for BIM software
 - 3.5.3.1

4. BIM USES AND DELIVERABLES

4.1 Application of BIM Uses

4.1.1 Design Authoring

4.1.1.1 Parametric Project Information Model (PIM) will be created from the tender BIM model as a centralized information source to support the creation of other BIM/Project deliverables. This PIM will be updated monthly with the latest information provided from the project stakeholders to facilitate the early collaboration of latest information, explore optimise solution and reduce abortive works

4.1.1.2 The centralize PIM also provide a single source of centralised information to facilitate the development of all other deliverables.

4.1.2 Design Review

4.1.2.1 Virtual Reality (VR) Model will be created from the PIM model to enable the project stakeholders to carry out interactive walk through, sectioning and measurement of the focused area. This VR model will be submitted with the detail design approval submission such as proposed Noise Enclosures and Landscape to facilitate the communication during design review meeting with Employer and District Council.

4.1.2.2 The VR models for the noise enclosure provide an immersive visual experience for the stakeholders to review the line of sight, dimensions, and clearance, etc before the construction stage. It shall shorten the review and approval time from the public.

4.1.3 Existing Conditions Modelling

4.1.3.1

4.1.4 3D Coordination

4.1.4.1

4.1.5 Phase Planning

4.1.5.1

4.1.6 Site Utilisation Planning

4.1.6.1

4.1.7 Cost Estimation

4.1.7.1

4.1.8 Digital Fabrication

4.1.8.1

4.1.9 3D Control and Planning

4.1.9.1

4.1.10 Drawing Generation

4.1.10.1

4.1.11 As-Built Modelling

4.1.11.1

4.1.12 Asset Management

4.1.12.1

4.2 Meeting Schedule

	Meeting	Frequency	Tentative Schedule
1	Kick off meeting	N/A	1 JUL 2021
2	Progress Meeting	Bi-Monthly	Every Tue of 3rd week of the month
3	Design Coordination Meeting	Need Based	N/A

4.3 Proposed Deliverables

4.3.1 Deliverables of BIM Uses

4.3.1.1 This table summarized the proposed deliverables of each BIM use.

	BIM Use	Goal/Purpose	BIM Deliverables
1	Design Authoring	Centralise single source of information to facilitate collaboration and reduce abortive works	a. Monthly WIP Project Information Models
2	Design Reviews	Enhance communication of public and shorten approval time	b. VR model of Bridge A with Noise Enclosure
3	Existing Conditions Modelling	Avoid onsite coordination and Reduce Abortive works	c. Monthly WIP Existing Condition Models d. Existing Underground Utilities Model
4	3D Coordination	Avoid onsite coordination and reduce Abortive works	e. Clash Report for Proposed watermain and sewerage network
5	Phase Planning	Facilitate early collaboration and avoid onsite coordination, Reduce abortive works	f. Initial 4D Phase planning model g. WIP 4D plan/actual construction schedule model
6	Site Utilisation Planning	Facilitate Early collaboration of project information to enhance safety and optimise construction efficiency	h. Construction method simulation of bridge A launching
7	Cost Estimation	Optimise the material cost	i. Weight of steel estimation of Noise Enclosure j. Cost Estimation report at CE (upon occurrence)
8	Digital Fabrication	Avoid onsite coordination, reduce construction waste, and optimise construction efficiency	k. LoD 400 Noise Enclosure model to support offsite fabrication
9	3D Control and Planning	Improve management efficiency	l. Monthly WIP PIM for DWSS/SSSS integration
10	Drawing Generation	Improve Productive	m. Working Drawings for Noise Enclosure
11	As-Built Modelling	Support the Development of CSDI	n. Verified As-built Model o. Verified existing Underground Utilities Model
12	Asset Management	Integration with Maintenance Parties CMMS	p. Asset Information Model for Bridge A q. COBie export

4.3.2 Submission Schedule

4.3.2.1 The below table summarise the tentative submission schedule of technical deliverables

	Deliverables	S1: Shared for Coordination	S2: Shared for Information	S3: Shared for project manager Review	S4: Shared for project manager approval	S5: Shared for Employer Approval	S6: Shared for Stage Approval
a	Monthly WIP Project Information Models	N/A	5 th of each Month	N/A	N/A	N/A	N/A
b	VR model of Bridge A with Noise enclosure	30 DEC 2021	N/A	i. 30 MAR 2022 ii. 30 MAY 2022	30 JUN 2022	30 JUL 2022	N/A
c	Existing Condition Models	N/A	30 MAY 2020	30 JUL 2020	15 AUG 2020	30 AUG 2020	N/A
d	Existing Underground Utilities Model	N/A	..	i. Zone A (30 JUN 2020) ii. Zone B (30 DEC 2020)	..	N/A	N/A
e	Clash Report for proposed watermain and sewerage network	..	..	..	..	N/A	N/A
f	Initial 4D phase planning model	N/A	..	..	..	N/A	N/A
g	WIP plan/actual construction schedule model	4 weeks before the submission of updated master programme	N/A	2 weeks before the submission of updated master programme	With the submission of updated master programme	N/A	N/A
h	Construction method simulation of bridge A launching	<u>Storyboard</u> 30 DEC 2020 30 Jan 2021	N/A	<u>Draft animation</u> i. 30 MAR 2021 ii. 30 MAY 2021	<u>Pre-Render</u> 30 JUN 2021	<u>Full Render</u> 30 Jul 2021	N/A
i	Weight estimation report for Noise Enclosure	N/A	..	..	..	N/A	N/A
j	Concrete volume and length of watermain and sewerage	N/A	..	..	..	N/A	N/A
k	Cost Estimation report upon (CE)	N/A	N/A	N/A	N/A	N/A	N/A
l	LoD 400 noise Enclosure model for offsite fabrication					N/A	N/A
m	Monthly WIP PIM for DWSS/SSSS integration	N/A	5 th of each Month	N/A	N/A	N/A	N/A
n	Working Drawing for Noise Enclosure	N/A	...	..	..	N/A	N/A
o	Verified as-built Model	N/A	..	i. Zone A (30 JUN 2021) ii. Zone B (30 DEC 2021)	..	N/A	..
p	Verified existing underground utilities model	N/A	N/A	..	..	N/A	..
q	Asset Information model for Bridge A	N/A	..	i. Zone A (30 DEC 2021) ii. Zone B (30 DEC 2022)	..	N/A	..
r	COBie Export	N/A	..	...	..	N/A	..

4.4 BIM Deliverables

4.4.1 Monthly WIP Project Information Model

4.4.1.1 The PIM will be gradually developed from the tender BIM model to support the development of other BIM deliverables continuously according to the master construction programme.

4.4.1.2 The WIP PIM shall include the proposed bridge works, noise enclosure works, road works and related excavation works, sewerage and watermain. The WIP PIM will be federated according to the model federation strategy in section 5.2.1. The content and LOIN of each federated disciplinary model are proposed in the model breakdown structure in section 5.4.1.

4.4.1.3 The WIP PIM will be enhanced from the tender model from LOD 200/300 to LOD300/400 according to the master construction programme. The WIP PIM will be submitted with the monthly progress report for the Project Manager to review the progress of works.

4.4.2 VR Model of the Bridge A and Noise Enclosure

4.4.2.1 The VR model allows the stakeholders/reviewers to carry out an immersive walk through to experience the to be constructed bridge and noise enclosure. It allows the stakeholders to visualize the proposal and provide early feedback to shorten the time of review and approval process.

4.4.2.2 The VR model will be developed with the latest PIM. The final LOIN of the object elements will be developed to LOD-G 300-400 according to the latest detail design information of focus area. Category Codes and Material Texture will be added into the VR model to enable the visualization of texture. The process of developing and sharing the VR models shall be further discuss in section 5.x. and 5.3

4.4.2.3 The final VR model of Noise Enclosure will be submitted 4 weeks before the construction works commence, tentatively DD-MM-YYYY. Two interim VR models will be submitted 8 weeks and 12 weeks before the construction works for stakeholders' review and comments.

4.4.2.4 The final VR model of footbridge A will be submitted 12 weeks before the construction works commence, tentatively DD-MM-YYYY to allow sufficient time to prepare the construction sequence simulation. Two interim VR models will be submitted 12 weeks and 16 weeks before the construction works for stakeholders' review and comments.

4.4.2.5 The review and collaboration process shall be further discussed in section 5.3

4.4.3 Monthly WIP Existing Condition Model

4.4.3.1 The existing condition model allows the project team to understand the site condition through a virtual 3D model. By overlaying the WIP PIM, the project team can accurately determine the excavation zone/site extend.

4.4.3.2 The initial site condition model shall be supplement with 3D digital scanning bi-monthly to allow the project team to carry out site logistics planning and progress monitoring. The 3D digital scanning process are described in section 5.5

- 4.4.3.3 The existing condition within 200 meters of the project boundary will be modelled as far as practicable. The objects in the initial Existing Condition Model will be modelled progressively by zone with reference to the agreed initial survey plan and supplement by the 3D spatial data provided by the Lands Department. The LOIN and modelling methodology of object elements are tabled in the section 5.2.4.4.
- 4.4.3.4 The zonal Existing Condition Model will be submitted 2 months after the agreement of the initial survey plan. The final Existing Condition Model will be submitted 3 months after the agreement of entire initial survey plan of the site area.
- 4.4.4 Existing Condition Model of Underground Utilities
 - 4.4.4.1 The existing condition model of the underground utilities allows the project team to understand the existing underground utilities through a virtualize 3D model. By overlaying the WIP PIM, the project team can determine the excavation zone to avoid onsite coordination of unpredictable clashes and reduce unnecessary abortive works.
 - 4.4.4.2 The initial existing condition of the underground model within the site boundary is created from the as-built record collected from the utilities undertakings. It shall be updated to LoD 300 with the survey record of the exposed utilities and trial pits until the end of the service period. The details of the updating process shall be discussed in section 5.7.x as-built modelling process of existing underground utilities.
 - 4.4.4.3 The underground utilities model shall be submitted for review with the monthly progress report.
- 4.4.5 Clash Report for Propose Watermain and Sewage
 - 4.4.5.1 The BIM Team shall carry out 3D coordination of the proposed watermain, sewage and the existing underground utilities at monthly interval and/or during the update of the existing underground utilities model to avoid onsite coordination.
 - 4.4.5.2 The BIM Team shall carry out regular coordination meeting to facilitate early resolution of issues. The coordination process and frequency shall be further discussed in section 5.4
 - 4.4.5.3 The latest coordination information register shall be submitted with the monthly progress report. A clash free report shall be submitted XX weeks before the excavation commences.
- 4.4.6 Initial & WIP 4D Phase Planning model
 - 4.4.6.1 4D phase planning model is developed to facilitate early collaboration of construction activities among different parties to provide better transparency of various construction process in a congested area.
 - 4.4.6.2 The Initial 4D phase planning model shall be developed from the master construction programme and the tender BIM model to provide a high-level understanding of the overall planning. The initial 4D phase planning model shall be submitted with the master construction programme.
 - 4.4.6.3 The initial 4D phase planning model shall be enhanced with the detail construction programme, temporary excavation, and temporary traffic arrangement. The actual commencement and completion of the construction activities shall be updated with this WIP 4D construction schedule model by linking with the master construction programme. The detail updating process are described in the section 5.6.1 - Phase Planning model.

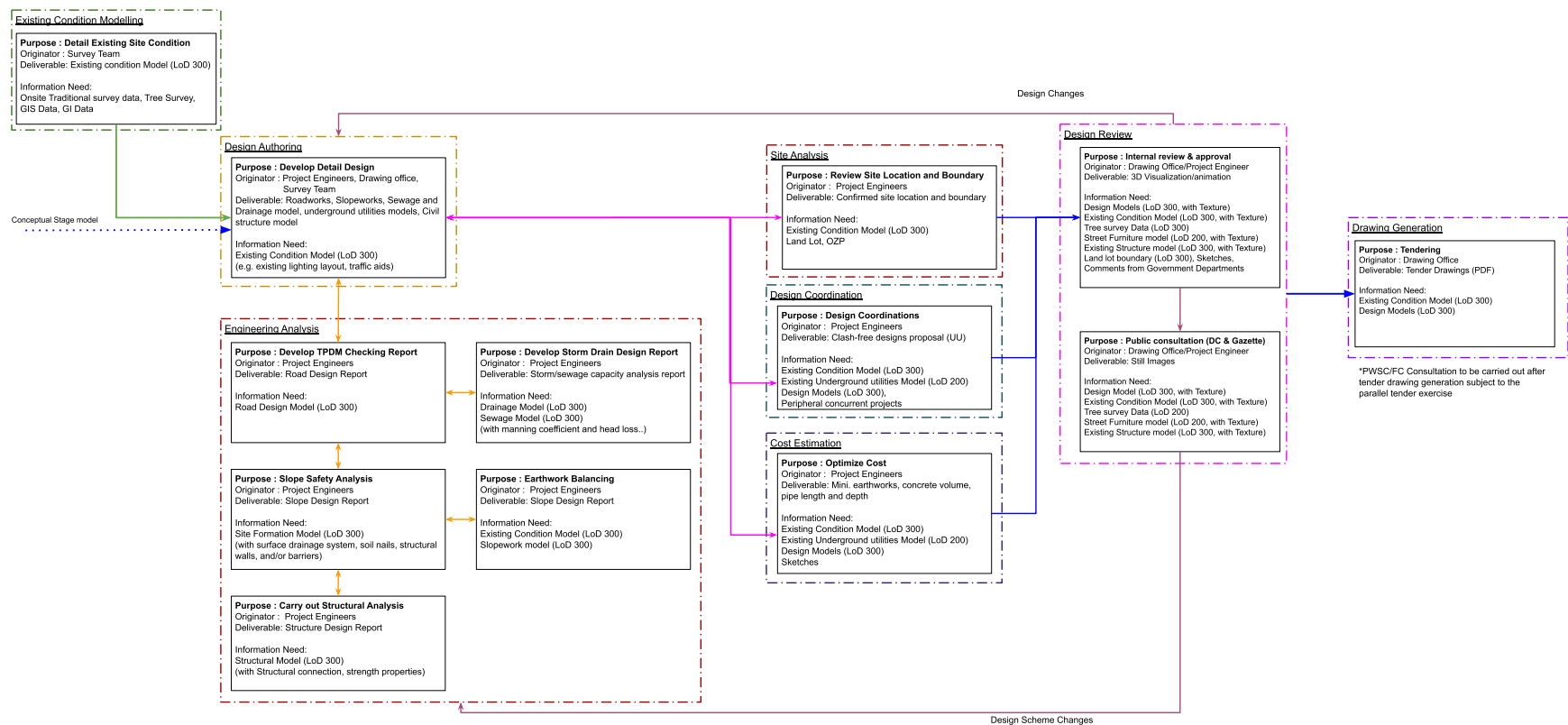
- 4.4.6.4 The WIP 4D construction schedule model shall be submitted with the submission of revised construction programme.
- 4.4.7 Construction Method Simulation of Bridge A
 - 4.4.7.1 The BIM Team shall develop construction method simulation of the launching of the bridge A to facilitate early collaboration with the Transport department and Police department. Meanwhile, planning and development of the construction sequence simulation allows the project team to review the safety measures and logistic arrangements in detail, which improve the construction safety and avoid unnecessary the delay of works.
 - 4.4.7.2 The construction method simulation shall be developed from the final design model of the bridge segments. The launching equipment, safety protection measures, temporary traffic arrangement shall be modelled to LoD-G 250 or as boundary envelopes to allow the estimation of working space and clearance during the segment launching. The BIM Team shall agree the required object elements with the Project Manager during the development of the construction method simulation.
 - 4.4.7.3 A storyboard will be development and shared for coordination around 6 months before the construction works commence. The BIM Team shall allow 5 months to develop/update draft simulation/animations for the project team to feedback and update the method statements. The final rendered simulation shall require 1 month to develop after the confirmation of all details.
 - 4.4.7.4 The detail process of developing and coordinating the construction method simulation are discussed in section 5.6.2 – Construction Method simulation.
- 4.4.8 Detail Design (LoD-G 400) for Noise Enclosure
 - 4.4.8.1 The LoD-G 400 Noise Enclosure model allows the project team to minimize construction wastage and improve productivities by using a centralised model.
 - 4.4.8.2 The design team shall enhance the noise enclosure elements in the tender model to LoD-G 300 according to the coordinated bridge design model for structural and wind tunnel analysis. The finalized design model shall pass to the specialist contractor to develop the LoD-G 400 model to generate working drawings and data sheets for offsite fabrication
 - 4.4.8.3 The LoD-G 400 noise enclosure model shall be completed and submitted XX weeks before the fabrication commences.
- 4.4.9 Cost estimation of Noise Enclosure
 - 4.4.9.1 The WIP PIM model of the noise enclosure shall be used to extract weight and number of steel in each type of structural framing of the noise enclosure to optimise the material cost during design variation.
 - 4.4.9.2 The material estimation will be submitted with the design report of the noise enclosure.
- 4.4.10 Working drawings for Noise Enclosure

- 4.4.10.1 Layout drawings, general arrangements drawings, sections drawings, material and setting out schedule are generated from the final PIM to ensure the information is synchronised. It reduces the effort to update the drawings upon design changes and provide accuracy setting out dimension to fabrication and construction team.
- 4.4.10.2 Standard drawings, detail sketches will not be generated from the PIM in considering the effectiveness of excessive modelling works.
- 4.4.10.3 The drawings and schedules will be directly extracted from the PIM model using the 2D/3D views of the software before project key dates. PDF drawings will be exported. The detail document production process will be further discussed in section 5.6.5.
- 4.4.10.4 The working drawings of the Noise Enclosure shall be submitted for review 4 weeks before the key dates.
- 4.4.11 As-built Models
 - 4.4.11.1 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 Client 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.
 - 4.4.11.2
- 4.4.12 Asset Information Models and COBie export
 - 4.4.12.1
- 4.4.13 WIP PIM for DWSS/SSSS integration
 - 4.4.13.1 ...
- 4.4.14 Cost estimation upon occurrence of CE
 - 4.4.14.1

5. INFORMATION PRODUCTION PROCESS

5.1 Process Overview

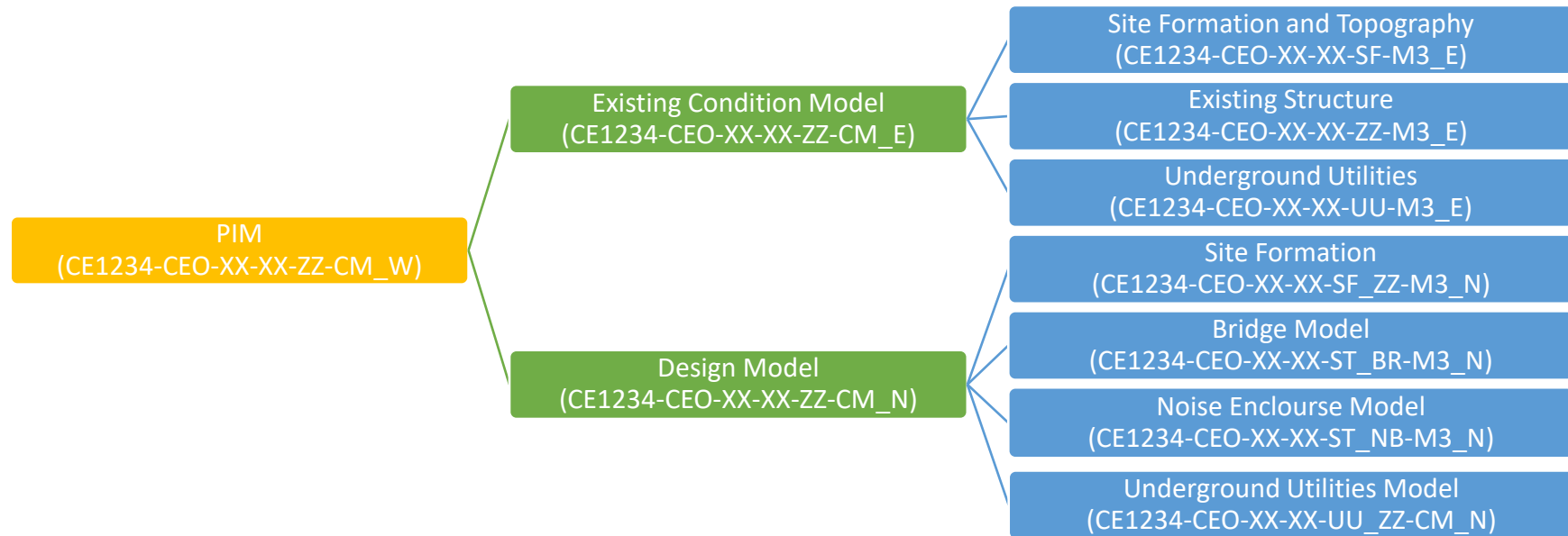
5.1.1.1 The following flowchart summarizes the process to create and deliver.



5.2 Model Authoring Process

5.2.1 Model Federation

5.2.1.1 The Project Information Model (PIM) is federated into 7 sub-models according to the CEDD Modelling Manual:



5.2.1.2 The sub-models shall be further federated:

- The sub-models will be separated by zone or system, when the file size of the model is larger than 200Mb
- The as-built objects in the sub-model will be separated from the sub-models into a separated file
-

5.2.1.3 This BEP shall be updated upon the changes in the model federation structure and/or introduction of new sub-models

5.2.2 BIM Origin Point and Orientation

5.2.2.1 All Models will be modelled in the metric unit. All heights will be referred to the Hong Kong Principal Datum. All the elements are modelled based on the HK80 grid coordinate system and the Hong Kong Principal Datum (HKPD).

The project basepoint of the footbridge model will be setup at Grid point A1 with the following coordinates:

No	Model	Model Reference Point	Easting	Northing	Level	Orientation	Units
1	Existing Site Formation and Topography	Model Origin	0	0	0	0	m
2	Existing Structure	Model Origin	0	0	0	0	m
3	Existing Underground Utilities	Model Origin	0	0	0	0	m
4	Proposed Site Formation	Model Origin	0	0	0	0	m
5	Proposed Bridge	SOP 20	810050.000	836100.000	0	0	m
6	Proposed Noise Enclosure	SOP 20	810050.000	836100.000	0	0	m
7	Proposed Underground Utilities	A1	810000.000	836000.000	5.0	0	mm

5.2.3 Model Breakdown structure

5.2.3.1 The object elements of each sub-model are proposed in the following tables. The LOIN of each object elements shall be progressively enhanced according to the Master Construction Programme to ensure the adequate information is included in the BIM deliverables.

5.2.3.2 The modelling methodologies are proposed in the below tables.

5.2.3.3 The LOIN of the proposed elements should be read with the LOIN Specification of CEDD.

5.2.3.4 Object elements of the Existing Site Formation and Topography Model will be created according to the agreed survey record plan. The following objects will be modelled:

No	Object Name	CAT Code	Existing Condition Modelling		WIP PIM/4DMS		Utilities Coordination		VR Models for Bridge and NE		Bridge launching CMS		As-Built / Drawing Production		Modelling Methodology	Modelling Tools
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I		
1	Barrier Fence	FX_	250	200	250	200	250	200	250	200	250	200	250	200	3D Solid	Civil 3D
2	Bollard at Road	BO_	250	100	250	100	250	100	250	100	250	100	250	100	3D Solid	Civil 3D
3	Catch Pit	CP_	250	200	250	200	250	200	250	200	250	200	250	200	3D Solid	Civil 3D

No	Object Name	CAT Code	Existing Condition Modelling		WIP PIM/4DMS		Utilities Coordination		VR Models for Bridge and NE		Bridge launching CMS		As-Built / Drawing Production		Modelling Methodology	Modelling Tools
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I		
4	E&M Pit	EM_	250	100	250	100	250	100	250	100	250	100	250	100	3D Solid	Civil 3D
5	Electric Pole	EP_	250	100	250	100	250	100	250	100	250	100	250	100	3D Solid	Civil 3D
6	Electric Transformer	ET_	250	100	250	100	250	100	250	100	250	100	250	100	3D Solid	Civil 3D
7	Existing Retaining Structure	WX_	250	200	250	200	250	200	250	200	250	200	250	200	3D Solid	Civil 3D
8	Fence	FX_	250	200	250	200	250	200	250	200	250	200	250	200	3D Solid	Civil 3D
9	Fire Hydrant	FH_	250	100	250	100	250	100	250	100	250	100	250	100	3D Solid	Civil 3D
10	Gate	GA_	250	100	250	100	250	100	250	100	250	100	250	100	3D Solid	Civil 3D
11	Hand Railing	RA_	250	200	250	200	250	200	250	200	250	200	250	200	3D Solid	Civil 3D
12	Hoarding	HD_	250	100	250	100	250	100	250	100	250	100	250	100	3D Solid	Civil 3D
13	Lamp Post	LP_	250	100	250	100	250	100	250	100	250	100	250	100	3D Solid	Civil 3D
14	Land Lot Boundary	LLB	200	100	200	100	200	100	200	100	200	100	200	100	3D Solid	Civil 3D
15	Rock head (DTM)	ROC	250	100	250	100	250	100	250	100	250	100	250	100	TIN	Civil 3D
16	Sign Pole	SP_	250	N/A	250	N/A	250	N/A	250	N/A	250	N/A	250	N/A	3D Solid	Civil 3D
17	Staircase	ST_	250	100	250	100	250	100	250	100	250	100	250	100	3D Solid	Civil 3D
18	Terrain (DTM)	TER	300	100	300	100	300	100	250	100	300	100	300	100	TIN	Civil 3D
19	Tree	TE_	200	200	200	200	200	200	200	200	200	200	200	200	3D Solid	Civil 3D
20	U-Channel	UC_	250	100	250	100	250	100	250	100	250	100	250	100	3D Solid	Civil 3D

5.2.3.5 The Existing Building sub-models will be created from 3D spatial data collected from the Lands Department. The LOIN of the model will be based on information available, typically around LoD-G 100-200.

No	Object Name	CAT Code	Existing Condition Modelling		WIP PIM/4DMS		Utilities Coordination		VR Models for Bridge and NE		Bridge launching CMS		As-Built / Drawing Production		Modelling Methodology	Modelling Tools
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I		
1	Existing Structure Mass Model	SUR	100	100	100	100	100	100	100	100	100	100	100	100	3D Solid	3DsMax

5.2.3.6 The Existing Underground Utilities sub-models will be created form the as-built record provided by the utilities undertakings and will be gradually updated according to agree survey records.

No	Object Name	CAT Code	Existing Condition Modelling		WIP PIM/4DMS		Utilities Coordination		VR Models for Bridge and NE		Bridge launching CMS		As-Built / Drawing Production		Modelling Methodology	Modelling Tools
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I		
1	Drawpit	ECD	250	100	250	100	250	100	250	100	250	100	250	100	3D Solid	AutoCAD
2	Gas Cables	GAS	100	100	100	100	100	100	100	100	100	100	100	100	2D Polylines	AutoCAD
3	Gully	GUL	250	100	250	100	250	100	250	100	250	100	250	100	3D Solid	AutoCAD
4	Inspection Chamber	FCH	250	100	250	100	250	100	250	100	250	100	250	100	3D Solid	AutoCAD
5	Manhole	MH_	250	200	250	200	250	200	250	200	250	200	250	200	3D Solid	AutoCAD
6	Manhole Foul Water / Sewer	FMH	250	200	250	200	250	200	250	200	250	200	250	200	3D Solid	AutoCAD
7	Manhole Storm Water	SMH	250	200	250	200	250	200	250	200	250	200	250	200	3D Solid	AutoCAD
8	Manhole Telephone	TMH	250	N/A	250	N/A	250	N/A	250	N/A	250	N/A	250	N/A	3D Solid	AutoCAD
9	Power cables	POW	100	100	100	100	100	100	100	100	100	100	100	100	2D Polylines	AutoCAD
10	Sewage Pipe	FWD	100	100	100	100	100	100	100	100	100	100	100	100	2D Polylines	AutoCAD
11	Stormwater Pipe	SWD	100	100	100	100	100	100	100	100	100	100	100	100	2D Polylines	AutoCAD
12	Telecommunication lines	TEL	100	100	100	100	100	100	100	100	100	100	100	100	2D Polylines	AutoCAD
13	Valve Fire	FPF	250	N/A	250	N/A	250	N/A	250	N/A	250	N/A	250	N/A	3D Solid	AutoCAD
14	Valve Gas	MVA	250	N/A	250	N/A	250	N/A	250	N/A	250	N/A	250	N/A	3D Solid	AutoCAD

No	Object Name	CAT Code	Existing Condition Modelling		WIP PIM/4DMS		Utilities Coordination		VR Models for Bridge and NE		Bridge launching CMS		As-Built / Drawing Production		Modelling Methodology	Modelling Tools
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I		
15	Valve Waterworks	FPF	250	N/A	250	N/A	250	N/A	250	N/A	250	N/A	250	N/A	3D Solid	AutoCAD
16	Water Pipe	FWP	100	100	100	100	100	100	100	100	100	100	100	100	2D Polylines	AutoCAD

5.2.3.7 The Site Formation Model include the roadworks and slope works elements. It is developed from the Design BIM model provided by the Consultant and shall be gradually enhanced to as-built and asset information models according to the detail design and planning activities.

No	Object Name	CAT Code	Existing Condition Modelling		WIP PIM/4DMS		Utilities Coordination		VR Models for Bridge and NE		Bridge launching CMS		As-Built / Drawing Production		Modelling Methodology	Modelling Tools
			LoD-G	LoD-I	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	400	300	400	Generic solid	AutoCAD
2	Bollard	FBL	300	200	300	200	300	200	300	200	300	400	300	400	Generic solid	AutoCAD
3	Foot path	RFW	300	200	300	200	300	200	300	200	300	400	300	400	Corridor	Civil 3D
4	Kerb	RKB	300	200	300	200	300	200	300	200	300	400	300	400	Corridor	Civil 3D
5	Man-Made Slope	SRS	300	200	300	200	250	200	300	200	300	400	300	400	Grading	Civil 3D
6	Planter	LTW	300	200	300	200	300	200	300	200	300	400	300	400	Generic solid	AutoCAD
7	Railing	FRA	300	200	300	200	300	200	300	200	300	400	300	400	Generic solid	AutoCAD
8	Retaining Structure	RTW	300	200	300	200	300	200	300	200	300	400	300	400	Corridor	Civil 3D
9	Road Paving	RCW	300	200	300	200	300	200	300	200	300	400	300	400	Corridor	Civil 3D
10	Road Marking	RMK	200	N/A	200	N/A	200	N/A	200	N/A	200	N/A	200	N/A	Polygon	AutoCAD
11	Rock (Cut/Fill)	ROC	300	100	300	100	300	100	300	100	N/A	N/A	N/A	N/A	3D solid	Civil 3D
12	Signage	FTS	200	N/A	200	N/A	200	N/A	200	N/A	200	400	200	400	Generic solid	AutoCAD
13	Sign Gantry	TSG	300	200	300	200	300	200	300	200	300	400	300	400	Generic solid	AutoCAD
14	Soil (Cut/Fill)	SOI	300	100	300	100	300	100	300	100	N/A	N/A	N/A	N/A	3D Solid	Civil 3D

No	Object Name	CAT Code	Existing Condition Modelling		WIP PIM/4DMS		Utilities Coordination		VR Models for Bridge and NE		Bridge launching CMS		As-Built / Drawing Production		Modelling Methodology	Modelling Tools
			LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I	LoD-G	LoD-I		
15	Topography (DTM)	TER	300	100	300	100	300	100	300	100	300	100	300	100	TIN	Civil 3D

5.2.3.8 Bridge Model will be created with Revit software....

5.2.3.9

5.2.3.10 Noise Enclosure model will be create with Tekla Software.....

5.2.3.11

5.2.3.12 Underground utilities model will be created with the Pipe function in the Civil 3D software...

5.2.3.13

5.2.4 Attribute definition

5.2.4.1

5.3 Collaboration, Review and Approval Process

5.3.1 Common Data Collaboration Platform for BIM (BIM CDCP)

5.3.1.1 XXXXX is proposed as the BIM CDCP Platform in this project. The proposed system is a cloud based BIM CDCP solution, which could be used to organize, distribute, and share files on a single, connected cloud platform, ensuring all team members have access to the information they need. Authorised users could access the BIM CDCP with a standard html5 supported web browser, such as Chrome, Safari and Firefox. The BIM Team will setup workflow process, meta data, folder structure, and role-based user access with the system.

5.3.1.2 The proposed BIM CDCP include built-in workflow process. It not only provides a cloud storage to share and stored the models, but also allows the authorised stakeholders to review and comment the models through a web-based browser. The workflow process records all the comments made by the users permanently in the system.

5.3.1.3 The proposed BIM CDCP is hoisted in a ISO27001 certified data centre with physical system resilience and network security. The system provider includes authentication, encryption and operational security control functions and features. For more information, please refer to the security white paper published by the XXXX in Annex X...

5.3.1.4 The proposed BIM CDCP also complied to the requirement of ISO19650 folder and naming convention requirements.

5.3.2 Information Management

5.3.2.1 All data and deliverables of the project shall be managed by folders in the BIM CDCP. Folders names are used to represent that state of the BIM data. Other metadata such as information originator, sharing status, approval status, version, and general description will be setup as the attributes of each file in the BIM CDCP system.

5.3.2.2 The BIM Team shall set up project folders in the BIM CDCP platform to control the data flow according to the requirement in the ISO19650 requirement. The proposed folder structure will be as follow:

- 01-WIP: Work In Progress folder. All current models are stored in this folder with sub-folders.
- 20-Shared: Shared folder. It records all shared and verified information.
- 30-Publish: All the submitted and published deliverables will be stored in this folder with sub-folders
 - YYMMDD_TQ : Technical queries
 - YYMMDD_Initial_Model: Initial BIM model
 - YYMMDD_Initial_4DMS: Initial 4DMS
 - YYMMDD_Monthly_Submission: WIP models of each month
- 40-Approved: Record all the latest approved deliverables with models

- Design Review Model: Latest approved model for design review
- 4DMS: Latest approved phase planning model
- CMS: Latest approved construction method simulation model
- 50-Incoming: Record all Incoming Documents, such as RRFI, contract drawings, programme, etc
 - YYMMDD_Contract_Drawings
- 90-Archive: Copies of significant interim deliverables and approved deliverables
 - YYMMDD_NE_CMS
 - YYMMDD_BG_VR

5.3.2.3 Folders is also used to control the access rights of each information user. 5 levels of access roles shall be assigned, known as

- Upload : Only allow to upload data into the folder
- Read: Can upload and read the information in the folder
- Full : Can read, upload and remove information in the folder
- Admin: Have full control to the folder, including access rights and folder structure

5.3.2.4 12 user accounts will be created and assigned to the RSS (3), Client (2), Contractor (3), BIM Team (3) and external guest (1). Roles will be assigned to each user according to their role and responsibility in this project. The proposed folder access control structure will be as follow:

ROLE	Folder					
	Admin	WIP	Publish	Approved	Incoming	Archive
Employer Representative	Read	Read	Read	Full	Read	Read
Project Manager	Read	Read	Read	Full	Read	Read
Engineers from the project manager	Read	Nil	Read	Full	Upload	Nil
Technical Team from the project manager	Read	Nil	Read	Read	Upload	Nil
BIM Coordination Manager	Admin	Admin	Admin	Admin	Admin	Admin
Assistant BIM coordination Manager	Admin	Admin	Admin	Admin	Admin	Admin
Planning and Construction team	Read	Nil	Read	Read	Upload	Nil

ROLE	Folder					
	Admin	WIP	Publish	Approved	Incoming	Archive
Planning and Construction team	Read	Nil	Read	Read	Upload	Nil
Disciplinary Engineers from the Contractor	Read	Nil	Read	Read	Upload	Nil
BIM Team Leader	Admin	Admin	Admin	Admin	Admin	Admin
Civil Modelling Team	Read	Full	Full	Read	Upload	Read
Building Modelling Team	Read	Full	Full	Read	Upload	Read
Simulation Team	Read	Read	Full	Read	Upload	Read
Backup Operator	Read	Read	Read	Read	Read	Read

5.3.3 Collaboration Process

- 5.3.3.1 All the WIP PIM, drawings, site sketches, TQ, RFIs, RRFIs, and the customized libraries are first stored in the local server that only accessible by the modelling team. The WIP data will be uploaded to the WIP folders in native format (without auditing check) weekly for progress tracking. The BIM CDCP system shall automatically assign the version number for each file uploaded.
- 5.3.3.2 The WIP data shall be cleaned up and upload to the SHARED folder by the end of each month for review and information sharing to project stakeholders. The metadata - status will be assigned to the SHARED data to indicate with the “Purpose of share” 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.
- 5.3.3.3 The data in the SHARED folder will be progressively enhanced from Status S1 to S5 using the Interim Deliverable review workflow. Upon feedbacks and change events, the agreed changes will be properly documented and passed to the BIM modelling team using the built-in workflow process. The modellers shall update the interim deliverables and pass to the BIM Team Leader for quality checking. The updated deliverables shall be publishing using the Interim Deliverable review workflow process until a final consent from the Project Manager is received.
- 5.3.3.4 The BIM Team Leader shall close the existing review event of the interim deliverables and restart the Interim Review Deliverable Process during a version update event. The follow event shall trigger a version update event:
- Changes in geometry and attributes of PIM after a design review meeting

- Changes in geometry and attributes of PIM after a design review meeting
- Programme changes after design review meetings
- Update of Construction Methodologies after a design review meeting

5.3.3.5 The metadata “Approval status” and “Status” shall be assigned to “Submitted” and “S5” when the deliverables are copied to the PUBLISH folder. The final deliverables with S5 status shall be submitted to the Project Manager with Contractor Submission Form (CSF). The BIM Team Leader shall upload the reviewed and approved deliverables with the related correspondents to the APPROVED folder. The metadata “Approval status” and “Status” shall be assigned to “Approved” and “S6” when the deliverables are copied to the APPROVED folder.

5.3.3.6 The WIP PIM, monthly reports, TQ reports and (Bi-monthly) QC reports shall be uploaded to the SHARED folder at the first week of the month after audited by the BIM Team Leader. These monthly submissions shall be submitted to the Project Manager using the Monthly submission workflow and copied to the PUBLISH folder for record. The metadata “Approval status” and “Status” shall be assigned to “Submitted” and “S5” when the deliverables are copied to the PUBLISH folder.

5.3.3.7 The final monthly submissions with S5 status shall be submitted to the Project Manager with Contractor Submission Form (CSF) 3 days after the monthly deliverables and copied to the PUBLISH folder. The BIM Team Leader shall upload the reviewed and approved deliverables with the related correspondents to the APPROVED folder. The metadata “Approval status” and “Status” shall be assigned to “Approved” and “S6” when the deliverables are copied to the APPROVED folder.

5.3.3.8 The BIM Team Leader shall create copies of project significant interim deliverables and all approved deliverables into the archive folder for future reference monthly or before the publishing of new approved information.

5.3.4 Workflow and Process

5.3.4.1 2 types of design review and approval process, known as Monthly Submission and Interim deliverable review shall be setup on the BIM CDCP platform.

5.3.4.2 The Monthly submission workflow will be used for the monthly submission of the WIP PIM models, monthly reports and audit reports to the project manager. The one-step workflow diagram is shown below:

(Insert Process/workflow Diagram, should include the identified stakeholders of step)

- 5.3.4.3 The Interim deliverable workflow is used before the review meetings of the WIP plan/actual construction schedule, construction method simulation of the bridge A, noise enclosure design, as-built models, details drawings for noise enclosure, and the asset information model to the Employer after the reviewed by the Project manager. The two-steps workflow diagram is shown below:

(Insert Process/workflow Diagram, should include the identified stakeholders of step)

5.3.5 Information History Summary

- 5.3.5.1 Upon the sharing of PIM, the BIM Team shall maintain an information register to document the related drawings, design reports in an excel table. The excel table shall be always uploaded with the sharing of PIM or deliverables.

- 5.3.5.2 The information register of is proposed as below:

no	Discipline	File Name	LOD	Last Update	Reference Drawings Set / Remarks
1	Existing Model				
1.1	Existing Site Formation	CE1234-CEO-XX-XX-SF-M3_E	250	20200102	
1.2	Existing Structure	CE1234-CEO-XX-XX-ZZ-M3_E	200	20210531	
1.3	Existing Underground Utilities	CE1234-CEO-XX-XX-UU-M3_E	100	20201130	
2	Proposed Design				
2.1	Site Formation	CE1234-CEO-XX-XX-SF_ZZ-M3_N	300	20200102	
2.2	Bridge A	CE1234-CEO-XX-XX-ST_BR-M3_N	300	20210531	
2.3	Noise Enclosure	CE1234-CEO-XX-XX-ST_NB-M3_N	300	20201130	
2.4	New Underground Utilities	CE1234-CEO-XX-XX-UU_ZZ-CM_N	300	20201130	
3	Bride A launching simulation	.....	...	....	Method statement

5.3.6 Audit Trail

- 5.3.6.1 The propose BIM CDCP include an audit trail function to record the change and update history in the BIM CDCP. The audit trail records the *Date, Activity, User name, Action, Action Type, Object Name, Folder Name* and *Target Name* automatically in the system. A sample audit trail from previous project is shown below:

Date	Activity	User name	Action	Action type	Object name	Folder name	Target name
Mon, 19 Jul 2021 03:51:13 GMT	Andy Chan viewed H120008-TG-00-XX-M2-C-0018_Zone 3 Section.dgn.	Andy Chan	view-entity	View file	H120008-TG-00-XX-M2-C-0018_Zone 3 Section.dgn	99_TEMP	
Mon, 19 Jul 2021 02:37:44 GMT	Andy Chan added subfolder 99_TEMP to Project Files folder.	Andy Chan	create-entity	Create folder	99_TEMP	Project Files	Project Files
Mon, 19 Jul 2021 02:37:37 GMT	Andy Chan deleted 00_TEMP folder from Drawings folder.	Andy Chan	delete-folder	Delete folder	00_TEMP	Drawings	
Mon, 12 Jul 2021 05:29:17 GMT	Edward Jung downloaded the 50_UP folder.	Edward Jung	download-entity	Download source file/Export sheet	50_UP	20210621_Submission	
Fri, 09 Jul 2021 10:05:07 GMT	Andy Chan copied P5L CMS 20210702.mp4 from WMV folder to 70_CMS folder.	Andy Chan	copy-entity	Copy item	P5L CMS 20210702.mp4	WMV	70_CMS
Fri, 09 Jul 2021 07:57:50 GMT	Andy Chan exported File log report of 40_BR folder.	Andy Chan	export-document-log	Export file log	40_BR	40_BR	40_BR - Documents - 2021-07-09 03 57 49pm
Mon, 05 Jul 2021 07:14:35 GMT	William Cheung shared the latest current version of the file YMTE-DWP_R13-4DMS-20210630.nwd from the 00_NWD folder with Andy Chan Yuk Fai.	William Cheung	shared-with-recipients-for-documents	Share file with recipients	YMTE-DWP_R13-4DMS-20210630.nwd	00_NWD	
Mon, 05 Jul 2021 07:04:22 GMT	William Cheung uploaded YMTE-DWP_R13-4DMS-20210630.nwd to 00_NWD folder.	William Cheung	upload-entity	Upload file	YMTE-DWP_R13-4DMS-20210630.nwd	00_NWD	
Mon, 05 Jul 2021 03:30:49 GMT	Carman Lee deleted BR-NEZ_1-AD-WIP-250.rvt from 40_BR folder.	Carman Lee	delete-entity	Delete item	BR-NEZ_1-AD-WIP-250.rvt	40_BR	
Mon, 05 Jul 2021 03:16:12 GMT	Carman Lee renamed 43_BR folder to 40_BR folder.	Carman Lee	rename-entity	Rename folder	40_BR	43_BR	

- 5.3.6.2 The BIM CDCP system maintain the entire audit trail for the entire project period and does not allow any altering of the audit trail record. The system administrator can download the audit trail of any selected period in CSV format from the system any time.

5.3.6.3 The audit trail could be submitted to the project manager within 7 days upon the request of the project manager.

5.3.6.4 To avoid the system failure, the BIM Team Leader shall download the audit trail every 2 months and store separately with the backup data in physical media. The audit trail will be kept for 1 year.

5.3.7 Information formats and version

5.3.7.1 All the BIM related files will be uploaded to the BIM CDCP and managed in folders in the proposed format.

5.3.7.2 The following software will be deployed in this project for the development and review of the BIM model and its deliverables:

	Navisworks	Civil 3D	Revit	Tekla	Excel	Fuzor
Disciplinary Model/Sub-models	2020	2020	2020	2020		
Clash Reports	2020				365	
Phase Planning Model	2020	2020	2020			2020
3D VR Model	2020	2020	2020			2020

5.3.7.3 The native format will be shared in the BIM CDCP during the entire project lifecycle unless under specific request by the project manager. It avoids unexpected data loss during the conversion and the use of out-of-date (non-synchronised) information. The as-built and asset information models shall be published and submitted in both native and IFCv4.0 format after the final acceptance by the project manager.

5.3.7.4 The following file formats will be used in the project for data exchange purpose.

	NWD	DWG	RVT	XLS	DGN	CHE	PDF	Others
Disciplinary Model/Sub-models	*	*	*					*.IFCv4
Clash Reports	*			*			*	*.html
Phase Planning Model						*		*.exe
Drawings/Site Sketches		*			*		*	
3D VR Model	*	*	*					*.exe

5.3.8 Backup and Recovery

- 5.3.8.1 The proposed BIM CDCP vendor is a cloud-based Software as a Service (SaaS) solution. The Vendor will be responsible for ensuring the system availability with 99.7% with system resilience infrastructure. System downtime shall not impact the daily operation. Meanwhile, the Vendor will apply necessary security update patch to ensure the security of the BIM CDCP system. In addition to system security, the proposed BIM CDCP is hoisted in a ISO27001 certified data centre with Tier III physical security measure.
- 5.3.8.2 Neither total system failure nor loss of critical data is expected under the proposed BIM CDCP solution. A 2-months backup strategy is proposed to avoid the data loss introduced by careless operation and disaster. All data, including the audit trail in the BIM CDCP will be replicated every 2 months by the backup operator. The offsite backup data will be kept in the Project Manager's data archive for 12 months to ensure essential data can be recovered.
- 5.3.8.3 The backup operator is only allowed to read the project data and download the data into backup storage only.

5.4 Coordination Process

5.4.1 Coordination Process

- 5.4.1.1 The BIM modeller is responsible to report the missing information and conflicts of information during the preparation of the WIP PIM. The BIM modeller shall review all the design drawings against the final design model collected from the Project Manager within the first 3 months after the project commence. The issues detected will be issued with TQ report and tracked in the Clash/Issue Summary report.
- 5.4.1.2 The BIM coordinator shall carryout clash coordination exercise after the initial verification period (after the information conflicts are resolved) according to the Clash detection matrix. TQ reports shall be issued to relevant parties 2 weeks before the coordination meetings (if necessary). The solutions shall be documented by the BIM coordinator and pass to the BIM modellers for updating the model until all major issues are resolved.
- 5.4.1.3 The BIM Coordinator shall upload the latest clash model to the SHARED folder of the BIM CDCP. The following procedure will be carried out before the publishing the TQ for coordination:
- Create close-up isometric 3D viewpoints and markup in the Navisworks model for the related subjects by disciplines;
 - Compressed the files and convert to *.nwd for smooth navigation;
 - Publish the raw editable files (*.rvt/*.dwg) for minor editing, creating sections and elevations during the meeting to explore possible options.
 - Extract the related screen captures, such as close up isometric 3D views, sections and drawings into TQ report
 - Update the TQ summary spreadsheet with submission date, reference drawing no and revision

A sample of the TQ report shall be submitted separately for approval.

- 5.4.1.4 Upon geometrical changes of the WIP PIM, the BIM coordinator is responsible to carry out the coordination process within 1 month after the completion of modelling works

5.4.2 Clash Detection Matrix and Rule

- 5.4.2.1 The BIM Team shall use XXXX software to detect the spatial conflicts of the LoD 300 object elements. The detection and resolution rules and priority, tolerance and clearance are listed in the below table:

Clash Validation Test	Test ID	Selection A	Selection B*	Type	Tolerance (mm)	Owner
Land Lot Boundary against Proposed Works	T01	Land Lot Boundary	Proposed Road Model	Clash	0	XX
Land Lot Boundary against Drainage	T02	Land Lot Boundary	Proposed Drainage Model	Clash	0	XX

Drainage against Gas Main	T03	Existing UU Model (Gas Main)	Drainage Model	Clash	0	XX
Drainage against Water Main	T04	Existing UU Model (Water Main)	Drainage Model	Clash	0	XX
Drainage against Existing Drains	T05	Existing UU Model (Existing Stormwater Drains)	Drainage Model	Clash	0	XX

*Selection B will be reviewed and updated to resolve the clashes detected in the test

5.4.3 Clash/Issue Summary

5.4.3.1 A clash/issue summary is proposed to track the progress of the 3D coordination tasks. The format of the summary is proposed as below:

TQ No	TestID	Description	Discipline	Type	Status	Owner	Reference Model / Drawing
0001	T01	Slope boundary outside site boundary	RD	Clash	RFI to be issue. Road profile in review process	XXX	2021 Jul Monthly WIP PIM
0002	N/A	Insufficient Setting out information of road Kerb	RD	Missing Information	RFI1002 issued. Setting out to be provided	XXX	SSK12345A.dwg, SSK23452A.dwg
0003	N/A	Insufficient working space for abutment installation	DR	Clearance	DR to be realigned	XXX	2021 Jul Monthly WIP PIM
0004	N/A	Dimension of segments on layout drawings different from the section drawings	BR	Information Conflict	RFI0028 is issued. Dimension of section drawings to be revised	XXXX	SSK324255A.dwg, SSK314435C.dwg
0005	T03	Drainage clashes with Gas main near Road A chainage 80.567	Gas	Clash	Resolved. Alignment of GAS main will be updated	BIM Team Leader	2021 Jul Monthly WIP PIM

5.4.3.2 The definitions of the columns are:

- TQ No: Sequential No to record the TQ
- Test ID : Related Clash Test
- Description: General description of the issue/clash
- Discipline: Disciplinary models to be updated/follow up
- Type: 4 types of Issue, known as Clash, Missing Information, Clearance, Information Conflict
- Status: Current solutions identified / agreed in the coordination meetings
- Owner: Current Action owner
- Reference Model/Drawings: Models/drawings that used to identified the Issue/clashes

5.4.3.3 This summary shall be updated after each coordination meeting and will be submitted with the monthly progress report.

5.5 3D digital scanning process

5.5.1 Specification of Laser Scanners

5.5.1.1 The survey team shall carry out 3D laser scanning to collect the existing condition of the site area, record the condition of the exposed underground utilities, as well as recording the as-built status of the construction.

5.5.1.2 The specification of the proposed laser scanner (Brand: Model no) are listed as follow:-.
(Insert Scanner Specifications)

5.5.2 Existing Condition Survey

5.5.2.1 The contractor survey team shall carry out Joint Survey with the Project Manager's survey team in capturing the existing condition of the site area within 3 months after the project commence.

5.5.2.2 The result (point cloud data) will be agreed and merged into a single point cloud file in HK80 coordinate system. The BIM Team shall further convert the point cloud data into RCP format (Autodesk Recap) to support the overlaying of the point cloud data with the WIP PIM.

5.5.2.3 The final point cloud data shall be agreed with the project manager's survey team and published in the BIM CDCP using the collaboration process in section 5.2.

5.5.3 Exposed Underground Utilities

5.5.3.1 The contractor survey team shall carry out Joint Survey with the Project Manager's survey team in capturing the exposed underground utilities as soon as practicable.

5.5.3.2 The BIM Team shall use the survey result to update the existing underground utilities model and submitted with the monthly WIP PIM.

5.5.4 As-built record

5.5.4.1 The contractor survey team shall carry out Joint Survey with the Project Manager's survey team in capturing the as-built records as soon as practicable.

5.5.4.2 The BIM Team shall use the survey result to update the WIP PIM to as-built model according to the tolerance agreed with the maintenance parties as far as practicable.

5.6 Detail Design and Construction Planning Process

5.6.1 Overview

5.6.1.1 The BIM Team shall always use the latest WIP PIM (last monthly submission) in developing the WIP phase planning model when a new version of programme is going to be released by the planning and design team. The BIM Team shall group multiple object elements into one construction activity if the construction details / breakdown structure is not yet available to the BIM Team. The BIM Team will not update the geometry in the phase planning model before the release of a new version of construction programme.

5.6.1.2 The construction method simulation of bridge A shall be developed with the LoD 300 bridge model noise enclosure model, as well as the detail construction method statement from the planning and design team. The BIM will not develop the construction method simulation before the detail construction method statement is available.

5.6.1.3 The BIM Team shall develop the portion of the WIP PIM to LoD 300 before the generation of any cost estimation analysis.

5.6.1.4 The working drawings of the noise enclosure shall be generated after the LoD 400 of the noise enclosure model is completed.

5.6.2 Phase planning model

5.6.2.1 An initial phase planning model will be created 90 days after the project commence using the initial construction programme. The BIM model and the initial construction programme will be imported into Fuzor VDC 2020. The 4D simulation engineers shall link the model components with the programme in the software to generate a phase planning model using the Activities ID in the programme. The activity ID in the programme will be embedded to the BIM components as accordingly during the modelling stage to enable automatic mapping between the programme and components in Fuzor. Construction activities in progress or completion shall be highlighted with different colours.

5.6.2.2 The phase planning model shall be exported to interactive model in *.EXE format. The user can open the exported model in 64-bits Windows environment and carry out interactive review of the model by time and space, as well as carry out distance measurements.

5.6.2.3 Unless otherwise instructed by the Project Manager, the initial phase planning model only be updated during the release of a new version of the construction programme. Temporary construction works (LoD-G 300), TTA (LoD-G 200), plants and major equipment (LoD-G 200) shall be added to the model according to the break down structure in the construction programme as far as practicable.

5.6.2.4 The updated/actual construction time of the phase planning model shall be updated by linking with the construction programme using the Activities ID.

5.6.2.5 The phase planning model shall be submitted within 14 days after the official release of an updated construction programme.

5.6.3 Construction Method Simulation

5.6.3.1 (Methodologies, schedule of submission, content and LOD-G of the object in the models...)

5.6.4 Cost Estimation

5.6.4.1 (Methodologies, schedule of submission, content and LOD-G of the object in the models...)

5.6.5 Working drawing production.

5.6.5.1 (Methodologies, schedule of submission, content and LOD-G of the object in the models...)

5.6.5.2 A drawing list is required for both electronic and paper format drawings. The drawing list shall include the drawing no, title, revision date, original paper size, and file names in a table format grouped by disciplines

Drawing no	Drawing Title	Revision	Original Size	File name/Format

5.6.5.3 The documentation team prepare a relationship table among drawing files and the BIM model files at the final stage and package together with the drawing packages.

			Modelfiles.rvt	Modelfiles.rvt	Modelfiles.rvt	Modelfiles.dwg	Modelfiles.dwg	Modelfiles.dwg	Modelfiles.dwg	Modelfiles.dwg
Discipline	Drawing title	File Name								
BR	Drawings files	Drawingfiles.pdf			*		*		*	

5.7 As-built Modelling Process

5.7.1 Verification and updating of PIM

5.7.1.1 The BIM Team shall develop the as-built BIM progressively from the agreed as-built survey of the survey team according to the tolerance allowable by the respective maintenance owner. The BIM Team shall overlay the as-built survey drawings against the WIP PIM. The critical points of the object elements shall be updated when they deviate outside the acceptable tolerance.

5.7.1.2 The BIM Team Leader shall communicate with the Project Manager and maintenance parties in the determination of the tolerance within 12 months after the Service commence. In case a tolerance could not be established, the BIM Team shall develop the as-built model according to the workmanship tolerance accepted by the Project Manager.

5.7.1.3 Unless otherwise instructed by the Project Manager, the BIM Team shall update geometry and attributes (LOIN) of the as-built model according to the BIM harmonisation standard published by the Development Bureau.

5.7.1.4 The As-built Model shall be submitted in Native format (in latest version) and IFC v4 format.

5.7.2 Submission Schedule

5.7.2.1 The as-built BIM model shall be submitted for review 2 months after the as-built survey of the portion/area is completed. The BIM Team shall combine and re-submit the as-built model by disciplinary 4 weeks after the completion of related works. The tentative schedule are listed below:

Area/Portion	Description	First Submission Date	Final Submission Date
Zone A	Watermain	DDMMYYYY	DDMMYYYY
Zone B	Watermain	DDMMYYYY	DDMMYYYY
...

5.7.3 Object libraries

5.7.3.1 All non-system object libraries shall be created and named according to the requirement in the CEDD Modelling Manual.

5.7.3.2 All the object libraries shall be submitted in native format with the as-built BIM model.

5.8 Asset Information Modelling Process

5.8.1 Development of Asset Information

5.8.1.1 The BIM Team shall develop the asset information model from the as-built BIM model according to the asset information requirement (AIR) of the maintenance parties. The object elements shall be re-organised according to the geometrical requirement in the AIR. Attributes required by the maintenance party shall be updated to the model.

5.8.1.2 The below maintenance parties, respective disciplinary models and available standards are identified in the below table:

Maintenance Department	Disciplinary model	Asset Information Standard
WSD	As-built Watermain (CE1234-CEO-XX-XX-UU_WM-M3_A) Exposed watermain (CE1234-CEO-XX-XX-UU_WM-M3_E)	.....
DSD	As-built Sewerage (CE1234-CEO-XX-XX-UU_FO-M3_A) Exposed Sewerage (CE1234-CEO-XX-XX-UU_FO-M3_E) As-built Stormwater (CE1234-CEO-XX-XX-UU_SW-M3_A) Exposed Stormwater (CE1234-CEO-XX-XX-UU_SW-M3_E)	.....
HyD	As-built Bridge Model (CE1234-CEO-XX-XX-ST_BR-M3_A)	To be identified
TD	As-built Noise Enclosure Model (CE1234-CEO-XX-XX-ST_NB-M3_A)	To be identified

5.8.1.3 The BIM Team Leader shall communicate with the Project Manager and maintenance parties in the determination of the Asset Information Requirement within 12 months after the Service commence. In case an AIR could not be established, the BIM Team shall develop the Asset Information Model according to the BIM harmonisation Guideline.

5.8.1.4 The Asset Information Model shall be submitted in Native format (in latest version) and IFC v4 format.

5.8.2 COBie/IFC Export

5.8.2.1 The proposed modelling software include built-in functions to configure and export COBie datasheet according to the mapping requirement of the asset information requirement of the respective maintenance department. In case the native modelling software (such as Civil 3D) does not carry such features, the project team shall import the asset information model into Autodesk Navisworks to carry out the data export.

5.8.2.2 All the proposed software support the direct export of IFC v4.0.

5.8.3 Submission Schedule

- 5.8.3.1 The asset information model shall be submitted for review within 2 months after the acceptance of the as-built model of the whole discipline. COBie data sheet shall be exported and submitted within 2 weeks after the acceptance of the Asset Information model. The tentative schedule is listed below:

Maintenance Department	Description	AIM Submission Date	COBie Submission Date
WSD	As-built Watermain (CE1234-CEO-XX-XX-UU_WM-M3_A) Exposed watermain (CE1234-CEO-XX-XX-UU_WM-M3_E)	DDMMYYYY	DDMMYYYY
DSD	As-built Sewerage (CE1234-CEO-XX-XX-UU_FO-M3_A) Exposed Sewerage (CE1234-CEO-XX-XX-UU_FO-M3_E) As-built Stormwater (CE1234-CEO-XX-XX-UU_SW-M3_A) Exposed Stormwater (CE1234-CEO-XX-XX-UU_SW-M3_E)	DDMMYYYY	DDMMYYYY
...

6. REFERENCE STANDARDS

6.1 General and Definition of Terms

6.1.1.1 This project shall reference to the published Technical Circular, CEDD standards, ISO19650 standards and CIC publication in the following order:

- DEVB TC(W) No. 2/2021 or latest version
- DEVB TC(W) No. 8/2021 or latest version
- DEVB BIM Harmonisation Guidelines for Works Department
- BIM Modelling Manual published by CEDD
- LOIN Specification published by CEDD
- Asset Information Requirement published by relevant maintenance parties
- CIC Building Information Modelling standards – General, Version 2.1, 2021 by the Construction Industry Council
- CIC BIM Dictionary, Dec 2020 by the Construction Industry Council
- CIC Production of Building Information Modelling Object Guide General Requirements, Version 2 - 2021 by the Construction Industry Council

6.2 Modelling Standard

6.2.1.1 This project team shall adopt the BIM Modelling Manual published by CEDD for creating all the PIM and BIM object libraries.

6.2.1.2 The project team shall use the CAT codes defined in the BIM harmonisation guideline in creating and labelling all BIM object libraries.

6.2.1.3 The project team shall use all the LOIN Specification published by the CEDD for the creating the geometrical detail and information content of the modelling objects.

6.2.1.4 The project team shall adopt the LOIN Specification published by the maintenance parties and report to the project manager in case the abovementioned standard is not applicable.

6.3 Naming Convention

6.3.1.1 This project team shall adopt the BIM Modelling Manual published by CEDD for the disciplinary files and BIM object naming of in this project.

6.3.1.2 The project team shall report to the project manager in case the abovementioned standard is not applicable.

6.4 Colour Convention

6.4.1.1 The colouring of BIM objects could be affected by the filtering and rendering features of individual BIM software. This project team shall adopt the BIM Modelling Manual published by CEDD for the colouring convention of BIM object during the publication of clash/TQ report only.

6.4.1.2 The project team shall use the texture maps of the object elements in the WIP PIM, phase planning models, virtual reality model and construction method simulation as far as practicable.

6.5 Drawing production

6.5.1.1 All the drawings shall be produced with the project title block.
(Insert title block)

6.5.1.2 The BIM Team shall use the Drafting Specification for Engineering Survey, Rev. 3.0/Nov 2014 by CEDD in preparing the layers, colour, font and annotation, linestyle, abbreviations and symbols of the working drawings as far as practicable.

6.5.1.3 It is known that some of the fonts, linestyles... could not be applied to the BIM modelling software. The project team proposed a replacement as follow:

Item	Drafting Specification	Proposed Replacement
1	Font Type	
	Arial	Arial Narrow

2	Line type	

6.5.1.4 This project team shall reference the Preparation of Statutory Plan Submissions (December 2020) guideline published by CIC for creating the working drawings for the noise enclosure when a solution could not be established by the standard software feature.

6.6 As-built / Asset Information Modelling

6.6.1.1 The project team shall adopt the BIM harmonisation guideline to update the PIM to create the as-built BIM model.

6.6.1.2 The project team shall adopt the LOIN and data attributes in the asset information requirement / modelling guideline of the maintenance parties to create the asset information model. The tentative arrangement is proposed as follow:

Item	Disciplinary Model	Proposed Asset Information Requirement
1	Existing Site Formation	
	Existing Structure	N/A
	Existing Underground Utilities	Respective Maintenance Parties, including DSD, WSD and LandsD
2	Proposed Design	
	Site Formation	LandsD
	Bridge A	HyD
	Noise Enclosure	Transport Department
	New Underground Utilities	Respective Maintenance Parties, including DSD, WSD and LandsD

6.6.1.3 The BIM Team shall coordinate with the Project Manager to identify the final requirements from maintenance parties. The asset information modelling requirement/standard shall be finalized within 12 months after the service commence.

7. HARDWARE AND SOFTWARE

7.1 Software Specification

7.1.1 Modelling Software

7.1.1.1 Modelling software shall be used to create all the PIM, as-built model and asset information models.

7.1.1.2 The BIM Team shall use the Autodesk Civil 3D and Revit 2020 to create the parametric objects for the existing site formation, proposed site formation, pipe works and bridge works in DWG or RVT format

7.1.1.3 The Noise Enclosure shall be modelled to LoD 300 with Autodesk Revit 2020 in RVT format and further enhanced to LoD 400 with Trimble Tekla 2020. The LoD 400 model will be shared and published with IFC v4.0.

7.1.1.4 Minor elements for virtual reality rendering, phase planning and construction method simulation shall be created with Autodesk AutoCAD and 3DsMax in DWG or FBX format.

7.1.1.5 The existing structure within 200m of the site boundary will be created from the 3D spatial data from Lands Department using Autodesk 3Ds Max and Infraworks in FBX format.

7.1.1.6 Except the minor elements, the data exchange formats, such as IFCv4.0 and COBie shall be exported directly from the native modelling software proposed.

7.1.1.7 The details of modelling software setup are described in section 5.2.3.

7.1.2 Coordination software

7.1.2.1 The BIM Team shall deploy the Autodesk Navisworks Manage to carry out the 3D coordination and clash detection. The coordination model shall be published in NWD format.

7.1.2.2 The clash shall be detected in the Autodesk Navisworks Manage. The result shall be organised and published in html (Web browser) and excel format.

7.1.3 Design Review and Phase planning software

7.1.3.1 The PIM and phase planning model shall be developed from the Fuzor VDC 2020 software in CHE format. The models will be shared in *.EXE format and could be opened for review in 64-bits Windows operation environment (without additional software required).

7.1.3.2 The exported *.EXE file could be directly opened with Virtual Reality Lens to support the immersive VR design review environment.

7.1.4 Construction Simulation Software.

7.1.4.1 The construction simulation is created and rendered by the Fuzor VDC 2020 software. Video editing software may be introduced to edit the video if necessary. The final animation shall be exported into *.MP4 format.

7.2 Hardware Specification ...

7.2.1 Native BIM models

- 7.2.1.1 The project manager and stakeholder could open and use the native models with a workstation with the following specification:
- CPU: Intel Xeon CPU W-2145 3.7GHz 8 core CPU
 - Memory: 64GB DDR3 ECC RDIMM RAM
 - Display card: NVIDIA Quadro RTX 4000 8GB
 - Storage: 1 no of 512MB SSD and 2TB 7200 RPM hard disk
 - Display: Dual 24 inch with WUXGA resolutions
- 7.2.2 Design review on Common Data Collaboration Platform for BIM
- 7.2.2.1 The project manager and stakeholder could open and use the review the models on the BIM CDCP using a standard web browser installed a basic workstation with the following specification:
- CPU: Intel Core i7-1065G7 1.3GHz 4 core CPU
 - Memory: 16GB DDR3 ECC RDIMM RAM
 - Display card: NVIDIA Quadro P620 with 2GB display memory
 - Storage: 1TB 7200 RPM hard disk
 - Display: 24 inch with WUXGA resolutions
- 7.2.2.2 The project manager and stakeholder shall also and use the review the models on the BIM CDCP using a iOS or Andorid tablet with following minimum configuration:
- CPU: Quad-core 2.34 GHz CPU
 - Memory: 3 GB RAM
 - Display: 1620 x 2160 pixels
 - Communication : Wi-Fi 802.11 a/b/g/n/ac
- 7.2.3 Phase Planning, simulation, and Animation
- 7.2.3.1 The project manager and stakeholder could open and use the phase planning export, simulation and animation with an entry grade workstation with the following specification:
- CPU: Intel Core i9-9900 3.1GHz 8 core CPU
 - Memory: 32GB DDR3 ECC RDIMM RAM
 - Display card: NVIDIA Quadro P1000 with 4GB display memory
 - Storage: at least 1TB 7200 RPM hard disk
 - Display: 24 inch with WUXGA resolutions
- 7.2.4 Virtual Reality Equipment
- 7.2.4.1 The project manager and stakeholder could carry out immersive VR review of the model using the following equipment:
- Display type: Dual low-persistence Samsung AMOLED
 - Display size: 91.9mm x 2447 ppi
 - Resolution: 1200 x 1080 (per eye)
 - Field of View: 110H x 113V degrees at optimal 8mm lens-to-eye distance
 - Lens type: Fresnel
 - Lens Adjustment: IPD (60.8 – 74.6mm)

7.3 Upgrade plans

- 7.3.1.1 The version of all software is maintained until the construction stage unless agreed by all parties in the Project.