Master Specification
Part PC-EDM5

Digital Engineering

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Government of South Australia
Department for Infrastructure and Transport

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Document Information

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0	Initial issue	31/08/2023
1	Update to amend terminology – change “Asset Data Collection Manual” to “Asset Data Collection Standard” and “Asset Data Spreadsheet” to “Asset Data Capture Template”	31/01/2024
2	Updated cover page	30/09/2024

Document Management

 This is a controlled document and it will be updated and reissued as approved changes are made.

Contents

PC-EDM5 Digital Engineering

1 General

a) This Master Specification Part sets out the requirements for digital engineering processes and methodology in the delivery of road infrastructure projects during the planning, concept, development, construction, and operation phases, including:

i) the documentation requirements, as set out in section 2;

ii) the relationship documents requirements, as set out in section 3;

iii) the information requirements, as set out in section 4;

iv) details regarding the Digital Information Manager, as set out in section 5;

v) the information models requirements, as set out in section 6;

vi) the information exchanges requirements, as set out in section 7;

vii) the standards and specifications requirements, as set out in section 8;

viii) the Digital Model requirements, as set out in section 9;

ix) Handover process requirements, as set out in section 10; and

x) the data quality assurance requirements, as set out in 11.

b) The digital engineering processes and methodology must comply with the Reference Documents, including:

i) Department Asset Handover Report (AM-PRC-001);

ii) Department Technical Data Requirements for Digital Engineering Projects (Digital Asset Governance Manual) (AM-PRC-003);

iii) Department Asset Data Collection Standard (AM-PRC-005);

iv) Department Digital Engineering Modelling Standard; and

v) ISO 19650 (series) Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) - Information management using building information modelling.

c) For the purposes of this Master Specification Part, the life cycle of the asset includes:

i) conception, strategy, and briefing;

ii) procurement;

iii) design;

iv) construction;

v) commissioning and handover;

vi) operation and maintenance;

vii) performance management;

viii) change of use or modification; and

ix) disposal or demolition.

d) Without limiting the Contractor's obligation to comply with the Contract Documents, the Contractor must ensure that all Project information that is transmitted for contractual purposes meets the requirements of PC-PM5 "Information Management".

2 Documentation

2.1 Data Security Plan

The Contractor must prepare a Data Security Plan in accordance with the requirements of section 7.2.

2.2 Digital Engineering Execution Plan (DEXP)

The Contractor must prepare a DEXP in accordance with the requirements of section 6.3.

2.3 Design Documentation

In addition to the requirements of PC-EDM1 “Design Management”, the Design Documentation must include:

a) Project Information Model (PIM) as required by section 6.1a); and

b) details of the Contractor’s preferred as-built site verification methodology, as required by section 10.2a).

3 Relationship documents

In complying with all digital engineering obligations under this Master Specification Part, the Contractor must consider the relationship between key digital engineering documents adopted in the delivery of Department projects, as set out in the Exchange Information Requirements (EIR) provided as part of the Contract Documents.

4 Information requirements

4.1 Exchange Information Requirements (EIR)

a) The Contractor must comply with all EIRs.

b) The Contractor must submit all the required information outlined in the EIR.

c) The Contractor must use the EIR to prepare a DEXP, as required by section 6.3, for the delivery and management of digital engineering on the Project.

4.2 Project information requirements (PIR)

The Contractor must comply with all requirements of the PIR provided as part of the Contract Documents, including in relation to:

a) Project scope and risks to mitigate;

b) information requirements, and who is responsible for sharing information;

c) information exchange (Project milestones);

d) roles and responsibilities (RACI matrix);

e) legacy data available (survey, drawings, reports and models);

f) any departures agreed by the Principal against the EIR or Asset Information Requirements (AIR);

g) Level of Information need; and

h) change management process with specific consideration for changes in technologies applicable to the Project over the Project lifecycle and any subsequent impacts on data file type, structure or integration.

4.3 Asset information requirements (AIR)

The Contractor must comply with the AIR provided as part of the Contract Documents.

5 Digital Information Manager

a) If required by the Contract Documents, the Contractor must provide a Digital Information Manager, who will be accountable for the provision of all aspects of Project information and data management throughout the Project lifecycle, ensuring infrastructure, interface, and information flow between all participating stakeholders.

b) Where the Contract Documents do not require the Contractor to appoint the Digital Information Manager, the Principal will appoint the Digital Information Manager.

6 Information models

6.1 Project Information Model (PIM)

a) The Contractor must submit a PIM as part of the Design Documentation and continually develop and update that PIM throughout the design and construction phase of the Project.

b) The Contractor must ensure that the PIM responds to all requirements set out in the EIR, the AIR and the PIR.

c) The PIM is the Federated Model, including all Design Documentation, Digital Models and a range of non-graphical (structured) data and documentation covering the entire scope of the Works in detail, including legacy information. The PIM must deliver a complete digital representation of the physical and functional characteristics of the Project, providing a comprehensive shared knowledge resource (single source of truth) for information about the Works and forming a reliable basis for decisions throughout the delivery phase of the Project.

d) The PIM must be utilised through each stage of the Project. Starting off as a design intent model, the Level of Development (LOD) and Level of Information (LOI) must increase and, eventually, become a virtual construction model containing all elements that need to be manufactured, fabricated, constructed, or installed by the Contractor as part of the Project as stipulated in the EIR.

e) The PIM must contain or provide integrated access to all Project information including Design Documentation, Design Departures, Non-Conformances, Defects, O&M Manuals, Training Manuals and As-Built Records.

f) As required by PC-CN2 “Asset Handover”, as a condition precedent to Handover, the Contractor must transfer all required information from the PIM to the Asset Information Model (AIM) in accordance with the processes set out in the EIR and the AIR.

6.2 Asset information model (AIM)

a) The Contractor must develop an AIM that satisfies all requirements of Department Technical Data Requirements for Digital Engineering Projects (Digital Asset Governance Manual) (AM-PRC-003).

b) The Contractor must deliver an AIM comprising:

   i) all relevant information from the PIM as required by section 6.1f);

   ii) a structured asset register following the requirements of:

      A. Department Asset Data Collection Standard (AM-PRC-005); and

      B. the AIR;

   iii) an organised repository of Design Documentation, drawings, relevant documents and files required for the operation and maintenance phase of the asset life cycle; and

iv) all relevant information including graphical (geometry) and non-graphical (data) from the Digital Models as required by the Principal and any relevant third parties.

c) The Contractor must deliver an AIM that is capable of being continually updated by the Principal or a third party post-Handover, as may be applicable to accommodate events including maintenance work, repairs, refurbishments or upgrades, replacement, decommissioning, risk assessments, performance evaluations or changes in regulations.

6.3 Digital Engineering Execution Plan (DEXP)

a) The Contractor must develop a DEXP, adopting the template provided by the Principal, in accordance with the AIR, PIR and EIR.

b) The Contractor must address the following requirements within the DEXP as a minimum:

i) all requirements of this Master Specification Part;

ii) all design authoring tools software and procedures must be defined;

iii) all Digital Model collaboration software and procedures must be defined;

iv) a detailed description of the GIS data to be provided;

v) as-built site verification methodology, as required by section 10.2a);

vi) model coordination strategy to be implemented by the Contractor;

vii) information exchange procedures to be implemented by the Contractor;

viii) procedure for recording and communicating changes to Digital Models to be implemented by the Contractor, including post IFC changes;

ix) strategic goals for implementing digital engineering on the Project;

x) roles and responsibilities in the implementation of digital engineering for the Project; and

xi) outline of additional resources, training, or other competencies necessary to successfully implement digital engineering in accordance with this Master Specification Part.

c) The Contractor must prepare, submit and update the DEXP in accordance with the following:

i) the DEXP must be developed in accordance with the Contract Documents; and

ii) the DEXP must be continually developed in accordance with PC-PM1 “Project Management and Reporting”.

7 Information exchanges

7.1 Common Data Environment (CDE)

a) The Contractor must establish, implement and maintain a Common Data Environment (CDE):

i) based on ISO19650-1 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;

ii) in accordance with the requirements of the EIR; and

iii) that satisfies the requirements of PC-PM5 “Information Management”.

b) The CDE required by section 7.1a) must:

i) comprise of a single digital information platform for storing and accessing Project data and information, including all Design Documentation;

ii) comprise a centralised data repository (single source of truth) both for Project and asset information through the PIM and AIM;

iii) provide a collaborative environment for all stakeholders to collect, manage, and disseminate Project and asset information through a managed process;

iv) contain a workflow which organises the flow and management of information (both graphical and non-graphical) across the whole life cycle of the asset; and

v) support the capture of digital data, including Design Documentation, contractual documents and correspondence, during all Project phases, and ongoing operation and maintenance phase and other phases of the asset's life cycle.

7.2 Data security

a) The Contractor must establish, implement and maintain a Data Security Plan for the management of requirements for the digital security of the Project.

b) The Contractor must ensure that the Data Security Plan identifies and details mitigations and specific security measures for potential security threats to the information stored within the CDE during all stages of the asset life cycle.

c) The Data Security Plan must provide application of security controls throughout the asset's life cycle (including the full Project lifecycle) to deliver a holistic approach encompassing:

i) safety;

ii) authenticity;

iii) availability (including reliability);

iv) confidentiality;

v) integrity;

vi) possession;

vii) resilience; and

viii) utility.

d) The Data Security Plan must detail the Project specific needs of confidentiality, integrity, and accessibility with the consequences of any loss or unauthorised release of the information, whether of a personal or business nature.

e) The Data Security Plan must outline the steps proposed to be taken for compliance with any data sovereignty requirements including locally hosted servers and failover servers.

f) The Data Security Plan must be prepared, submitted and updated in accordance with the requirements of PC-PM1 "Project Management and Reporting".

8 Standards and specifications

8.1 Project Digital Models

a) In developing the DEXP and other digital engineering deliverables, the Contractor must apply the Department Digital Engineering Modelling Standard.

b) The Contractor must ensure that all 2D and 3D CAD drawings and documentation, including all Design Documentation and Construction Documentation, is derived from the Digital Models as specified in the EIR and the Contract Documents.

8.2 CAD

The Contractor must submit 2D CAD drawings at each design review stage required by PC-EDM1 "Design Management", unless specified otherwise in the Contract Documents.

8.3 Survey

The Contractor must comply with all surveying requirements set out in:

a) PC-SI5 “Engineering Survey”; and

b) PC-SI1 “Site Surveys”,

as applicable to the digital engineering requirements of this Master Specification Part.

8.4 Geographic information system (GIS)

The Contractor must comply with all GIS requirements set out in PC-SI4 “GIS & Aerial and Remote Data Capture Standard” as applicable to the digital engineering requirements of this Master Specification Part.

8.5 Asset data deliverables

a) The Contractor must comply with all asset data deliverables specified in:

   i) PC-CN2 “Asset Handover”;

   ii) Department Technical Data Requirements for Digital Engineering Projects (Digital Asset Governance Manual) (AM-PRC-003); and

   iii) Department Asset Data Collection Standard (AM-PRC-005).

b) The Contractor must ensure that asset register data is:

   i) captured during the performance of the Works within the Digital Models; and

   ii) updated in the Asset Data Capture Template which forms part of the handover deliverables in PC-CN2 “Asset Handover”.

9 Digital Model requirements

9.1 General

a) The Contractor must compile all individual discipline Digital Models to create the Federated Model and ensure consistent processes for model sharing and coordination are in place.

b) The Contractor must comply with the requirements for graphical information (LOD) and the non-graphical information (LOI) inclusion in the individual discipline Digital Models and Federated Model as specified in this section 9.

c) The Contractor must ensure the Digital Model elements contain the properties, and relevant attributes, as defined in the AIR.

d) The Digital Models must provide drawing production that must be produced from the 3D environment.

9.2 Legacy data

a) The Contractor must review all legacy data for accuracy and degree of useability and relevance to the Project, including as required by the EIR.

b) The Contractor must verify all existing Site information or legacy data available to the Project against the existing conditions for any discrepancies and assessment of accuracy.

c) The Contractor may not place any reliance on the legacy data. The use of any aspect of the legacy data is entirely at the Contractor’s risk, unless otherwise specified in the Contract Documents.

10 Project Handover - process

10.1 General

a) As a condition precedent to Handover, the Contractor must deliver both the Works as executed (as-built) and record Digital Models. The Contractor must ensure that this information is representative of what has been built, with all associated data needed to assist in operating and maintaining the completed asset.

b) The Contractor must comply with all requirements of the EIR, including workflows to be carried out by the Contractor during the Completion and Handover phase of the Project.

c) The Contractor must also comply with the following:

i) all information requirements set out in the PIR, AIR and EIR, including as set out in the relevant DEXPs;

ii) all relevant Project GIS management plans; and

iii) PC-CN2 “Asset Handover”.

10.2 Asset Handover (built asset)

a) The Contractor must include the preferred as-built site verification methodology in the DEXP and as part of the Design Documentation.

b) In complying with section 10.1a), the Contractor must ensure that all documents, data and models have been site verified by the Contractor as reflecting as-built conditions. The Contractor must undertake as-built site verification in accordance with the methodology included in the approved DEXP.

11 Data quality assurance

a) The Contractor must ensure that all data is structured and delivered in accordance with:

i) Department Asset Handover Report (AM-PRC-001);

ii) Department Technical Data Requirements for Digital Engineering Projects (Digital Asset Governance Manual) (AM-PRC-003);

iii) Department Asset Data Collection Standard (AM-PRC-005),

in such a way to reduce manual input and optimise the automated extraction of the manageable asset data.

b) All models must be able to be accessible by the Principal during all phases of the Project and viewed through free downloadable software such as Navisworks Freedom.