Guideline

Building Information Modelling (BIM) for Transport and Main Roads

A guide to enabling BIM on Road Infrastructure Projects

November 2021

Queensland Government

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1 Introduction

1.1 Purpose of the guideline

This document sets out the Building Information Modelling (BIM) direction for Transport and Main Roads. The purpose of this document is to assist the department's Project Managers and project stakeholders to implement BIM processes and methodology in the delivery of road infrastructure projects during the planning, concept, development, implementation and finalisation phases.

In reading this document it is expected that departmental staff and project stakeholders will gain knowledge of:

- Transport and Main Road's BIM implementation program and plan.
- Why the department is adopting a digital approach to deliver capital projects.
- What are the key BIM procurement documents and how they need to be developed.
- What processes need to be followed to efficiently implement BIM on projects.
- Who is responsible for which activities.

1.2 Context

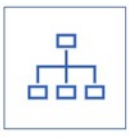
In the 2016 State Infrastructure Plan (SIP), the Queensland Government stated the intention to introduce BIM to all projects by 2023, with a series of principles in draft to underpin whole of Government adoption.

Transport and Main Roads has already developed its BIM processes and methodology and has undertaken several pilot projects to test the challenges and benefits anticipated. BIM Implementation will have an impact on the processes that underpin the planning, concept, development, implementation and finalisation as well as operations and maintenance of the department's infrastructure projects.

As a member of the Queensland BIM Working Group, Transport and Main Roads was a key player in the development and delivery of the *Digital Enablement for Queensland Infrastructure – Principles for BIM Implementation* document published in November 2018 by the Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP). This overarching document has been published for use by all Queensland Government departments, agencies and statutory authorities and applies to the full lifecycle, including design, delivery and asset management, of all new major state infrastructure assets.

In line with the principles outlined in the publication, the department's focus is ensuring the implementation strategy aligns with the four key principles of:

OPEN
To allow interoperability



MANAGED
Active management of information throughout the asset lifecycle.

SUPPORTED
Building capability supported by government-led training and research.

EFFECTIVE
A drive towards best practice.

Transport and Main Roads has been applying BIM principles on major projects since 2016. The department's criteria on the application of BIM are as follows:

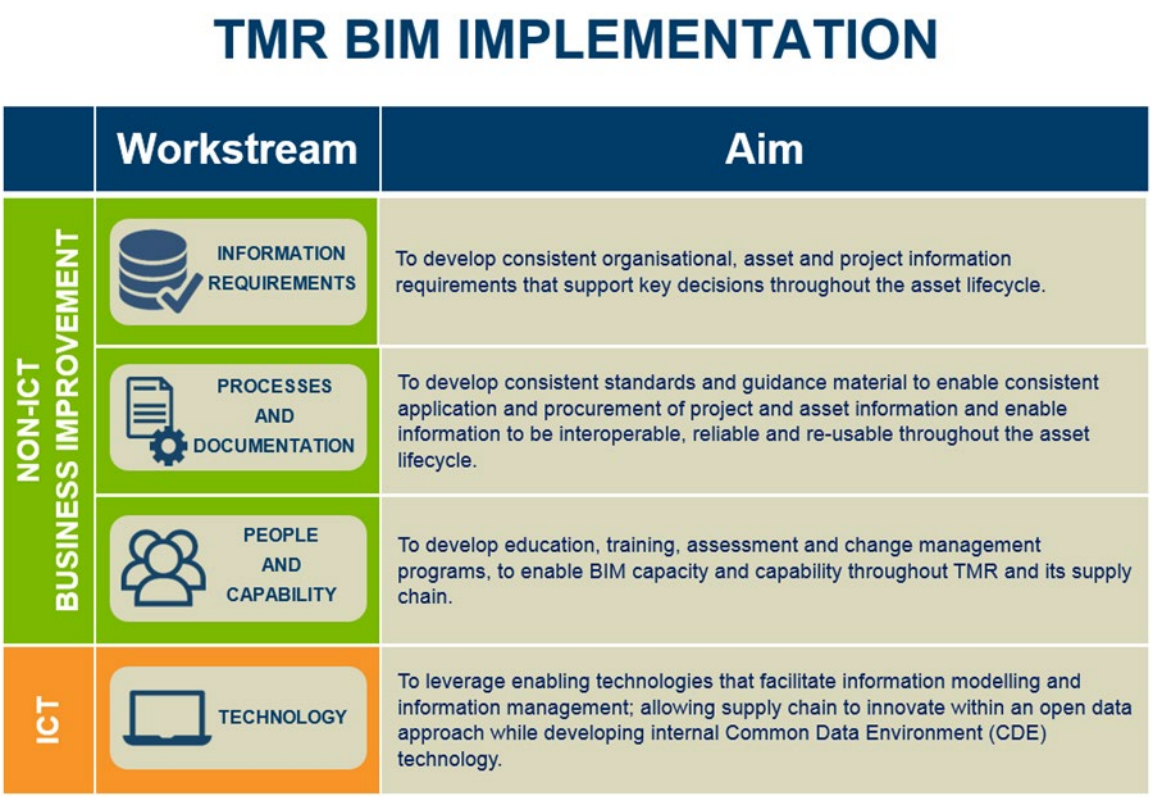
- All major projects shall implement BIM methodologies using the department's specifications effective immediately, taking into account:
  - Complexity / Characteristics (For example, the requirements for complex staging, and interfacing with other infrastructure or built environment).
  - Capability (The level of collaboration and knowledge of BIM, required and/or available within Transport and Main Roads and industry).
  - Contract type (Alignment with contract provisions and risk allocation).

1.3 Transport and Main Roads BIM implementation program and plan

The department's BIM Implementation Program has been in development for several years, resulting in over 30 BIM-enabled projects to date. BIM for the department represents the development of 3D object-based modelling in road design, alongside robust processes and defined requirements for information and data management in project delivery.

To meet the Queensland Government's direction, the department has developed its own BIM Implementation Strategy with four "workstreams" as outlined in Figure 1.3(a) below.

Figure 1.3(a) – Transport and Main Roads BIM implementation program



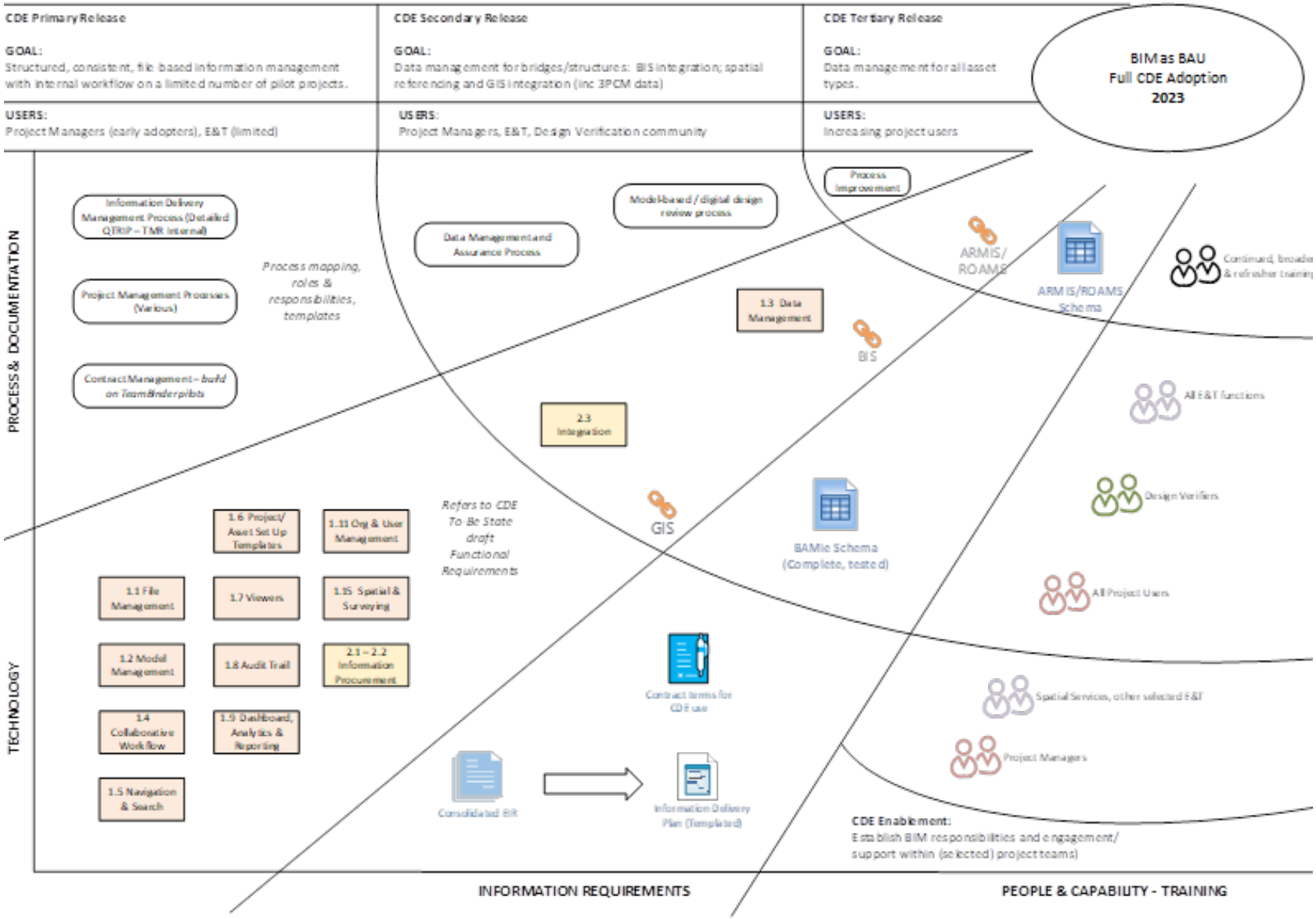
Transport and Main Road's BIM implementation vision is

To drive information sharing efficiencies within all phases of an asset's lifecycle

Efficiencies will be realised through the adoption of international standards for information management using BIM (ISO 19650) which will enable Transport and Main Roads and their suppliers to receive and share all required information during the correct project phases to enable informed decisions.

As indicated in Figure1.3(b), the Implementation Plan's four workstreams are designed to progress in parallel to achieve the most effective implementation of BIM processes into Transport and Main Roads.

Figure 1.3(b) – Transport and Main Roads BIM implementation plan



1.4 Benefits of BIM

Transport and Main Road's BIM program will promote the avoidance of wasteful activities, in accordance with ISO 19650 series.

Wasteful activities may include:

- Waiting and searching for information.
- Over-production of information with no defined use.
- Difficulties to identify ownership, validity, and currency of information.
- Defects caused by poor co-ordination across graphical and non-graphical data sets, resulting in rework.

The departmental BIM Implementation objectives and benefits are outlined in Table 1.4(a) and Table 1.4(b), differentiated between Strategic (S) and Project (P) objectives.

Table 1.4(a) – Strategic objectives and benefits

	Objective	Benefits
S1	Achieve consistency for the management of asset information and data in the Queensland Transport and Roads Investment Program (QTRIP) process, including the necessary requirements for departmental suppliers to meet their asset information and data obligations.	Consistency creates efficiency benefits while improving quality in information procurement and management. Providing suppliers with a consistent process will make it easier for consultants and contractors to respond to the department's BIM requirements and improve assessment.
S2	Provide the consistent processes and tools to achieve the business change and associated benefits identified by Transport and Main Road's BIM Implementation Plan.	• Reduction in time required to complete business functions (e.g. design verification). • Fewer variations. • Fewer time and cost overruns. • Reduced manual work at handover.
S3	Provide the necessary technology, process and documentation to meet current international BIM standards.	This ensures industry development is in line with departmental requirements. Alignment with supplier expectations on information management and modelling approaches, drives consistency, increases speed of delivery and improves the quality of project outcomes.

Table 1.4(b) – Project objectives and benefits

	Objective	Benefits
P1	Better information management	• Less time required to find information. • Ensure consistency on procuring, collecting and managing information. • Reduce errors/information lost/duplication. • Lower risk and better predictability of outcomes.
P2	Communication and visualisation	• Enhance collaboration, communication, and productivity. • Improve visualisation for better decision-making.

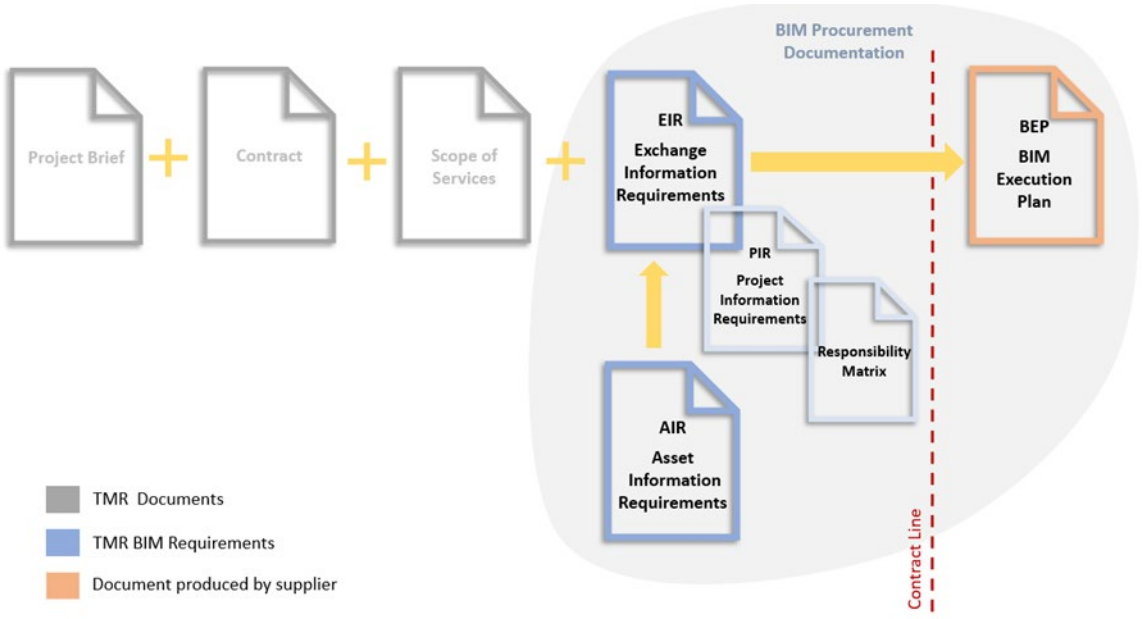
	Objective	Benefits
P3	Design Co-ordination	• Reduce re-work from better coordination and clash detection. • Reduce conflicts and changes during construction.
P4	Design Review	• Improve efficiency in design reviews and approval cycles.
P5	Asset Management	• Improve data collection for digital Operate and Manage (O&M) handover and asset information creation.

2 Transport and Main Roads BIM procurement documentation

2.1 Overview

The key documents to implement BIM within the department's capital project and the relationships between the various BIM procurement documents are shown in Figure 2.1.

Figure 2.1 – BIM procurement documentation



The suite of documents to the left of the contract line form part of the appointment and tender documents which enable suppliers to detail their response in their initial BIM Execution Plan (BEP), to the right of the contract line.

The BEP sets out the supplier's detailed plan for the production, management and quality controls of information delivered under the contract.

The BIM procurement documents are a combination of 'static' departmental documents used across all projects without alteration, and templates that are modified for each individual project. These documents are applicable to all QTRIP projects and are based on Transport and Main Road's standard suite of procurement routes.

The information requirements are aligned to international best practice standards which include the ISO 19650 series.

The processes outlined in ISO 19650-2 should be considered in conjunction with the department's *Transport Infrastructure Project Delivery System* (TIPDS).

These BIM requirements are intended to support and enable an agile and consistent approach to all project activities by adopting digital ways of working. The focus is on ensuring that the right people have the right information at the right time and in the right format to effectively carry out their roles from inception of the project through to operation and decommissioning.

A high-level definition of each BIM procurement document is detailed in Table 2.1.

Table 2.1 – BIM procurement documents

Document	Description	How it is issued	Update frequency
Asset Information Requirements (AIR)	Defines the specific information and data which must be delivered, to achieve Transport and Main Road's target state Asset Information Model (AIM).	Maintained by the department as an overarching asset requirement guide.	Static document applied across all projects (updated from time to time as lessons are learned).
Exchange Information Requirements (EIR)	Sets out managerial, commercial and technical aspects of producing project information. This includes the standards, methods and procedures to be implemented by the delivery team producing a Project Information Model (PIM).	Issued to Suppliers.	Static document applied across all projects (updated from time to time as lessons are learned).
Project Information Requirements (PIR)	Defines the specific information requirements for the project, (for example, specific requirements beyond the AIR/EIR, timing requirements and any specifics relating to information delivery and transmission.	Issued to Suppliers.	Populated for each project.
BIM Execution Plan (BEP)	A document that is produced by the supplier in response to the EIR. It describes the processes and standards that the team will adopt to deliver the requirements of the EIR.	Issued by supplier.	To be created by supplier.

2.2 Transport and Main Roads Asset Information Requirements (AIR)

The objective of the AIR is to provide a clear statement of the requirements that will enable the project to deliver an AIM comprising of:

- A structured asset register, including asset characteristics suitable to Transport and Main Road's asset management requirements.
- An organised repository of drawings, documents and files required for the operational and maintenance phase of the asset lifecycle.
- Accurate as-constructed model/s (including associated data and information).
- Coordinated components consistently cross-referenced, with minimal duplication of data, presented in a format appropriate to the organisation's systems and management capabilities.

As a State Government organisation Transport and Main Roads has legislative requirements for asset management. The Transport Infrastructure Asset Management Policy and supporting documents define the Organisational Information Requirements (OIR) and Asset Information Requirements (AIR) for the department. A review of these overarching policy / procedural documents is required to confirm the alignment of these documents with ISO 19650 workflows for data capture.

There are three Asset Management Systems that currently store asset information for the department, they are:

- ARMIS – A Road Management Information System.
- BIS – Bridge Information System.
- ROAMS – Road Operations Asset Management System.

A review of the asset information requirements across these three major asset management databases is being undertaken to ensure correct asset information is captured during project delivery.

To ensure accuracy and completeness of the Asset Information Model (AIM) it should be produced as an output from the Project Information Model (PIM). This assumes the PIM is the one source of truth for all project information throughout design, construction, commissioning and handover phases. The purpose of the AIM is to provide information that will support the ongoing management of the asset. The AIM should deliver a fully populated asset data set to be used by the department's Asset Information Management Systems.

2.3 Transport and Main Roads Exchange Information Requirements (EIR)

The EIR specifies the department's project and asset information requirements, reasons and purpose to the project team. It also outlines the technical standards and commercial procedures to enable BIM and information management.

The EIR is a critical element of BIM and information management and it is used to clearly define to project teams what information (models, data and documents) is required to successfully enable BIM at each project stage.

Essentially the EIR establishes:

- What information is needed? – Detailed information requirements.
- Why the information is needed? – Defined information purpose.

The EIR is reviewed by the Project Manager prior to engaging a supplier and it will form part of the contract. All Project Briefs for the engagement of suppliers must provide clear definition of the EIR for each stage of project development.

All proponents tendering for departmental projects will be required to demonstrate the proposed approach, capability, and capacity to deliver the BIM requirements for the department though the development of a BEP as outlined in the EIR provided during tender engagement.

2.4 Transport and Main Roads Project Information Requirements (PIR)

The Project Information Requirements (PIR) captures the specific information to inform and manage a project. The AIR and EIR will mainly cover the standard departmental asset and project requirements for projects, while the PIR must be populated by the Project Manager for each project and/or work package.

PIR will include:

- Details of the project such as unique project challenges and risks and how BIM can be used to mitigate them.
- Identify Model Uses to be delivered by the awarded proponent during project delivery.
- When information is needed and who is responsible for sharing the information, including project milestones and information exchange timings outlined in the responsibility matrix.
- Who is undertaking which information management / BIM roles.
- What existing information is available about the project (for example surveys, drawings or models).
- Any additional requirements above and beyond the EIR and AIR (such as specific legislative requirements or information requirements required to test new innovations).
- Any agreed deviations against the EIR and AIR (such as reduction in requirements due to the scope of the project, for example if it involves minor work or refurbishment).
- Responsibility matrix defining the Level of Definition (LOD) of the model and related responsibilities.

The PIR defines requirements for the data, information and models which need to be produced at each project stage along with the required level of information need and their purpose. This data, information and models collectively form the PIM.

The PIR is the responsibility of, and should be completed by Transport and Main Roads, but can be discussed and produced in collaboration with relevant suppliers where appropriate.

2.5 Inclusion of BIM procurement documents in contract forms

The approach for inclusion in contract documents will depend on the underlying contract form and procurement approach.

Collaborative Project Agreement (CPA) Approach:

BIM Procurement Documents are included/dispersed through the Statement of Works and Technical Criteria (SWTC) generally used for *Transport Infrastructure Contract – Design & Construct* (TIC – D&C) contracts as follows:

- Appendix 34: BIM EIR

- Appendix 7: Project Plans (inc BIM Execution)
- Appendix 7 Attachment 7A: Information Delivery Milestones
- Appendix 10: As-Constructed Information Requirements

Engagement of *Consultant's For Professional Engineering* (CFEP) *Manual* and *Transport Infrastructure Contract – Construct Only* (TIC – CO) – Functional Specification Approach:

- The AIR, EIR and PIR will be included or referenced within the Functional Specification for each phase of project development (Options Analysis, Business Case, Preliminary Design, and Detailed Design).

2.6 Model Uses

The defined Model Uses represent Transport and Main Road's desired outcome for 3D models being used on the project. The department's Project Manager together with the Project Information Manger will identify in the PIR the Model Uses to be requested under the Contract. Transport and Main Roads has identified the following core Model Uses detailed in Table 2.6; refer to Appendix 1 for further specification.

Table 2.6 – Transport and Main Roads core Model Uses

Model Use	Description
Modelling existing conditions	Define the extent of existing conditions to be modelled under the project details in the EIR.
Civil/Structural Design – spatial and object-based design models	A process in which 3D software is used to develop a model based on design criteria for transport infrastructure design. Two groups of applications at the core of BIM based design processes are design authoring tools and audit and analysis tools.
Design visualisation for functional analysis	A process in which a 3D model is used to showcase the design to the stakeholders and design reviewers to evaluate the compliance of the design to the relevant design standards while meeting the initial project scope requirements.
Engineering modelling and analysis	A process in which intelligent modelling software uses the 3D model to determine the most effective engineering solution/method based on design specifications. These analysis tools and performance simulations can significantly improve the design of infrastructure.
Quantity take-off and cost planning	A process in which a 3D model can be used to assist in the generation of accurate quantities of materials and cost estimates early in the design process and provide cost effects of various design options with the potential to save time and money and avoid budget overruns. Cost estimation will occur throughout each phase of the project development allowing financial management tracking against budget allocation.
Clash detection/coordination	A process in which clash detection software is used during the coordination process of design elements to determine field conflicts by comparing 3D models of roadway components including subsurface elements. The goal of clash detection is to eliminate the major system conflicts prior to construction.

Model Use	Description
2D Drawing production	The primary purpose of project drawings is to clearly represent the design that is required to be constructed. 2D drawing information for the purposes of assembling a printed set of plans shall be derived from the 3D model(s) to the fullest extent possible.

2.7 Supplier BIM Execution Plan (BEP)

The BEP is a formal document that is submitted by the proponents during a tender process, for design and construction phases (which could be issued separately depending on the procurement approach), outlining how they intend to meet the BIM requirements defined in the department's EIR and associated contract documents, for example, PIR, Functional Specification or SWTC used in the different contract types. During the design, the supplier Information Manager shall create a BEP based on the requirements defined in the PIR and EIR and shall reference the relevant sections from this document. This will enable all parties to understand whether the BIM requirements and uses will be met for specific project stages.

At tendering stage, the tendering contractors shall create a BEP based off the previously developed BEP and reference the relevant PIR and EIR sections where applicable. The BEP shall be included as part of the contractor's tender submission.

The department does not have a BEP template; it is the responsibility of the proponent to prepare the BEP for the project outlining how they will address the following:

- Project information
- Project schedule
- BIM goals
- Project team roles, staffing and competency
- detail of individuals undertaking the information management function
- information delivery strategy including the team approach to meeting the department's EIR and PIR
- the delivery team's high-level responsibility matrix
- proposed federation strategy
- collaboration procedures and method to handle shared models
- quality control
- plan for file sharing, storage and retrieval, and data security, and
- technology infrastructure and software.

3 BIM and information management process

3.1 Setting information requirements

QTRIP project contracts need to include comprehensive requirements for suppliers to provide a full set of information about every asset when it is handed over.

As described above, the EIR and PIR are the primary documents for communicating information requirements and establishing information management processes from Transport and Main Roads to its suppliers.

A key step in setting up the team for development of the EIR / PIR is to nominate a competent individual for the information management role (Project Information Manager). The Project Information Manager role can be covered by departmental staff or a third party working on behalf of the department. Their role will be to ensure that the project acquires knowledge about the assets to be specified and handed over. It is the responsibility of the Project Manager to ensure this role is established at the beginning of the project.

The Project Information Manager performs a key, integral function alongside all other project management activities. As such the role holder must be fully supported by and closely aligned with the Project Manager.

Table 3.1 defines the activities required to implement the BIM procurement documents.

Table 3.1 – Tasks required to compile BIM procurement documents

Document	Responsible	Tasks
AIR and EIR	Transport and Main Roads Project Information Manager	• Brief internal Transport and Main Roads Project Team on the requirements.
EIR / PIR	Transport and Main Roads Project Information Manager	• Complete the EIR / PIR incorporating the responsibility matrix. • Brief internal Transport and Main Roads Project Team on the requirements.
BEP	Suppliers	• Provide a BEP responding to the requirements highlighted in the EIR. • Following contract award, agree on approach with Transport and Main Roads Project Information Manager. • Ensure supply chain have been briefed and have the capability to meet the requirements.
	Transport and Main Roads Project Information Manager	• Evaluate BEP quality and completeness as part of the tender stage. • Following contract award, review the supplier's BEP and confirm that it complies to the requirements.

3.2 Evaluation and assessment of BIM Execution Plans (BEPs)

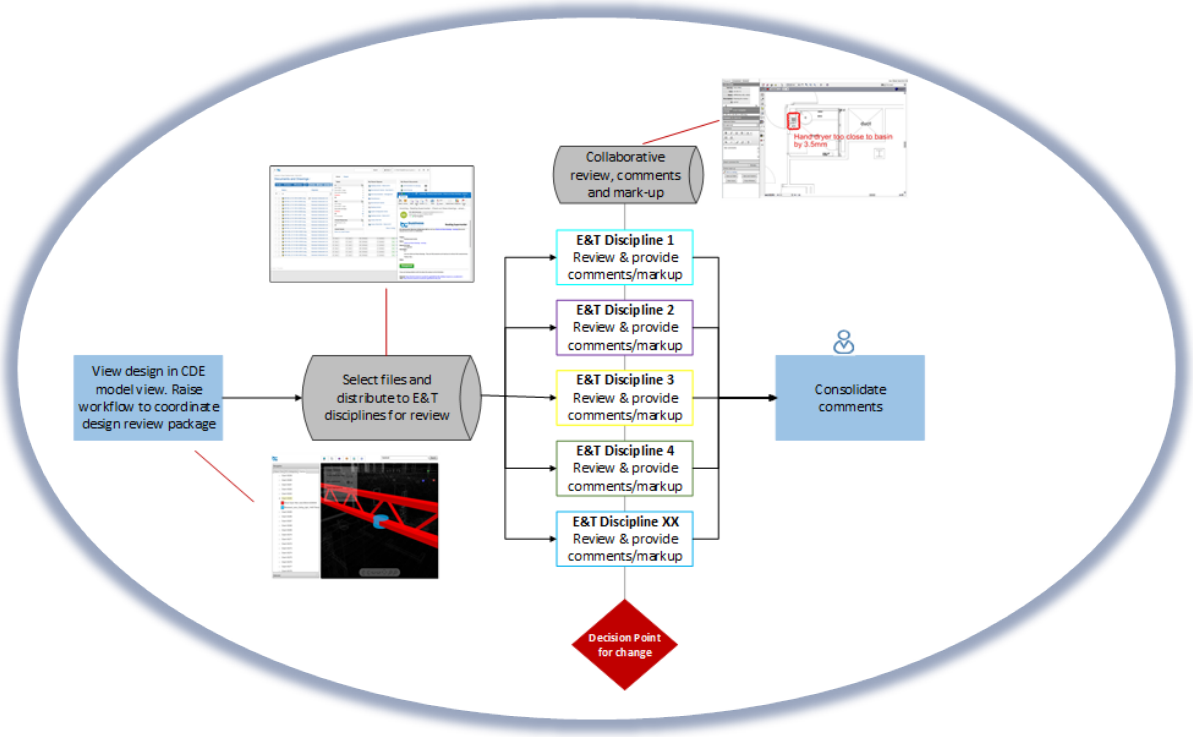
The evaluation and assessment of BEPs will be undertaken by the Transport and Main Roads Project Manager and Transport and Main Roads Project Information Manager. In the process of finalising the contract with the successful proponent, the BEP is revisited and updated as required. The BEP is to be treated as a live document and is to be updated as the project develops, agreed approaches to BIM change, or individual roles and responsibilities are changed.

3.3 Ensuring the Information Requirements are delivered

Once the BEP is agreed, validation and verification checks should be undertaken by the Transport and Main Roads Project Information Manager on behalf of the department's Project Manager. In particular, the Transport and Main Roads Project Information Manager is responsible for validating the information and deliverables provided by the supplier against the requirements stated in the PIR and EIR. The Transport and Main Roads Project Information Manager is also responsible for coordinating the review process at every information exchange to include input from relevant E&T Discipline Model Managers (Subject Matter Experts (SMEs)) to ensure compliance.

Figure 3.3 shows the Design review process: Information will be submitted to the department by the Supplier Information Manager at the relevant project milestones into the agreed Common Data Environment (CDE). The Project Information Manager is responsible for raising the collaborative workflow to coordinate design review by distributing the files among the E&T Discipline Model Managers and managing the process until all comments are closed. The CDE will support the collaborative review and the CDE will keep a record of the comments and mark-ups.

Figure 3.3 – Design review process (CDE-enabled)



3.4 Common Data Environment (CDE)

The CDE is a technology platform that provides a single source of truth for all project information. It is used to collect, manage, and disseminate all relevant project information in a managed process that allows information to be shared between all members of the project team.

To support the BIM implementation Transport and Main Roads intends to procure a CDE solution to manage asset information. The CDE will support the capture of digital data and asset information, including contractual documents and correspondence, during the QTRIP phases and ongoing Operate and Manage phases of the asset lifecycle. The CDE solution will also meet the needs of Collaborative Contract Management, i.e. the management of contractual documents and correspondence (such as drawings, specifications, letters, inspector diaries, photographs, lots, etc) on an infrastructure project.

Currently and prior to a Transport and Main Roads enterprise CDE being available, the department's Project Manager and department's Project Information Manager should agree with their suppliers on the best approach to software use to provide CDE functionality. For example, recent major projects have used a combination of Collaborative Contract Management Software (CCMS) for some CDE functions, supported by contractor owned CDE platforms for model sharing and viewing.

4 Roles and responsibilities

Transport and Main Roads has developed the following roles and responsibilities to provide clarity to project teams.

The department will establish the roles outlined below, with both general and specific BIM and information management responsibilities. It is expected that the contractor will provide equivalent roles to interact with the department. The contractor resources must take full responsibility for delivery of BIM and information management for their contracted part of a Transport and Main Roads project.

Roles and responsibilities are defined below and should not be confused with job titles and do not necessarily reflect full time equivalent (FTE) positions. It is important to consider these roles in terms of ownership, responsibility and authority.

4.1 Transport and Main Roads – Project Manager

The Project Manager must retain overall control of the project program, deliverables and communication. To support BIM the Transport and Main Roads Project Manager must perform the following activities:

Role	Responsibilities
	• Assign a Project Information Manager for the project. • With assistance from Project Information Manager, prepare the EIR/ PIR to go out during tender evaluation. • Review and comment on BIM Execution Plans (BEPs). • Guide in the establishment, monitoring and reporting of BIM KPIs.

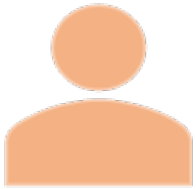
4.2 Transport and Main Roads – Project Information Manager

Role	Responsibilities
 TMR – Project Information Manager	• Assist the Transport and Main Roads Project Manager to complete the, EIR / PIR to go out during tender evaluation (for smaller projects, this role could be taken by the department's Project Manager). • Lead in the evaluation of the BEP received from contractors during the tender evaluation. • Establish, monitor and report BIM KPIs. • Periodic reviews of project processes, outputs and compliance against the EIR / PIR for auditing purposes. • Manage the Transport and Main Roads CDE (depending on solution adopted and as defined in the EIR / PIR). • Manage and maintain the exchange of information between stakeholders. • Report on the delivery of information exchanges at all project stages/milestones to the Transport and Main Roads Project Manager. • Enable integration and coordination of information within the PIM.

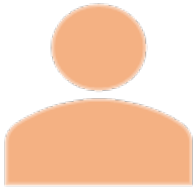
4.3 Transport and Main Roads – E&T Discipline Model Manager (Subject Matter Experts (SME))

Role	Responsibilities
 TMR – E&T Discipline Model Manager	• Review and comment on the BEP. • Ensure relevant discipline models comply with the EIR. • Approve graphical models and design artefacts developed.

4.4 Supplier – Information Manager

Role	Responsibilities
 Supplier – Information Manager	• Develop the BEP. • Liaise with Task Team Information Managers to include their inputs into the BEP. • Coordinate delivery of information into Transport and Main Roads CDE at designated data drops / exchanges • Manage spatial coordination on behalf of the whole project team. • Ensure production of information in compliance with standards and methods.

4.5 Supplier – Task Team Information Manager

Role	Responsibilities
 Supplier – Task Team Information Manager	• Support the BEP development by providing Task Team Information Delivery Plans to the Supplier – Information Manager. • Ensure information is delivered as per Responsibility Matrix. • Confirm suitability of models throughout project to enable collaboration. • Manage spatial coordination on behalf of the discipline specific team. • Manage clash avoidance where sub-contracted assets interface. • Manage all coordination and clash detection within contracted part of graphical models.

4.6 Sub-contractor

Role	Responsibilities
 Sub-contractor – Task Team Information Manager	• Input into the main contractor's Task Team Information Delivery Plans to support the project BEP. • Coordinate delivery of information into main contractor's CDE or Transport and Main Roads CDE at designated data drops. • Production of design outputs related to a discipline specific package of work. • Production of information in compliance with standards and methods. • Ensure information is delivered as per Responsibility Matrix • Confirm information is suitable for issue to the CDE. • Manage spatial coordination on behalf of the discipline specific team. • Propose resolutions to coordination issues / clashes.

5 Model Uses

Some of the below-described Model Uses will be commonly used on projects, others are an indication of where BIM may be applied in the future. Examples of BIM Uses that could be requested under the Contract may include:

5.1 Modelling existing conditions

Define the extent of existing conditions to be modelled under the project details in the Project BIM Brief.

The area over which the Ground and Feature Model (GFM) to be established should be clearly defined in the Survey Brief.

GFM surveys are used for recording the current status of the existing conditions of the project site and define a project's topography and locate those existing features, both surface and sub-surface, which may influence a road infrastructure project.

Table 5.1 – Existing Conditions Modelling

Existing Conditions Modelling
Description
This model will be developed to create a discipline model, as part of the PIM, of the existing conditions of the project site. It will represent the digital terrain model of the existing surfaces of the site and will include both surface objects and underground objects within the boundaries of the site limits. The *TMR Surveying Standards* defines this model as the Ground and Features Model (GFM). Further Project Information Modelling details that cover hydraulic modelling, geotechnical reports, Dial Before Your Dig (DBYD) services information, and so on, also form part of the Existing Conditions Modelling (ECM) and should be provided for the project.
Potential Value
• representation of existing natural surface • guides the development of horizontal and vertical alignment design • provide interface between design and natural surface for earthworks calculations • aid to clash detection for both surface and subsurface objects, e.g. underground services • enhance efficiency and accuracy of existing conditions documentation • use for visualisation purposes, and • provision of all relevant ECM models, drawings, and reports further enhances the project knowledge leading to more informed project decision making.
Resources Required
• Ground and Feature model development • *TMR Surveying Standards* for model and string naming conventions • 3D Model manipulation • 3D Laser scanning, if required, and • 3D Laser scanning point cloud translation into objects, if required.
Team Competencies
• ability to manipulate, navigate, and review a 3D model • knowledge of BIM authoring tools, and • knowledge of 3D laser scanning tools.

Existing Conditions Modelling
Selected Resources
• *TMR Surveying Standards* and Surveying Technical Notes

5.2 Civil/Structural Design – spatial and object-based design models

Design model requirements are defined in the department's *Drafting and Design Presentation Standards Manual*, *Volume 1: Chapter 5 – Project Electronic Models*[1]. Examples are provided showing preferred Model Names and indicative model content. For the department's BIM adoption there may be an aggregation of specific discipline models listed in the manual into a single Federated model. An example of this aggregation of models is shown below:

- Survey – Existing Conditions Modelling
- Civil Infrastructure
- Structures – bridges (Superstructure, Substructure, additional models)
- Drainage – cross drainage culverts and longitudinal networks
- Electrical, Communications and Reticulation
- Utility Infrastructure – all third-party Public Utility Plant infrastructure (Depending on level of complexity this model may be expanded to have individual services represented in their own model)
- Tunnels – surfaces and components
- Intelligent Transport Systems
- Landscaping
- Noise attenuation, and
- Environment

Table 5.2 – Design Authoring

Design Authoring
Description
A process in which a software is used to develop a discipline model, as part of the PIM, based on design criteria for transport infrastructure design. Two groups of applications at the core of BIM based design process are design authoring tools and audit and analysis tools. Authoring tools create models while audit and analysis tools study or add richness of information in a model. Most audit and analysis tools can be used for Design Review and Engineering Analysis BIM Uses. Design Authoring tools are a first step towards BIM and are key in connecting the 3D Model with a powerful database of properties, quantities, costs and schedules.

[1] Note that a complete review of this guideline still needs to be undertaken to better define 3D Object based model naming conventions

Design Authoring
Potential Value
• transparency of design for all stakeholders • better control and quality control of design, cost and schedule • powerful design visualisation • true collaboration between project stakeholders and BIM users, and • improved quality control and assurance.
Resources Required
• model authoring software certified as being suitable for use with the most current version of Industry Foundation Class (IFC) file format • model Authoring Software certified as being able to export native files to IFC format without the loss of geometric integrity • traditional 2D documentation, in a digital format, prepared with approved IFC compliant BIM authoring software and plans, and • commercially available model checking software that provides interoperability between different software applications.
Team Competencies
• ability to manipulate, navigate, and review a 3D model • knowledge of design standards and their application, and • knowledge of construction means and methods.
Selected Resources
• Design Authoring software tutorials, and • Transport and Main Road's design technical policies, standards, and guidelines.

5.3 Design visualisation for functional analysis

BIM provides the opportunity to build a virtual road or bridge and to virtually test that road or bridge for functionality during design. This allows project stakeholders to see and understand design solutions that represents reality so they can work towards improving the road or bridge design before construction starts.

The Design Team is encouraged to find efficiencies and uses for BIM to enhance communication for the project. At a minimum, the model shall be integrated into design reviews, review submittals, and 3D construction documentation views. Areas that would benefit from the use of 3D imagery and fly-throughs during the design process and during construction shall be identified and noted in the PIR.

Visualisation tools refer to animated models, fly-throughs, static 3D renderings, 4D process sequencing, and other techniques to assist decision making and comprehension. It should be noted that even though the individual discipline or federated models contain most of the source information needed for visualisation, they may require further refinement in specific animation and visualisation software to accomplish the intended results.

During design, special consideration should be given to alignment coordination and sight visibility issues that can be modified to improve the safety and operational aspects of the design. Consider the following uses of BIM for communication purposes and record those selected in the Project BIM Brief.

The purpose, intended users, nature (static or animated), level of detail (outline, photorealistic, etc) and scope of each should also be defined such as:

Visualisation:

a) views of the roadway elements at specific locations or points of interest in isometric or orthographic projections

b) sectional views through the models at specific locations or points of interest

c) enhanced visualisations for presentation purposes using photorealistic rendering software and photomontages of the proposed design, and

d) simulated videos of the road, e.g. 'fly overs', 'fly throughs'.

Table 5.3 – Design Reviews (including visualisations)

Design Reviews (including visualisations)
Description
A process in which a federated model is used to showcase the design to the stakeholders and design reviewers to evaluate the compliance of the design to the relevant design standards while meeting the initial project scope requirements. The Design Team is encouraged to find efficiencies and uses for BIM to enhance communication for the project. At a minimum the models shall be integrated into design reviews, review submissions, and 3D construction views.
Potential Value
• 3D review can highlight sight line and alignment coordination issues that are difficult to detect in 2D plans views • project drive-through / fly overs are more easily understood by the community • create shorter and more efficient design reviews, and • easily communicates the design to the client and allows instant feedback on meeting design requirements.
Resources Required
• 3D model manipulation • Design authoring software • 3D visualisation tools within the design authorising software • additional visualisation software applications that may enhance the native file format, and • Interactive Review capability.
Team Competencies
• ability to manipulate, navigate, and review a discipline and federated model, and • ability to apply textures and drapes with the design modelling software.
Selected Resources
• Transport and Main Roads *Drafting and Design Presentation Standards, Volume 1, Chapter 6: Visualisation,* and • design authorising software visualisation tutorials and help files.

5.4 Engineering modelling and analysis

The design teams will utilise intelligent modelling authoring software to create the BIM models for their respective disciplines to determine the most effective engineering solution/method based on design specifications.

For each discipline specific model, the Model Element Authors will document what design analysis tools were used to validate the design against the engineering standards applicable to the respective disciplines, e.g. cross sections, sight distance checking, design vehicle swept path analysis, structural analysis in bridge design. In some instances, this design analysis can be demonstrated by inclusion of visual outputs in the federated model file viewer, e.g. Swept Path analysis in Saved Viewpoints.

All engineering disciplines shall provide the RPEQ engineer with models that identify the location and extent of all major infrastructure elements.

Table 5.4 – Engineering Analysis (Civil, Structural)

Engineering Analysis (Civil, Structural)
Description
A process in which intelligent modelling software uses the federated model to determine the most effective engineering solution / method based on design specifications. These analysis tools and performance simulations can significantly improve the design of the infrastructure.
Potential Value
• automating analysis and saving time and cost • achieve optimum design solution by applying various rigorous analyses, and • improve the quality of the design and reduce the cycle time for design analyses
Resources Required
• 3D model manipulation • engineering analysis tools and software, and • structural modelling and analysis tools and software
Team Competencies
• ability to manipulate, navigate, and review a federated model • ability to assess a model through engineering analysis tools • knowledge of construction means and methods, and • design and construction experience.
Selected Resources
• engineering analysis tools for civil and structural design and analysis

5.5 Quantity take-off and cost planning

Cost Estimation may be used across all phases of project development including design and construction. During the design phases the process can be used for quantity take-off to determine material quantities from the design models for inclusion in the estimating process.

Refer to the department's *Project Cost Estimating Manual* for more detail on the process for developing project cost estimates at the various phases of project development.

Table 5.5 – Cost Estimation

Cost Estimation
Description
A process in which a federated model can be used to assist in the generation of accurate quantities of materials and cost estimates early in the design process and provide cost effects of various design options with the potential to save time and money and avoid budget overruns. Cost estimation will occur throughout each phase of the project development allowing financial management tracking against budget allocation. The process can be adapted to suit either: • quantity take-off application of cost estimation during the design phases, or • cost planning in the construction phase for ordering materials or items of plant.
Potential Value
• precise estimation of material quantities and generation of quick revisions if needed • exploring different design options and concepts during options analysis stage • provision of cost information to the project sponsor at each stage of project development • visual representation of project and construction elements that must be estimated, and • stay within budget constraints with frequent preliminary cost estimates or updated costs of material.
Resources Required
• estimating software • design authoring software, and • cost data.
Team Competencies
• ability to define specific design modelling procedures which yield accurate quantity take-off information • ability to identify quantities for the appropriate estimating level, and • ability to manipulate models to acquire quantities usable for estimation.
Selected Resources
• *Infrastructure Cost Estimating Policy*, can be provided upon request from the Project Manager • *Project Cost Estimating Manual*, and • 3PCM.

5.6 Clash detection/coordination

It is the supplier's team's responsibility to conduct and manage an adequate and thorough Clash Detection process so that all major interferences between components will have been detected and resolved before construction. It shall be the goal of the Design / Construction Teams to reduce the number of changes during construction due to major building interferences to zero.

The Supplier – Information Manager shall assemble a federated model from all the model parts of each design discipline for the purpose of performing a visual check of the infrastructure design for spatial and system coordination. Prior to each scheduled coordination meeting, an updated Clash Report will be issued by the Supplier – Information Manager to all parties as defined in the BEP.

Clash detection may be undertaken in the native design authoring tool or the federated model.

Clash detection tolerances, e.g. hard clash or clearance clash shall be agreed between the Transport and Main Roads Information Manager and the contractor and outlined in the BEP for acceptance by the department's representative.

Table 5.6 – Clash detection / coordination

Clash detection / coordination
Description
A process in which clash detection software is used during the coordination process of design elements to determine field conflicts by comparing 3D models of roadway components including subsurface elements. The goal of clash detection is to eliminate the major system conflicts prior to construction. The Design / Construction Team is responsible for conducting and managing adequate Clash Detection processes so that all major interferences between the infrastructure elements will have been detected and resolved early in the design process.
Potential Value
• reduce and eliminate construction conflicts • visualise final construction • reduce construction cost • decrease construction time • increase productivity on site, and • improve accuracy of As-Constructed model and drawings.
Resources Required
• 3D model manipulation, and • Model review capability.
Team Competencies
• ability to manipulate, navigate, and review a 3D model • knowledge of BIM model applications, and • ability to deal with project challenges.
Selected Resources
• Dial Before You Dig • Survey Ground and Features Model, and • Pothole survey.

6 2D drawing production

The primary purpose of project drawings is to clearly represent the design that is required to be constructed. It is important that the shapes and location of the different materials together with their interfaces are clearly articulated. The information shown must be adequate for the tendering and construction contractor to be able to calculate any construction information from the drawings.

2D drawing information for the purposes of assembling a printed set of plans shall be derived from the BIM model(s) to the fullest extent possible.

Refer to the department's *Drafting and Design Presentation Standards Manual* for more information. More work is still required on Chapter 5 to include 3D object based modelling, object naming conventions and attribute assignment, exporting to IFC file format, and the application of model sets, appearance profiles, and saved viewpoints in model file viewers.

7 Modelling and documentation practices

The following are the key considerations for modelling and documentation best practice.

7.1 Planning the modelling process

All projects have slightly different drivers and all companies will have different modelling standards and protocols. It is not the intention of this guide to try and make all projects the same. This is both impractical and would inhibit innovation. However, as a minimum, all planning and modelling processes shall comply with the department's survey and modelling standards / policies / and guidelines. Refer to the following references for more details:

- *Drafting and Design Presentation Standards Manual*
- *TMR Surveying Standards*
- Technical Specifications
- Other relevant departmental technical policies, standards and guidelines found on the departmental website via http://www.tmr.qld.gov.au/business-industry/Technical-standards-publications.

The collaborative development of the BIM Execution Plan is where the standards, processes and procedures for the project are aligned.

7.2 Model location and orientation

Models should be located in accordance with the department's survey standards / policies and guidelines.

All survey plan co-ordinates must be on the Map Grid of Australia (MGA), which is based on the Geocentric Datum of Australia (GDA). All survey levels must refer to Australian Height Datum.

The Contractor must ensure that all surveying complies with the *TMR Surveying Standards*. The *TMR Surveying Standards* are comprised of a manual in two parts; a Schedule and technical notes.

7.3 Naming conventions and structure

As more and more information is shared digitally, the use of structured, consistent and understandable naming conventions for information becomes vital. The department is currently working to develop a naming convention and structure based on the concept of "container-based collaborative working" as outlined in the draft ISO/DIS 19650-1-2017 Annexure B that outlined a container naming convention.

In this sense it should be noted that a "container" can be a 3D model, a drawing, a document, a database, also known in general terms as a file.

7.4 Asset element attributes

The ability to efficiently reuse data and information throughout the life of the model and the asset it relates to is one of the greatest benefits of BIM. In discussion with the department's Project Manager and other stakeholders the BIM Execution Plan should define:

- the granularity and naming conventions for elements, and as a minimum comply with the requirements of the department's *Drafting and Design Presentation Standards Manual* (DDPSM)[2], and
- specific parametric requirements for elements

Even if the end use of the model / data has not been confirmed, the data must be created in a structured and consistent way for future translation.

In trying to achieve this consistency, and alignment with the department's Asset Management system requirements, the following tables provide guidance on the elements and attributes that the department is looking to capture with a view to digitally extracting the asset attributes and uploading to the relevant systems.

The information listed in the following tables is not considered to be a comprehensive list at this stage but gives guidance to users on what the department is looking to achieve.

Where the department identifies additional elements to suit the needs of the project that are not listed in the Element Attributes Tables shown below, the department shall define the element's attributes for inclusion in the consultant's BIM Execution Plan.

For elements relating to Transport and Main Roads structures please refer to the *Building Information Modelling (BIM) for Bridges Design Manual*.

7.4.1 Element attributes tables – Civil

Table 7.4.1(a) – Drainage

Element	Attribute	Example Attribute
Culvert	control line	MC1A0
	start chg	62100
	end chg	62100
	skew angle	0°
	material	RCP
	pipe size	450
	invert us	4.010
	invert ds	3.900
	construction lot number	To Contractors QA system
	construction date	01/01/2018

[2] Note that a complete review of this guideline still needs to be undertaken to better define 3D Object based model naming conventions

Element	Attribute	Example Attribute
Pipe (Network)	name	8/124 to 9/124
	material	RCP
	pipe size	450
	invert us	4.010
	invert ds	3.900
	construction lot number	To Contractors QA system
	construction date	01/01/2018
Gully pit / field inlet	name	1/101
	description	RKO
	pit type description	GULLY - TMR DWG 1311
	pit type remarks	INLET ON GRADE - 'S' LINTEL - LIL
	cover rl	7.564
	pit centre x	535763.782
	pit centre y	6894618.016
	invert ds	6.294
	pit depth	1.270
	construction lot number	To Contractors QA system
	construction date	01/01/2018
Access chambers / manholes	name	3/100
	pit type description	MH1050
	pit type remarks	REFER TMR DWG 1307
	cover rl	7.603
	pit centre x	535765.026
	pit centre y	6894618.410
	setout z	7.603
	invert us	5.270
	invert ds	5.250
	pit depth	2.353
	construction lot number	To Contractors QA system
	construction date	01/01/2018

Table 7.4.1(b) – Pavements

Element	Attribute	Example Attribute
Pavements	Layer “x” Pavement type	M2-ACl-1
	Layer “x” Pavement layer description	Stone Mastic Asphalt
	Layer “x” Pavement layer code	SM14
	Layer Thickness	100 mm
	Layer “x” Binder type	A5S
	Layer “x” Additive (if applicable)	
	Layer “x” Additive percentage (if applicable)	
	width	7.0 m
	control line	MC1A0
	start chg	61950
	end chg	62300
	TDistStart	61.950 km
	TDistEnd	62.300 km
	Carriageway description (to ARMIS coding)	Primary through undivided
	Carriageway code (to ARMIS coding)	2
	Carriageway direction	Gazettal / Against Gazettal
	Construction lot number	To Contractors QA system
	Construction date	01/01/2018

Table 7.4.1(c) – Road Furniture

Element	Attribute	Example Attribute
Safety fence	model name	Design 1000 MC1J0
	description	[FB] Safety Fence – W beam
	start type	QUADGUARD_QS2408Y
	end type	SD1474_DET
	control line	MC1J0
	start chg	113.200
	end chg	245.000
	construction lot number	To Contractors QA system
	construction date	01/01/2018
Concrete barrier	name	Concrete Barrier Single Slope Extruded TL5
	model name	TRIMESH 1000 BARRIER MC1B0

Element	Attribute	Example Attribute
	start type	SD1468 EJ
	end type	SD1475 CB to WB
	control line	MC1B0
	start chg	61800.000
	end chg	62030.000
	construction lot number	To Contractors QA system
	construction date	01/01/2018
Concrete barrier transition	name	Concrete barrier transition
	model name	TRIMESH 1000 BARRIER MC1A0
	start type	Transition to existing
	end type	Transition to SD1468
	control line	MC1B0
	start chg	61695.500
	end chg	61664.100
	construction lot number	To Contractors QA system
	construction date	01/01/2018
Kerb / channel	model name	TRIMESH 1000 KERB MD1A0
	description	SD1033_28
	control line	MD1A0
	start chg	61695.500
	end chg	61664.100
	construction lot number	To Contractors QA system
	construction date	01/01/2018
Signage	sign id	20.14
	mutcd code	G1-1
	location	539482.297,6891706.702
	construction lot number	To Contractors QA system
	construction date	01/01/2018

Table 7.4.1(d) – Noise Barriers

Element	Attribute	Example Attribute
Barrier Design	RdSectName	Bruce Highway
	RdSectID	10A
	TDistStart	12.5
	TDistEnd	12.8
	Carriageway	1, 2, 3
	RoadEdgeBoundary	RoadEdge, Road Reserve, Boundary
	District	Metro
	InternalPostSpacing	2.4
	FreeEndPostSpacing	1.2
	PostSize	400
	FootingDepth	2
	BarrierHeight	4.6
	BarrierLength	300
	PostType	Timber, Steel, Brick
	PanelType	Concrete, Krusscrete, Timber, Steel, Brick, Plywood, Asbestos, Hebel, Glass, Acrylic, Polycarbonate, Composite
	DesignTopString	"Record"
	DesignBottomString	"Record"
	DesignDrawing	"Record"
	NoiseReport	"Record"
	NoiseModel	"Record"
	DesignCertificate	"Record"
Barrier Construction	ConstructionDate	1/05/2019
	ConstructedBy	Fenco
	AsConTopString	"Record"
	AsConBottomString	"Record"
	AsConDrawing	"Record"
	ConstructionCert	"Record"

Element	Attribute	Example Attribute
Asset Management	InspectionDate	1/05/2019
	InspectionLevel	1, 2
	InspectedBy	SLR, Projex Partners, Noise Team, Region, RoadTek
	OverallCondition	CRL0, CRL1, CRL2
	InspectComment	Free text
	InspectionReport	"Record"
	MaintnDate	1/05/2019
	MaintnBy	RoadTek
	MaintnDetails	Free text
	MaintnReport	"Record"
	DisposalDate	1/05/2019
	Comments	Free text

Table 7.4.1(e) – Public Utility Plant

Element	Attribute	Example Attribute
Existing utilities	name	SS
	original model name	EXIST 0000 COMMS
	asset owner	CGC
	AS5488 quality level	QL-C
	size	225
	material	PVC
	status	Live
	construction lot number	To Contractors QA system
	construction date	01/01/2018
	work completed	Decommissioned
Proposed utilities	owner	Telstra
	name	TU31DRdia100L
	AS5488 quality level	QL-A
	size	100
	material	PVC
	construction lot number	To Contractors QA system
	construction date	01/01/2018

7.4.2 Element attributes tables – Lighting

Table 7.4.2 – Lighting

Element	Attribute	Example Attribute
Points of supply	InstallationType	New
	PointOfSupplyType	Electricity Authority Service Pillar (Existing)
	Location	511643.854,7035645.328,7.445
	Tariff	Rate 3
	SiteID	P203759
	Electricity_Supplier	Energex
	Electricity_Retailer	Origin Energy
Switchboards / Junction boxes / BellJoints	InstallationType	New
	Switchboard_Type	Pole Mounted Cabinet
	Location	511625.828,7035691.688,7.480
	Phase	3 Phase
	Manufacturer	NHP
	Date_Manufactured	DD/MM/YYYY
	Date_Installed	DD/MM/YYYY
	Date_Commissioned	DD/MM/YYYY and time
Pits / Barrier voids	InstallationType	New
	Pit_Type	LV
	Pit_Size	No 4
	Location	511643.854,7035646.071,7.446
	Serial_Number	xyz123
	Manufacturer	ACO Poly
	Date_Manufactured	DD/MM/YYY
	Date_Installed	DD/MM/YYY
Mounts (Poles, mounting brackets, outreach arms, etc..)	InstallationType	New
	MountType	Pole
	Pole_Material	Steel
	Pole_Base	Slip base
	Pole_Type	Octagonal
	Location	511632.667,7035749.116,7.951
	Rotation	-54.206
	SiteID	P203759
	Serial_Number	xyz123
	PartNo	xyz123
	PartNo_PoleBase	xyz123

Element	Attribute	Example Attribute
	Joint_Use	Yes / No
	Rate3_Label	Yes / No - xyz123
	Manufacturer	GM Poles
	Date_Manufactured	DD/MM/YYY
	Date_Installed	DD/MM/YYY
	Date_Commissioned	DD/MM/YYY and time
	(For each outreach arm)	
	Outreach_Length	4.5
	Rotation	0
	Serial_Number	xyz123
	PartNo	xyz123
	Manufacturer	GM Poles
	Date_Manufactured	DD/MM/YYYY
	Date_Installed	DD/MM/YYYY
	Date_Commissioned	DD/MM/YYYY and time
Luminaire	InstallationType	New
	Model	Aeroscreen
	Lamp_Type	HPS - High Pressure Sodium
	PLCode	3011
	MountHeight	10.5
	Serial_Number	xyz123
	PartNo	xyz123
	Manufacturer	Rexel
	Date_Manufactured	DD/MM/YYYY
	Date_Installed	DD/MM/YYYY
	Date_Commissioned	DD/MM/YYYY and time
Linear Segments (e.g. conduit runs, etc..)	InstallationType	New
	Start from AssetType	PointOfSupply_P123456
	End at AssetType	Switchboard_SB123456
	LinearSegment_Type	Ducting
	Ducting_Type	Electrical
	Ducting_Size	100mm
	Ducting_Arrangement	Type 2
	Trench_Type	Type 3
	Trench_Bore	Trench
	CWay_Other	Carriageway
	Cover	0.75m

Element	Attribute	Example Attribute
	AerialSegment_Type	N/A
	RoutingPath	XYZ, XYZ, XYZ

7.4.3 Element attributes tables – Traffic Signals

Table 7.4.3 – Traffic Signals

Element	Attribute	Example Attribute
Cabinet Housing	ORG_UNIT	
	ASSET_ID	
	ASSET TYPE	
	ASSET MANUFACTURER	
	SUPPLIER	
	ASSET OWNER	
	ASSET STATUS	Installed, Commissioned, Operating, Non-Operating
	RESPONSIBLE AUTHORITY	
	CONDITION	
	MODEL	
	SERIAL NUMBER	
	DATE INSTALLED	
Cameras	ORG_UNIT	
	ASSET_ID	
	ASSET TYPE	
	ASSET MANUFACTURER	
	SUPPLIER	
	ASSET OWNER	
	ASSET STATUS	Installed, Commissioned, Operating, Non-Operating
	RESPONSIBLE AUTHORITY	
	CONDITION	
	MODEL	
	SERIAL NUMBER	
	DATE INSTALLED	
Controller Logic Modules	ORG_UNIT	
	ASSET_ID	
	ASSET TYPE	
	ASSET MANUFACTURER	
	SUPPLIER	
	ASSET OWNER	

Element	Attribute	Example Attribute
	ASSET STATUS	Installed, Commissioned, Operating, Non-Operating
	RESPONSIBLE AUTHORITY	
	CONDITION	
	MODEL	
	SERIAL NUMBER	
	DATE INSTALLED	
Detectors	ORG_UNIT	
	ASSET_ID	
	ASSET TYPE	
	ASSET MANUFACTURER	
	SUPPLIER	
	ASSET OWNER	
	ASSET STATUS	Installed, Commissioned, Operating, Non-Operating
	RESPONSIBLE AUTHORITY	
	CONDITION	
	MODEL	
	DATE INSTALLED	
Field Processors	ORG_UNIT	
	ASSET_ID	
	ASSET TYPE	
	ASSET MANUFACTURER	
	SUPPLIER	
	ASSET OWNER	
	ASSET STATUS	Installed, Commissioned, Operating, Non-Operating
	RESPONSIBLE AUTHORITY	
	CONDITION	
	MODEL	
	SERIAL NUMBER	
	DATE INSTALLED	
Lanterns	ORG_UNIT	
	ASSET_ID	
	ASSET TYPE	
	ASSET MANUFACTURER	
	SUPPLIER	
	ASSET OWNER	

Element	Attribute	Example Attribute
	ASSET STATUS	Installed, Commissioned, Operating, Non-Operating
	CONDITION	
	MODEL	
	DATE INSTALLED	
Pushbuttons	ORG_UNIT	
	ASSET_ID	
	ASSET TYPE	
	ASSET MANUFACTURER	
	SUPPLIER	
	ASSET OWNER	
	ASSET STATUS	Installed, Commissioned, Operating, Non-Operating
	RESPONSIBLE AUTHORITY	
	CONDITION	
	MODEL	
	DATE INSTALLED	
Mounts (Pedestals)	ORG_UNIT	
	ASSET_ID	
	ASSET TYPE	
	ASSET MANUFACTURER	
	SUPPLIER	
	ASSET OWNER	
	ASSET STATUS	Installed, Commissioned, Operating, Non-Operating
	DATE INSTALLED	
Mounts (Mast Arms)	ORG_UNIT	
	ASSET_ID	
	ASSET TYPE	
	ASSET MANUFACTURER	
	SUPPLIER	
	ASSET OWNER	
	ASSET STATUS	Installed, Commissioned, Operating, Non-Operating
	DATE INSTALLED	

7.4.4 Element attributes tables – Information Technology Systems and Electrical (ITS&E)

Table 7.4.4 – Information Technology Systems and Electrical (ITS&E)

Element	Attribute	Example Attribute
Detectors	BIM ID	RLD_30393_2
	District	Far North
	Site ID	L123456
	Site Description	
	Asset Type	
	Asset Owner	Transurban
	Point of Supply	Battery Solar
	Latitude of Asset	-27.692614
	Longitude of Asset	152.659176
	Datum	GDA94
	Road Section ID	18A
	Model	
	Manufacture Date	2006-03-11
	Expected Useful Life	10
	Installation Date	2007-06-16
	Installed by (Entity)	RoadTek
	Commissioning Date	2007-06-16
	Commissioned By	Joe Bloggs (RoadTek)
	Verified By (Person and RPEQ #)	Joe Bloggs (12345)
	Maintaining Authority	Transurban
	Link To Photo of Entire Asset	
Electronic Signs	BIM ID	RLD_30393_2
	District	Far North
	Site ID	L123456
	Site Description	
	Pole ID	
	Gantry ID	
	Asset Type	
	Structure Type	Pole
	Sign Size (m)	4x2
	Asset Owner	Transurban
	Electricity Retailer	Origin Energy
	Point Of Supply	Battery Solar
	Latitude of Asset	-27.692614

Element	Attribute	Example Attribute
	Longitude of Asset	152.659176
	Datum	GDA94
	Road Section ID	18A
	Design Running Load	25
	Measured Running Load	29
	Manufacturer	
	Model	
	Serial Number	A171809345W158
	Manufacture Date	2006-03-11
	Warranty Expiration Date	2007-06-16
	Expected Useful Life	10
	Installation Date	2007-06-16
	Installed By (Entity)	RoadTek
	Commissioning Date	2007-06-16
	Commissioned By	Joe Bloggs (RoadTek)
	Verified By (Person and RPEQ#)	Joe Bloggs (12345)
	Maintaining Authority	Transurban
	Link to Photo of Entire Asset	
ITS Structures	BIM ID	RLD_30393_2
	District	Far North
	Site ID	L12345
	Site Description	
	Asset Type	
	Asset Owner	Transurban
	Point of Supply	Battery Solar
	Latitude of Asset	-27.692614
	Longitude of Asset	152.659176
	Datum	GDA94
	Road Section ID	18A
	Design Running Load	25
	Measured Running Load	29
	Measured running Load Date	
	Manufacturer	
	Model	
	Manufacture Date	2007-06-16
	Warranty Expiration Date	2007-06-16

Element	Attribute	Example Attribute
	Expected Enclosure Useful Life	10
	Enclosure Installation Date	2007-06-16
	Enclosure Installed By (Entity)	RoadTek
	Commissioning Date	2007-06-16
	Commissioned By	Joe Bloggs (RoadTek)
	Verified By (Person and RPEQ#)	Joe Bloggs (12345)
	Maintaining Authority	Transurban
	Condition Rating of Enclosure	2. Good
	Condition Rating Date	2015-05-20
	Link to Photo of Entire Asset	
Lanterns	BIM ID	RLD_30393_2
	District	Far North
	Site ID	L12345
	Site Description	
	Asset Owner	Transurban
	Electricity Distributor	Essential Energy
	Electricity Retailer	Origin Energy
	National Metering Identifier	31950000007
	Point of Supply	Battery Solar
	Latitude of Site	-27.692614
	Longitude of Site	152.659176
	Datum	GDA94
	Road Section ID	18A
	Manufacturer	
	Expected Useful Life	10
	Installed By (Entity)	RoadTek
	Commissioning Date	2007-06-16
	Commissioned By	Joe Bloggs (RoadTek)
	Verified By (Person and RPEQ#)	Joe Bloggs (12345)
	Maintaining Authority	Transurban
	Link to Photo of Entire Asset	
Luminaires	BIM ID	RLD_30393_2
	District	Far North
	Site Id	L12345
	Site Description	

Element	Attribute	Example Attribute
	Pole ID	
	Gantry ID	
	Model Number	
	Asset Type	LMRLFL – Linear Fluorescent (33)
	Asset owner	Transurban
	Electricity Distributor	Essential Energy
	Electricity Retailer	Origin Energy
	Tariff Rate	Rate 3
	National Metering Identifier	31950000007
	Point of Supply	Battery Solar
	Solar Powered	No
	Latitude of Asset	-27.692614
	Longitude of Asset	152.659176
	Datum	GDA94
	Road Section ID	18A
	Luminaire Mounting Height	10.5
	Watts	37
	AEMO Nominal Load	37
	Design Running Load	25
	Glare Treatment	Glare Shield (Front Only)
	Manufacturer	BETACOM – Betacom Gough
	Serial Number	A171809345W158
	Manufacture Date	2006-03-11
	Expected Useful Life	10
	Installation Date	2007-06-16
	Installed By (Entity)	RoadTek
	Commissioning Date	2007-06-16
	Commissioned By	Joe Bloggs (RoadTek)
	Verified By (Person & RPEQ#)	Joe Bloggs (12345)
	Link to Photo of Entire Asset	
	Link to Photo of Pole Number	
TSC Enclosures	BIM ID	RLD_30393_202006_B:394455.3
	District	Far North
	Site ID	L123456
	Site Description	

Element	Attribute	Example Attribute
	Asset Type	TSCA04 - Aldridge ATSC4
	Asset Owner	Transurban
	Electricity Distributor	Essential Energy
	Electricity Retailer	Origin Energy
	National Metering Identifier	31950000007
	Point of Supply	Battery Solar
	Latitude of Asset	-27.692614
	Longitude of Asset	152.659176
	Datum	GDA94
	Road Section ID	18A
	Design Running Load	25
	Manufacturer	
	Model	
	Serial Number	A171809345W158
	Manufacture Date	2007-06-16
	Warranty Expiration Date	2007-06-16
	Expected Cabinet Useful Life	10
	Cabinet Installation Date	2007-06-16
	Cabinet Installed By (Entity)	RoadTek
	Commissioning Date	2007-06-16
	Commissioned By	Joe Bloggs (RoadTek)
	Verified By (Person and RPEQ#)	Joe Bloggs (12345)
	Maintaining Authority	Transurban
	Operational Status	Out of Service
	Condition Rating of Enclosure	2. Good
	Condition Rating Date	2015-05-20
	Link to Photo of Entire Asset	

8 Glossary

The following are terms used in this guideline or in common usage in discussion about BIM.

Term	Definition
Asset Information Model (AIM)	Information model relating to the operational stage. (Refer to ISO 19650)
Asset Information Requirement (AIR)	Defines the specific information and data which must be delivered, along with the delivery format, to achieve Transport and Main Road's target state Asset Information Model (AIM). (Refer to ISO 19650)
Asset Management Information Systems (AIMS)	A suite of IT systems (i.e. ARMIS, ROAMS, BIS, etc.) that supports Asset Management.
A Road Management Information System (ARMIS)	Made up of multiple sub-systems, a data warehouse and a number of presentation and analysis tools. The information within ARMIS includes road location, road inventory, pavement condition, traffic, crashes and routine maintenance performance contracts and so on. These systems capture and store the information, which is then fed into the data warehouse for retrieval using the presentation tools.
BIM Execution Plan (BEP)	A formal document that is submitted by the proponents during a tender process outlining how they intend to meet the BIM requirements defined in the department's EIR and PIR.
Building Information Management (Data Definition)	Supports the data standards and data requirements for BIM use. Data continuity allows for the reliable exchange of information in a context where both sender and receiver understand the information.
Building Information Model (BIM) (Product)	An object-based digital representation of the physical and functional characteristics of a road or structure. The Building Information Model serves as a shared knowledge resource for information about a facility, forming a reliable basis for decisions during its lifecycle from inception onward.
Building Information Modelling (BIM) (Process)	A collection of defined model uses, workflows, and modelling methods used to achieve specific, repeatable, and reliable information results from the model. Modelling methods affect the quality of the information generated from the model. When and why a model is used and shared impacts the effective and efficient use of BIM for desired project outcomes and decision support.
Bridge Information System (BIS)	Part of the larger Bridge Asset Management System project or BAMS. The objective of the BAMS is to establish effective business processes for the management of structures and to support this goal by an integrated and accessible information system. The BAMS includes: • development of an overarching policy for the management of structures • development of an inspection methodology and manual for structures • improvement of the processes involved in determining load carrying capacities of structures • implementation of the BIS.

Term	Definition
	The purpose of the BIS is to support the BAMS by providing an integrated and accessible information system, containing comprehensive quality information on structures.
Computer Aided Design (CAD)	A geometric / symbol-based computer drawing system that replicates hand drawing techniques.
Common Data Environment (CDE)	A central repository where construction project information is housed. The contents of the CDE are not limited to assets created in a 'BIM environment' and it will therefore include documentation, graphical model and non-graphical assets.
Exchange Information Requirements (EIR)	A key document intended to be part of the wider tender document set for the procurement of the Design Team and the Constructor.
Deliverables	The product of engineering and design efforts to be delivered to the client as digital files and / or hardcopy documents. Typically, this would be the concept submittal and the corrected final design. A deliverable may have multiple phases.
E&T Discipline Model Manager	BIM leader for each discipline of a project.
Federation	The combination of multiple discipline specific models into a single model for review or coordination.
Industry Foundation Class (IFC)	A system of defining and representing standard architectural and construction-related graphic and non-graphic data as 3D virtual objects to allow data exchange among BIM tools, cost estimation systems, and other construction-related applications in a way that preserves the ability to perform analysis on those objects as they move from one BIM system to another. IFC files saved or exported from BIM-authoring software can be used for the following tasks: • coordination of BIM models and related design disciplines • clash detection • rules-based checking • Building Code compliance • sharing models between different BIM-authoring software • COBie data derived from BIM models • energy testing data derived from BIM models, and • systems simulation.
Interoperability	The ability of two or more systems or components to exchange information and to use the information that has been exchanged.
Map Grid of Australia (MGA)	A coordinate system based on the Universal Transverse Mercator projection and the Geocentric Datum of Australia. The unit of measure is the metre.
Model Use	A unique task or procedure on a project which can benefit from the application and integration of BIM into that process.
Project Information Manager	Leads and coordinates the BIM processes for the project.
Project Information Model (PIM)	Information model developed during the design and construction phase of a project in response to requirements set out in the EIR. (Refer to ISO 19650)

Term	Definition
Project Information Requirements (PIR)	Defines the specific information requirements for the project, (for example, specific requirements beyond the AIR/EIR, timing requirements and any specifics relating to information delivery and transmission.
Road Operations Asset Management System (ROAMS)	An asset management and maintenance system which holds asset related data for Intelligent Transport Systems and Electrical (ITS&E), Traffic Survey Data Management (TSDM), busway and tunnel assets.
Supplier	The appointed party and is the provider of information concerning works, goods or services. (Refer to ISO 19650)

9 References

1. ISO 19650-1:2018 *Organisation and digitisation of information about buildings and civil engineering works, including building information modelling (BIM) – Information management using building information modelling – Part 1: Concepts and principles*. The International Organization for Standardization https://www.iso.org/standard/68078.html
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3. Transport and Main Roads D*rafting and Design Presentation Standards Manual* (DDPSM). https://www.tmr.qld.gov.au/business-industry/Technical-standards-publications/Drafting-and-design-presentation-standards
4. Transport and Main Roads *TMR Surveying Standards*. https://www.tmr.qld.gov.au/business-industry/Technical-standards-publications/Surveying-standards