Digital engineering for fixed rail infrastructure - Part 2: Technical requirements

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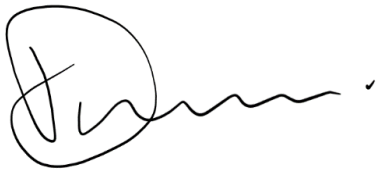

Damien White
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Preface

This Standard is Part 2 of the AS 7739 Digital engineering for fixed rail infrastructure series.

Part 1: Concepts and principles (published January 2023)

AS 7739 Part 1 provides digital engineering guidance that introduces and defines key concepts and principles for the Australian and New Zealand rail industry. Part 1 provides detailed information on how to build data management capability, and the overarching digital framework required for successful digital engineering project implementation.

It is not intended to be directly referenced in project procurement contracts, as it does not provide the appropriate level of detail necessary to adequately specify digital engineering project deliverables.

Part 2: Technical Requirements

This Standard AS 7739 Part 2 provides detailed technical requirements (including specifications and procedures) for the procurement and management of digital engineering project deliverables.

Objective

The objective of this Standard is to:

- build on current developments and progress with digital engineering;
- combine globally leading practice;
- define contemporary best practice;
- specify building blocks for national consistency;
- reduce complexity for both asset owners and industry suppliers;
- provide a method for creating and classifying information relating to rail assets in a consistent manner; and
- simplify the mapping of asset information by providing a consistent and repeatable information delivery method.

Compliance

There are four types of provisions contained within Australian Standards developed by RISSB:

(a) Requirements.
(b) Recommendations.
(c) Permissions.
(d) Constraints.

Requirements – it is mandatory to follow all requirements to claim full compliance with the Standard. Requirements are identified within the text by the term ‘shall’.

Recommendations – do not mention or exclude other possibilities but do offer the one that is preferred. Recommendations are identified within the text by the term ‘should’.

Recommendations recognize that there could be limitations to the universal application of the control, i.e. the identified control is not able to be applied or other controls are more appropriate or better.

Permissions – conveys consent by providing an allowable option. Permissions are identified within the text by the term ‘may’.

Constraints – provided by an external source such as legislation. Constraints are identified within the text by the term ‘must’.

For compliance purposes, where a recommended control is not applied as written in the standard it could be incumbent on the adopter of the standard to demonstrate their actual method of controlling the risk as part of their WHS or Rail Safety National Law obligations. Similarly, it could also be incumbent on an adopter of the standard to demonstrate their method of controlling the risk to contracting entities or interfacing organisations where the risk may be shared.

RISSB Standards address known hazards within the railway industry. Hazards, and clauses within this Standard that address those hazards, are listed in Appendix C.

Appendices in RISSB Standards may be designated either “normative” or “informative”. A "normative" appendix is an integral part of a Standard and compliance with it is a requirement, whereas an "informative" appendix is only for information and guidance.

Commentary

Commentary *C Preface*

This Standard includes a commentary on some of the clauses. The commentary directly follows the relevant clause, is designated by ‘C’ preceding the clause number and is printed in italics in a box. The commentary is for information and guidance and does not form part of the Standard.

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Section 1 Scope and general

1.1 Introduction

1.1.1 General

AS 7739 (all parts) provides information on best-practice digital engineering (DE), based on International Standards and leading digital initiatives from global organisations and Australian and New Zealand (ANZ) transport agencies.

This series aims to inform the ANZ rail industry by providing guidance, requirements, and recommendations for the use of DE in planning, design, and construction of rail infrastructure projects.

The AS 7739 series consists of two parts:

(a) *Part 1: Concepts and principles*

(b) *Part 2: Technical requirements* (i.e. this Standard)

The advice provided in this series builds on cross-sector digital innovation, established business processes, major infrastructure projects, and leading global sources. The resulting guidance defines how best to enable DE standardization throughout the ANZ rail industry.

Referring to Figure 1-1, AS 7739 (all parts) aims to provide nationally consistent:

(c) high-level advice for organisational strategies and planning;

(d) more informed guidance and managerial processes; and

(e) detailed technical solutions and data specifications.

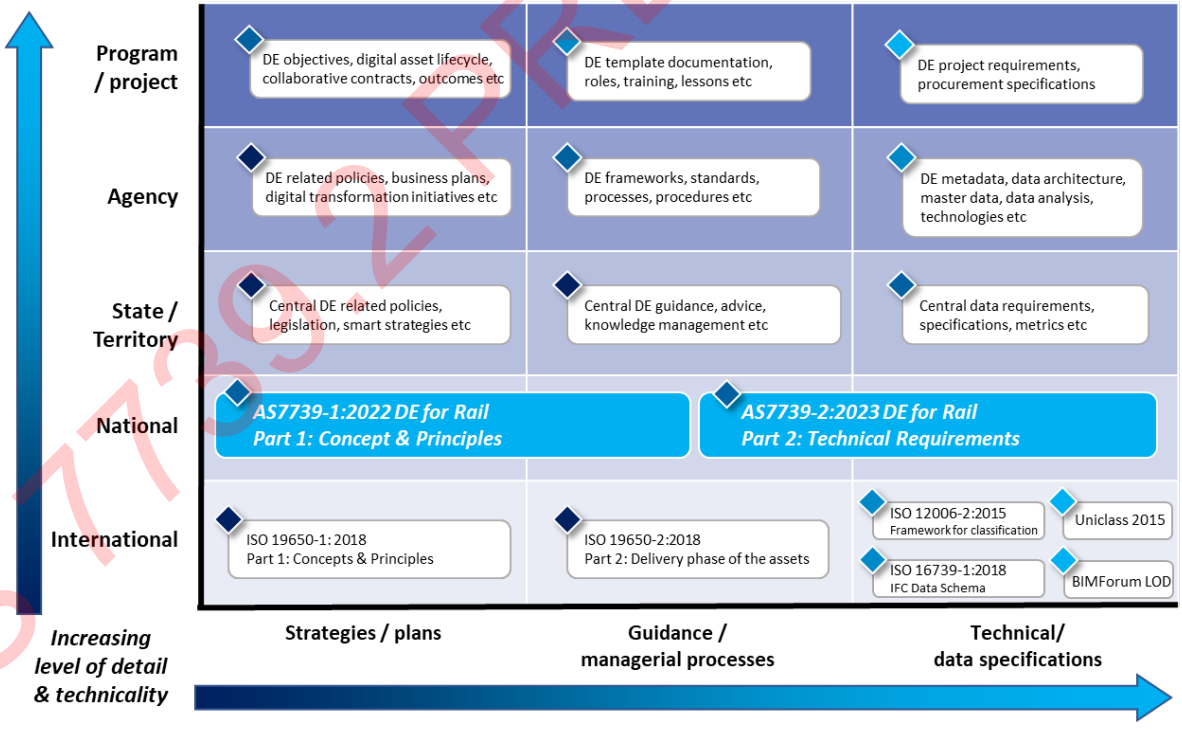

Figure 1-1: Landscape of DE standardization – from international guidance through to detailed project specifications

It is noted further detail and specification could be required at a state/territory, agency, and program level, to ensure suitable requirements are established for procurement and exchange of DE project deliverables.

1.1.2 Evolution from current methodologies

Since its release in 2018, BIM according to ISO 19650, has become the globally leading form of information management in the built environment. This has led to governments and asset owners around the globe establishing frameworks, guidance material and training based on the methodologies presented in the series of standards.

The common data model (CDM) is an important evolution beyond the BIM approach and presents a paradigm shift in the way data should be managed in the ANZ infrastructure sector. DE according to AS 7739, and the adoption of a standardized data model, provides some notable differences to the BIM approach. Some of these differences include:

(a) data management, based on a consistent data model, is promoted over BIM information containers and traditional file naming conventions;

(b) the CDM is the central mechanism for governing and exchanging metadata, in lieu of more traditional, process-oriented BIM or GIS approaches;

(c) CDM is promoted as a relational form of data modelling, with clearly defined entities and relationships, that offers more effective control over linked data and openBIM methodologies such as industry foundation classes (IFC); and

(d) structured query language (SQL) is promoted as an open-source solution for data management, association and querying – and is considered essential for effective business intelligence solutions.

Industry adoption of these standards will enable a step change in data management capabilities, by improving data literacy and providing a common language for effective data exchange. In time, it is expected the ANZ rail sector will become less reactive and more proactive, as data-driven decisions become commonplace at all stages of the asset lifecycle.

1.2 Scope

1.2.1 Overview

This Standard provides a common baseline to establish a standardized approach for improved procurement, management, and exchange of project information deliverables through DE. This is aimed at improving digital collaboration between asset owners and their supply chains and promotes further digital transformation of the ANZ rail industry.

AS 7739 (all parts) covers fixed infrastructure associated with the railway network.

The scope of AS 7739 (all parts) covers the overarching principles, data management processes and technical requirements, to define good practice DE for project information deliverables.

1.2.2 Technical requirements

AS 7739 (all parts) defines a novel approach to data management on rail infrastructure projects. This Standard builds on global standards, captures best practice from leading ANZ rail industry initiatives and is informed by recent project case studies.

AS 7739-1 introduces a number of concepts that are not universally common throughout the ANZ rail industry. These include:

(a) information management methodologies that extend beyond building information modelling (BIM);

(b) the need for asset owners to establish the digital asset lifecycle, supported through the Connected Digital Ecosystem (CDE 2.0);

(c) how metadata should be developed to support semantic interoperability;

(d) international classification standards and how they may be applied in the ANZ sector;

(e) data modelling and how it applies to DE; and

(f) the breakdown of reference, master and operational data.

Where the objective of AS 7739-1 was to provide background and introduce concepts, this Standard provides more detailed instruction and practical advice on data modelling and data management activities necessary to achieve holistic objectives of DE.

The task of national standardization is complex, given the broad range of technical requirements that currently exist through the ANZ rail industry. The requirements defined in this Standard aim to strike a balance between:

(g) high-level of prescription – which can prove challenging for industry to adopt, and introduce into their existing technologies and business processes; and

(h) high-level of flexibility – which can be easy to adopt but could lose the benefits of standardization.

These requirements support both organizational business transformation, and management of DE rail projects. The level of detail is deemed appropriate for consistent specification and procurement of DE in project contracts, by defining a baseline for industry data exchange.

1.2.3 Introducing the common data model

In AS 7739-1, concepts such as structured data and semantic interoperability are introduced as key enablers for successful DE implementation. The CDM is presented as a standardized approach for enabling efficient and reliable data exchange throughout the rail industry.

The CDM provides a novel solution for specifying, managing and exchanging structured data. This applies a top-down methodology for data modelling, applicable for specification and production of deliverables on major infrastructure projects. For background details on data modelling and the need for a standardized data model, refer to AS 7739-1.

This Standard provides further details of the components that form the CDM, including the background of why they have been selected, their contents and how they are applied when specifying DE on rail infrastructure projects.