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Metrolinx
Reliability, Availability and Maintainability Validation Report: Product Description

MX-SEA-PD-125

Revision 00

Date: May 2023

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Publication Date: May 2023

Amendment Record

Revision	Date (DD/MM/YYYY)	Description of changes

Preface

This is the first edition of the Metrolinx Reliability, Availability and Maintainability (RAM) Validation Report Product Description (MX-SEA-PD-125). It forms part of a suite of guidance documents that describe the procedures to be followed to comply with Metrolinx's Reliability, Availability, Maintainability and Safety (RAMS) requirements.

The purpose of this document is to describe the contents of the Report which details the actions that took place to validate the RAM requirements for the change to the railway system and details the result of the validation. Project proponents may need to apply the process when they are undertaking a technical change to the railway system or modifying a maintenance regime or undertaking an operational change to the railway system.

Suggestions for revision or improvements can be sent to the Metrolinx Systems Engineering Assurance office at Engineering.Assurance@metrolinx.com. The Director of the Systems Engineering Assurance office authorizes the changes. Include a description of the proposed change, background of the application and any other useful rationale or justification. Be sure to include your name, company affiliation (if applicable), e-mail address, and phone number.

May 2023

Contents

Tables

Documents

Table 1 Supporting Documents

Document Number	Document Title	Relation
BS EN 50126-1:2017	Railway Applications – The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS) Part1: Generic RAMS Process	Parent Standard
MX-SEA-STD-100	RAMS Process Standard	Related Standard
ISO 9001:2015	Quality management systems — Requirements	Supporting Standard
MXSD-SSA-L1-STD-0001	Railway Risk Assessment Standard	Supporting Standard
MX-SEA-GDC-125	Reliability, Availability and Maintainability Validation Report Guidance	Guidance
MX-SEA-TPL-125	Reliability, Availability and Maintainability Validation Report Template	Template
MX-SEA-TOR-001	Metrolinx System Review Panel (SRP) Terms of Reference (ToR)	Review Panel ToR
April 5, 2023	Metrolinx Safety Certification Committee (SSC) Terms of Reference (ToR)	Certification Committee ToR

Acronyms and Abbreviations

Table 2 Acronyms and Abbreviations

Abbreviation	**Full Name**
CTO	Consent To Operate
ISA	Independent Safety Assessor
PDD	Process Description Document
PFD	Process Flow Diagram
RACI	Responsible, Accountable, Consulted and Informed
RAM	Reliability, Availability and Maintainability
RAMS	Reliability Availability Maintainability and Safety
SCC	Safety Certification Committee
SRP	System Review Panel
ToR	Terms of Reference

Definitions

Table 3 Definitions

Term	Definition	Source
Asset Owner	Groups and individuals that are responsible for asset ownership, asset maintenance, inventory management, document control, asset handover and reliability engineering	MX-ALM-STD-001
Availability	Ability of an item to be in a state to perform a required function under given conditions at a given instant of time or over a given time interval, assuming that the required external resources are provided.	BS EN 50126:2017
Maintainability	Ability to be retained in, or restored to, a state to perform as required, under given conditions of use and maintenance.	BS EN 50126:2017
Project Company	The private sector entity which enters into the Project Agreement with Infrastructure Ontario and Lands Corporation and Metrolinx to design, build and where applicable, finance, operate or maintain a Project. The special-purpose entity which has entered into a Project Agreement with the Contracting Authority.	CKH-QMA-FRM-003
Project Management	Appointed by Metrolinx as its representative and is responsible for the delivery of the Project within the prescribed Schedule and budget. Metrolinx employees fulfilling the role of the Project Manager may also be considered the Cost Centre Manager, if this person is also delegated signing authority in accordance with the Metrolinx Corporate Administrative Manual, Administrative Management, Approval Authorization Controls and Designations. It is noted that non-Metrolinx employees fulfilling the role of the Project Manager are not considered Cost Centre Managers. In such cases refer to	CKH-QMA-FRM-003

	approved Project Chart of Accounts for the Program for the designated Cost Centre Manager.	
Reliability	Ability to perform as required, without failure, for a given time interval, under given conditions.	BS EN 50126:2017
Subsystem	Part of a system, which is itself a system	BS EN 50126:2017
System	Set of interrelated elements considered in a defined context as a whole and separated from their environment	BS EN 50126:2017
Validation	confirmation, through the provision of objective evidence, that the requirements for a specific intended use or application have been fulfilled	BS EN 50126:2017

1 Reliability, Availability and Maintainability Validation Report

1.1 Purpose

1.1.1 The Reliability, Availability and Maintainability (RAM) Validation Report documents the activities that took place to demonstrate compliance with the RAM requirements and details the result of the validation.

1.1.2 Validation is the process to demonstrate that a system complies with customer (Metrolinx) needs. Validation activities include determining if the system complies with the specified requirements. The results of validation activities provide objective evidence that RAM targets are met and the system will function as intended once it has been accepted and is in operation. This also includes the demonstration that the RAM targets for and existing systems that interface with the change have not been negatively impacted.

1.2 Applicability

1.2.1 This product is mandatory for any project that undertakes a technical change to the railway system (i.e. introduction of a new subsystem, renewal of an existing subsystem, a modification to an existing subsystem, or introduction of a new or modified maintenance regime) or undertakes an operational change to the railway system.

1.2.2 This product is not applicable for established routine maintenance activities including like-for-like replacement of components.

1.2.3 This product is considered good practice when developing or modifying any complex system.

1.3 Supporting Material

1.3.1 The RAM Validation Report shall be documented in the RAM Validation Report template is located in MX-SEA-TPL-125.

1.3.2 Guidance on completing the RAM Validation Report is located in MX-SEA-GDC-125.

1.4 Products

1.4.1 The RAM Validation Report is a product of the System Assurance process. Guidance on this process is available via MX-SEA-STD-100.

1.5 Key Responsibilities

1.5.1 The Project Company is responsible for the production of the RAM Validation Report. Preparation of the RAM Validation Report may be delegated, however the Project Company is responsible for its content and quality.

1.5.2 The System Review Panel (SRP) has delegated authority from the Safety Certification Committee (SCC) and is responsible for endorsing the RAM Validation Report. The System Review Panel ensures that the RAM Validation Report is compliant with the project requirements, applicable legislation, and national, industry, and Metrolinx standards. The SRP may also identify uncertainties, issues, and assumptions that may arise as the project progresses that should be addressed

1.5.3 The Project Company is the organization responsible for the contracted scope of work at the time of development.

1.5.4 The Project Management may be performed by Metrolinx or may be contracted, for example in a Design/Build, whereby Metrolinx Project Management would ensure contract provisions for the RAM Validation Report are met and would not develop the RAM Validation Report.

1.5.5 Some of the Asset Owner obligations and responsibilities may be transferred through contracting, whereby the contract contains RAM and operating and requirements. The Metrolinx Asset Owner would participate in endorsing the RAM Validation Report whereas a contracted party responsible for RAM would develop the RAM Validation Report as directed by the Project Management.

1.6 Competence

1.6.1 All personnel responsible for the RAM Validation Report shall have knowledge of RAM management and the specific RAM requirements and activities of the project.

1.7 Structure

1.7.1 The Structure of the RAM Validation Report is described in the RAM Validation Report Guidance document located in MX-SEA-GDC-125.

1.7.2 The document requires the following section titles:

a) Introduction;

b) Project RAM Organization;

c) RAM Analyses and Management

d) Validation of RAM Requirements; and

e) Conclusions

1.8 Contents

1.8.1 The contents of the RAM Validation Report are described in the RAM Validation Report Guidance document located in MX-SEA-GDC-125 .

1.8.2 As a minimum, it shall contain the following:

a) A description of the RAM organization including discussion of the level of independence and autonomy of those performing Verification and Validation activities as per EN50126-1.

b) Confirmation that the processes and activities detailed in the RAM Plan and RAM Validation Plan have been adhered to and complete. Deviations from the plans are recorded and justified.

c) Evaluation of the conformance of the project and system to the project management, engineering plans, and applicable standards including EN50126.

d) Evaluation of the System Requirements including:

   1) Coverage of the requirements to determine if any requirements were not identified and if additional testing, verification, validation activities are necessary

   2) Traceability of requirements from the unit, sub-system, and system level throughout design and verification

e) Details of the RAM Validation activities carried out on the project

f) The results each RAM Validation activity including:

   1) References to supporting documentation

   2) Non-conformances and corrective actions identified as a result of the activities

g) The supporting documentation referenced shall include:

   1) Name of the person(s) that performed the validation activity

   2) Date and location of the validation activity

   3) A description of the system or sub-system under consideration

   4) The configuration of the system during the validation activity

   5) Any documents that are relevant to the activity (test procedures, calibration records etc)

   6) Any equipment or software used during the validation activity including serial numbers, calibration data, software version as applicable

h) The verification and validation status of each RAM requirement including:

   1) Traceability to the applicable verification and validation activities performed to determine system compliance

i) Conclusion of the Validation Results including:

   1) A statement regarding whether the system under consideration fulfils the requirements for its intended use in the defined environment.

   2) A statement regarding confirmation of the correctness, consistency and adequacy of the verification process.

3) A detailed list of all non-conformances, deviations and the status of the actions addressing them.

4) Confirmation of the correctness, consistency and adequacy of installation, commissioning, maintenance and operation manuals for the system under consideration.

1.8.3 Any update to the RAM Validation Report shall consider and capture those activities which are already completed, and hence define any remaining activities (including potentially repeating activities where required).

1.9 Quality Criteria

1.9.1 The RAM Validation Report shall have sufficient detail to clearly demonstrate whether RAM requirements have been met by the project, and to clearly indicate any cases where they have not been met.

1.9.2 The quality management system used shall conform to ISO 9001:2015 rules or equivalent rules accepted by the Metrolinx Project Delivery Team and be appropriate for the system under consideration.

1.10 Document Management

1.10.1 The RAM Validation Report is produced at Phase 9 (System Validation) and is a requirement for the Consent To Operate (CTO) gate.

1.10.2 Table 4 provides an overview of the RAM Validation Report document phases.

Document	Phase
RAM Validation Report	9 – System Validation

TABLE 4: DOCUMENT PHASES