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Metrolinx
Reliability, Availability and Maintainability Validation Plan: Product Description

MX-SEA-PD-123

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

Preface

This is the first edition of the Metrolinx Reliability, Availability and Maintainability (RAM) Validation Plan Product Description (MX-SEA-PD-123). 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 document that defines the actions required to validate the RAM requirements for the change to the railway system and details how the validation actions shall be implemented. 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.

April 2023

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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) (PHASE 1: Adoption of European Standard EN 50126-1:2017)	Parent Standard
ISO 9001:2015	Quality management systems — Requirements	Supporting Standard
MX-SEA-STD-100	RAMS Process Standard	Related Standard
MXSD-SSA-L1-STD-0001	Railway Risk Assessment Standard	Supporting Standard
MX-SEA-GDC-123	Reliability, Availability and Maintainability Validation Plan Guidance	Guidance
MX-SEA-TPL-123	Reliability, Availability and Maintainability Validation Plan 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**
ISA	Independent Safety Assessor
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

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 Manager	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 approved Project Chart of Accounts for the Program for the designated Cost Centre Manager.	CKH-QMA-FRM-003

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 Plan

1.1 Purpose

1.1.1 The Reliability, Availability and Maintainability (RAM) Validation Plan defines the actions required to confirm the system complies with the RAM requirements and how the validation actions shall be implemented.

1.1.2 Validation is the process of demonstrating that a system complies with customer (Metrolinx) needs and that the design process and plan have yielded the desired results. Validation activities determine 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 existing systems which interface with the change have not been negatively impacted after implementation of the change.

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.

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

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

1.3 Supporting Material

1.3.1 The RAM Validation Plan template is located in MX-SEA-TPL-123.

1.3.2 Guidance on completing the RAM Validation Plan is located in MX-SEA-GDC-123.

1.4 Products

1.4.1 The RAM Validation Plan 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 Plan. Preparation of the RAM Validation Plan 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 Plan. The System Review Panel ensures that the RAM Validation Plan 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 Plan are met and would not develop the RAM Validation Plan.

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

1.5.6 The full Responsible, Accountable, Consulted, and Informed (RACI) information that sets out the interaction between all stakeholders involved in the production and endorsement of the RAM Validation Plan is available in MX-SEA-STD-100.

1.6 Competence

1.6.1 All personnel responsible for the delivery of the RAM Validation Plan shall possess the necessary competence to deliver the works. This shall be 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 Plan is described in the RAM Validation Plan Guidance document located in MX-SEA-GDC-123.

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) Reporting

1.8 Contents

1.8.1 The contents of the RAM Validation Plan are described in the RAM Validation Plan Guidance document located in MX-SEA-GDC-123.

1.8.2 As a minimum, it shall contain or reference the following:

a) List of validation tasks for each phase of the project lifecycle including:

1) A description how the Project Company will ensure that RAM analyses and management activities are carried out thoroughly, completely and following the RAM Plan and that the list of RAM requirements is complete and has been managed appropriately.

2) Description of each task including the type of validation activity (Test, Demonstration, Inspection, Analysis or combination thereof)

3) The RAM requirement being verified or validated by the task

4) A reference to, or description of, any procedures or specifications that will govern the task

5) List of resources required to perform the task (procedures, equipment, facilities, personnel, witnesses etc.)

6) Traceability to project schedule and/or plan(s) that will be used to manage each task (e.g. Manufacturing Inspection Test Plan, Test Specification, Integration Plan, Commissioning plan etc.)

b) A summary and justification of the validation strategy chosen. The justification shall include consideration of the testing/analysis strategy; acceptance of proposed test strategies by the test entity; and witness and coverage of the test strategy.

c) The steps necessary to validate system, subsystem or equipment specifications to ensure their adequacy

d) Process to manage deviations from expected results and non-compliances, including:

1) How they will be documented

2) How they will be considered in subsequent tasks

3) How non-compliances and safety related constraints that arise from deviations will be addressed and managed

4) How the impact of deviations and non-compliances will be documented

e) Process to ensure the validation activities (specified test, demonstration, inspection, or analysis) are sufficient to determine compliance to the RAM requirements.

f) A plan for reporting the results of validation activities and the confirmation that the process and activities defined in the RAM Validation Plan have been completed. Any deviation must be recorded and justified.

g) Description of the project organization that ensures validator independence as per EN 50126-2:2017.

1.8.3 Any update to the RAM Validation Plan 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 Plan shall have sufficient detail to completely define RAM Validation activities such that the RAM targets can be demonstrated, and detail of who is responsible for completing those actions at the correct stage. It shall set a clear plan for all actors responsible for RAM activities.

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 Plan is produced at Phase 4 (System Requirements) and may be reviewed up to Phase 8 (Integration).

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

Document	Phase
RAM Validation Plan	4 – System Requirements
RAM Validation Plan update (if required)	5 – Apportionment - 8 – Integration

TABLE 4: DOCUMENT PHASES