NSW GOVERNMENT | Transport for NSW

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Technical Note - TN 082: 2016

Issued date: 21 December 2016

Subject: Revised reference to risk criteria

This technical note has been issued by the Asset Standards Authority (ASA) to notify the following.

- The risk criteria to be used by the Authorised Engineering Organisations (AEOs) providing engineering services to TfNSW are contained in T MU MD 20002 ST *Risk Criteria for Organisations Providing Engineering Services*, version 1.0.

- 30-ST-164 *TfNSW Enterprise Risk Management (TERM) Standard* provides the risk criteria to be used by TfNSW.

- All references to the TERM standard in this document, where applicable to AEOs, shall read as T MU MD 20002 ST.

Authorisation:

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NSW GOVERNMENT | **Transport for NSW**

T MU TE 81003 ST

Standard

Test Processes and Documentation for Programmable Electronic Systems and Software

Version 1.0

Issued Date: 27 August 2014

Standard governance

Owner: Lead Telecommunications Engineer, Asset Standards Authority

Authoriser: Chief Engineer Rail, Asset Standards Authority

Approver: Director, Asset Standards Authority on behalf of ASA Configuration Control Board

Document history

Version	Summary of change
1.0	First issue

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Transport
Asset Standards Authority
NSW

Preface

The Asset Standards Authority (ASA) is an independent unit within Transport for NSW (TfNSW) and is the network design and standards authority for defined NSW transport assets.

The ASA is responsible for developing engineering governance frameworks to support industry delivery in the assurance of design, safety, integrity, construction, and commissioning of transport assets for the whole asset life cycle. In order to achieve this, the ASA effectively discharges obligations as the authority for various technical, process, and planning matters across the asset life cycle.

The ASA collaborates with industry using stakeholder engagement activities to assist in achieving its mission. These activities help align the ASA to broader government expectations of making it clearer, simpler, and more attractive to do business within the NSW transport industry, allowing the supply chain to deliver safe, efficient, and competent transport services.

The ASA develops, maintains, controls, and publishes a suite of standards and other documentation for transport assets of TfNSW. Further, the ASA ensures that these standards are performance based to create opportunities for innovation and improve access to a broader competitive supply chain.

This document has been developed to set out a scalable approach for requirements and risk based testing by tailoring conformance of ISO/IEC/IEEE 29119:2013 appropriate to the worst-case credible risk of the project being delivered. This allows projects assessed with low risks to be delivered in an effective manner based on processes and documentation items appropriate to the risk.

This standard is the first issue.

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1.   Introduction

An authorised engineering organisation (AEO) shall have arrangements for verification and validation management of the engineering services or products provided. This is stated in TS 10502 *AEO Authorisation Requirements.* TS 10506 *AEO Guide to Verification and Validation* provides guidance on forms of verification activities that may be carried out.

Testing, using both static and dynamic techniques, is a commonly used form of verification and validation for rail infrastructure and rolling stock projects comprising 'programmable electronic' systems and software. Historically, testing activities for 'programmable electronic' systems and software have been delivered with varying degrees of rigour and without alignment to international standards for software and systems engineering, such as IEEE 829 or the recently released ISO/IEC/IEEE 29119.

This document sets out a scalable approach for requirements and risk based testing by tailoring conformance of ISO/IEC/IEEE 29119:2013 appropriate to the worst-case credible risk of the project being delivered. This allows projects assessed with low risks to be delivered in an effective manner based on processes and documentation items appropriate to the risk.

2.   Purpose

The purpose of this document is to standardise the test processes and documentation requirements for the delivery of 'programmable electronic' systems and software within rail infrastructure and rolling stock projects.

2.1.   Scope

This document sets out the minimum requirements for test processes and documentation where testing is used as part of verification and validation activities for rail infrastructure and rolling stock projects comprising 'programmable electronic' systems and software. Figure 1 shows the static and dynamic testing techniques.

Alternate forms of verification and validation such as formal methods and analysis are not in scope of this document. Guidance on alternate forms of verification and validation is provided in TS 10506.
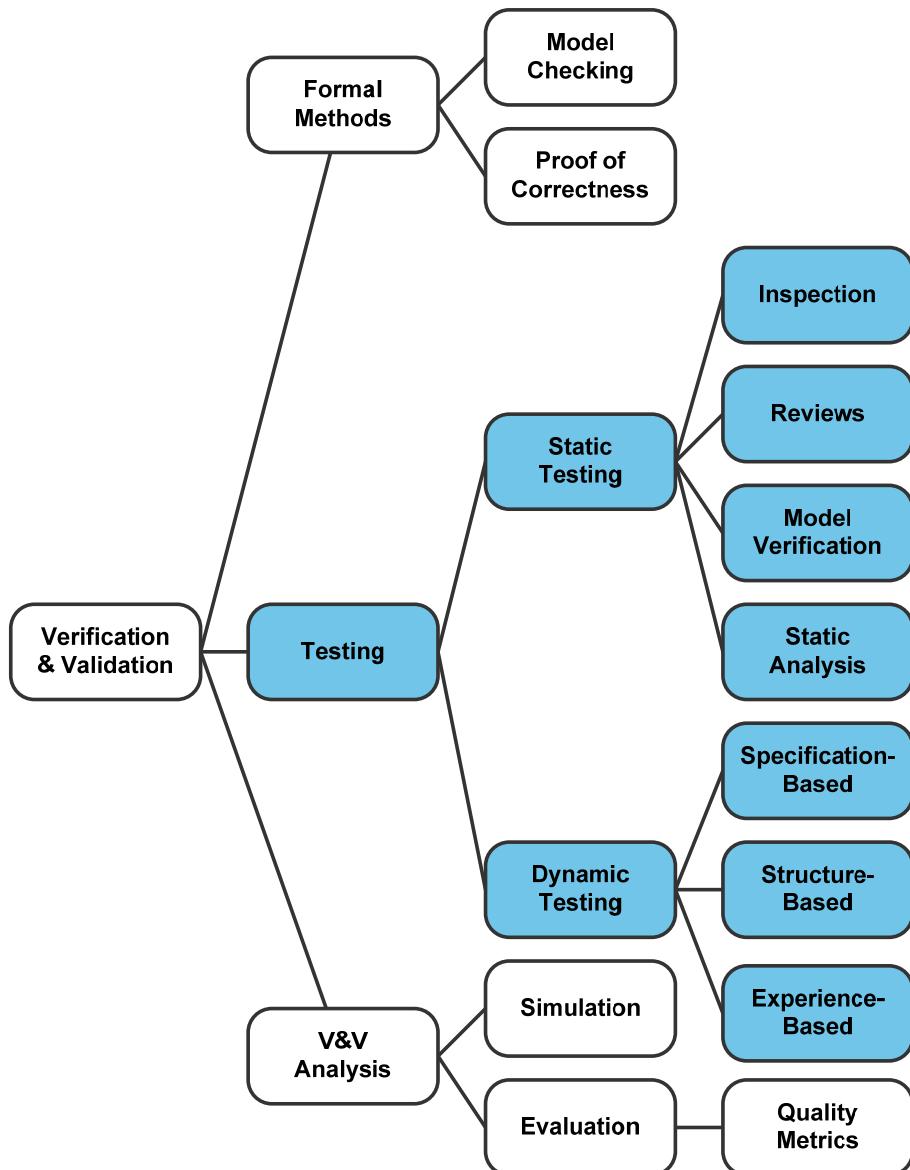
Figure 1 - Hierarchy of verification and validation activities from ISO/IEC/IEEE 29119-1:2013

2.2. Application

Where a system has safety-related system functions as defined by either AS 61508.4-2011 or EN 50129, the testing activities shall comply with EN 50128 and EN 50129 in addition to this standard. In areas of overlapping scope between this standard and EN 50128 or EN 50129, such as Section 6.1.4 of EN 50128 and Section 5.3.9 of EN 50129, and where conflicts exist, the most stringent requirement shall be complied with.

Where discipline specific standards or specifications exist covering test processes and documentation they shall be complied with in addition to this standard. In areas of overlapping scope between this standard and discipline specific standards or specifications, and where conflicts exist, the most stringent requirement shall be complied with.

3.   Reference documents

International standards

EN 50128 Railway Applications - Communication, signalling and processing systems - Software for railway control and protection systems

EN 50129 Railway Applications - Communication, signalling and processing systems - Safety related electronic systems for signalling

IEEE 829-2008 Software and System Test Documentation

ISO/IEC/IEEE 24765 Systems and software engineering - Vocabulary

ISO/IEC/IEEE 29119-1:2013 Software and systems engineering - Software testing - Part 1: Concepts and definitions

ISO/IEC/IEEE 29119-2:2013 Software and systems engineering - Software testing - Part 2: Test processes

ISO/IEC/IEEE 29119-3:2013 Software and systems engineering - Software testing - Part 3: Test documentation

Australian standards

AS 61508.4-2011 Functional safety of electrical/electronic/programmable electronic safety-related systems - Definitions and abbreviations

Legislation

Rail Safety National Law (NSW)

Transport for NSW standards

TS 10502 AEO Authorisation Requirements

TS 10506 AEO Guide to Verification and Validation

TS 20001:2013 Safety Systems Standard for New or Altered Assets

Other reference documents

30-ST-164 TfNSW Enterprise Risk Management (TERM) Standard

State Records, Policy on digital records preservation, October 2011, ISBN 978-0-9757845-7-0
http://www.records.nsw.gov.au/recordkeeping/rules/policies/policy-on-digital-records-preservation

4. Terms and definitions

The following terms and definitions apply in this document:

acceptance test (as defined in ISO/IEC/IEEE 24765)

1. testing conducted to determine whether a system satisfies its acceptance criteria and to enable the customer to determine whether to accept the system.

2. formal testing conducted to enable a user, customer, or other authorized entity to determine whether to accept a system or component.

programmable electronic (PE) (as defined in AS 61508.4) based on computer technology which may be comprised of hardware, software, and of input and/or output units

rail infrastructure (as defined in Rail Safety National Law (NSW)) means the facilities that are necessary to enable a railway to operate and includes -

(a) railway tracks and associated railway track structures; and

(b) service roads, signalling systems, communications systems, rolling stock control systems, train control systems and data management systems; and

(c) notices and signs; and

(d) electrical power supply and electric traction systems; and

(e) associated buildings, workshops, depots and yards; and

(f) plant, machinery and equipment,

but does not include-

(g) rolling stock; or

(h) any facility, or facility of a class, that is prescribed by the national regulations not to be rail infrastructure;

rolling stock (as defined in Rail Safety National Law (NSW)) means a vehicle that operates on or uses a railway, and includes a locomotive, carriage, rail car, rail motor, light rail vehicle, train, tram, light inspection vehicle, self propelled infrastructure maintenance vehicle, trolley, wagon or monorail vehicle, but does not include a vehicle designed to operate both on and off a railway when the vehicle is not operating on a railway

system testing (as defined in ISO/IEC/IEEE 24765) 1. testing conducted on a complete, integrated system to evaluate the system's compliance with its specified requirements.

systems integration testing (as defined in ISO/IEC/IEEE 24765) 1. testing conducted on multiple complete, integrated systems to evaluate their ability to communicate successfully with each other and to meet the overall integrated systems' specified requirements.

5. Risk based tailored conformance

For the purpose of applying this standard, the risks shall be assessed using the risk matrix defined in Appendix B of 30-ST-164 *TfNSW Enterprise Risk Management (TERM) Standard*.

The mappings contained in Section 6 and Section 7 of this standard shall be used to achieve a tailored conformance to ISO/IEC/IEEE 29119:2013 where the risk rating is the worst-case credible risk.

In the event that the risks have not been assessed, full conformance to the following shall be required:

- ISO/IEC/IEEE 29119-2:2013

- ISO/IEC/IEEE 29119-3:2013

- Other standards and specifications as required by Section 2.2 of this standard

6.   Mapping of test process requirements

Table 1 shows the mapping of the normative test process requirements to those defined in ISO/IEC/IEEE 29119-2:2013 based on the assessed worst-case credible risk.

The risk based mapping contained within this standard establishes the minimum tailored conformance to ISO/IEC/IEEE 29119 2:2013 for a given risk rating. Where a process defined in ISO/IEC/IEEE 29119-2:2013 is not followed and where permitted by this standard, no further justification or rationale is required.

The tailored conformance of ISO/IEC/IEEE 29119-2:2013 has been undertaken with consideration of the applicable risk and the agreement of relevant stakeholders.

Table 1 - Mapping of normative test process requirements

ISO/IEC/IEEE 29119-2 requirement reference number	ISO/IEC/IEEE 29119-2 Requirement	Low risk rating	Medium risk rating	High / very high risk rating
6	Organizational test process	Shall	Shall	Shall
6.2	Organizational test process	Shall	Shall	Shall
6.2.4.1	Develop organizational test specification (OT1)	Shall	Shall	Shall
6.2.4.2	Monitor and control use of organizational test specification (OT2)	Shall	Shall	Shall
6.2.4.3	Update organizational test specification (OT3)	Shall	Shall	Shall
7.	Test management processes	Shall	Shall	Shall
7.2	Test planning process	Shall	Shall	Shall
7.2.4.1	Understand context (TP1)	Shall	Shall	Shall
7.2.4.2	Organize test plan development (TP2)	Shall	Shall	Shall
7.2.4.3	Identify and analyse risks (TP3)	Shall	Shall	Shall

ISO/IEC/IEEE 29119-2 requirement reference number	ISO/IEC/IEEE 29119-2 Requirement	Low risk rating	Medium risk rating	High / very high risk rating
7.2.4.4	Identify risk mitigation approaches (TP4)	Shall	Shall	Shall
7.2.4.5	Design test strategy (TP5)	Shall	Shall	Shall
7.2.4.6	Determine staffing and scheduling (TP6)	Shall	Shall	Shall
7.2.4.7	Record test plan (TP7)	Shall	Shall	Shall
7.2.4.8	Gain consensus on test plan (TP8)	Shall	Shall	Shall
7.2.4.9	Communicate test plan and make available (TP9)	Shall	Shall	Shall
7.3	Test monitoring and control process	NA	NA	Shall
7.3.4.1	Set-up (TMC1)	NA	NA	Shall
7.3.4.2	Monitor (TMC2)	NA	NA	Shall
7.3.4.3	Control (TMC3)	NA	NA	Shall
7.3.4.4	Report (TMC4)	NA	NA	Shall
7.4	Test completion process	Shall	Shall	Shall
7.4.4.1	Archive test assets (TC1)	Shall	Shall	Shall
7.4.4.2	Clean up test environment (TC2)	Shall	Shall	Shall
7.4.4.3	Identify lessons learnt (TC3)	NA	Shall	Shall
7.4.4.4	Report test completion (TC4)	Shall	Shall	Shall
8	Dynamic test processes	Shall	Shall	Shall
8.2	Test design and implementation process	Shall	Shall	Shall
8.2.4.1	Identify feature sets (TD1)	NA	Shall	Shall
8.2.4.2	Derive test conditions (TD2)	Shall	Shall	Shall
8.2.4.3	Derive test coverage items (TD3)	NA	Shall	Shall
8.2.4.4	Derive test cases (TD4)	Shall	Shall	Shall

ISO/IEC/IEEE 29119-2 requirement reference number	ISO/IEC/IEEE 29119-2 Requirement	Low risk rating	Medium risk rating	High / very high risk rating
8.2.4.5	Assemble test sets (TD5)	NA	Shall	Shall
8.2.4.6	Derive test procedures (TD6)	Shall	Shall	Shall
8.3	Test environment set-up and maintenance process	Shall	Shall	Shall
8.3.4.1	Establish test environment (ES1)	Shall	Shall	Shall
8.3.4.2	Maintain test environment (ES2)	Shall	Shall	Shall
8.4	Test execution process	Shall	Shall	Shall
8.4.4.1	Execute test procedure(s) (TE1)	Shall	Shall	Shall
8.4.4.2	Compare test results (TE2)	Shall	Shall	Shall
8.4.4.3	Record test execution (TE3)	Shall	Shall	Shall
8.5	Test incident reporting process	Shall	Shall	Shall
8.5.4.1	Analyse test results (IR1)	Shall	Shall	Shall
8.5.4.2	Create/update incident report (IR2)	Shall	Shall	Shall

7. Mapping of test documentation information items

Table 2 shows the mapping of the normative test documentation information item requirements to those defined in ISO/IEC/IEEE 29119-3:2013 based on the assessed worst-case credible risk.

The risk based mapping contained within this standard establishes the minimum tailored conformance to ISO/IEC/IEEE 29119 3:2013 for a given risk rating. Where a documentation information item defined in ISO/IEC/IEEE 29119 3:2013 is not followed and where permitted by this standard, no further justification or rationale is required.

The tailored conformance of ISO/IEC/IEEE 29119-3:2013 has been undertaken with consideration of the applicable risk and the agreement of relevant stakeholders.

Table 2 - Mapping of normative test documentation information item requirements

ISO/IEC/IEEE 29119-3 requirement reference number	ISO/IEC/IEEE 29119-3 Requirement	Low risk rating	Medium risk rating	High / very high risk rating
5.2	Organizational Test Policy	Shall	Shall	Shall
5.2.4	Test policy statements	Shall	Shall	Shall
5.2.4.1	Objectives of testing	Shall	Shall	Shall
5.2.4.2	Test process	Shall	Shall	Shall
5.2.4.3	Test organization structure	NA	NA	Shall
5.2.4.4	Tester training	Shall	Shall	Shall
5.2.4.5	Tester ethics	Shall	Shall	Shall
5.2.4.6	Standards	Shall	Shall	Shall
5.2.4.7	Other relevant policies	Shall	Shall	Shall
5.2.4.8	Measuring the value of testing	NA	NA	Shall

ISO/IEC/IEEE 29119-3 requirement reference number	ISO/IEC/IEEE 29119-3 Requirement	Low risk rating	Medium risk rating	High / very high risk rating
5.2.4.9	Test asset archiving and reuse	Shall	Shall	Shall
5.2.4.10	Test process improvement	NA	NA	Shall
5.3	Organizational Test Strategy	Shall	Shall	Shall
5.3.4	Project-wide organizational test strategy statements	Shall	Shall	Shall
5.3.4.1	Generic risk management	Shall	Shall	Shall
5.3.4.2	Test selection and prioritization	Shall	Shall	Shall
5.3.4.3	Test documentation and reporting	Shall	Shall	Shall
5.3.4.4	Test automation and tools	Shall	Shall	Shall
5.3.4.5	Configuration management of test work products	Shall	Shall	Shall
5.3.4.6	Incident management	Shall	Shall	Shall
5.3.4.7	Test sub-processes	Shall	Shall	Shall
5.3.5	Test sub-process-specific organizational test strategy statements	Shall	Shall	Shall
5.3.5.1	Entry and exit criteria	Shall	Shall	Shall
5.3.5.2	Test completion criteria	Shall	Shall	Shall
5.3.5.3	Test documentation and reporting	Shall	Shall	Shall
5.3.5.4	Degree of independence	Shall	Shall	Shall
5.3.5.5	Test design techniques	NA	NA	Shall
5.3.5.6	Test environment	NA	NA	Shall
5.3.5.7	Metrics to be collected	NA	NA	Shall
5.3.5.8	Retesting and regression testing	NA	NA	Shall
6.2	Test Plan	Shall	Shall	Shall

ISO/IEC/IEEE 29119-3 requirement reference number	ISO/IEC/IEEE 29119-3 Requirement	Low risk rating	Medium risk rating	High / very high risk rating
6.2.4	Context of the testing	Shall	Shall	Shall
6.2.4.1	Project(s) / test sub-process(es)	Shall	Shall	Shall
6.2.4.2	Test item(s)	Shall	Shall	Shall
6.2.4.3	Test scope	Shall	Shall	Shall
6.2.4.4	Assumptions and constraints	Shall	Shall	Shall
6.2.4.5	Stakeholders	Shall	Shall	Shall
6.2.5	Testing communication	Shall	Shall	Shall
6.2.6	Risk register	Shall	Shall	Shall
6.2.6.1	Product risks	Shall	Shall	Shall
6.2.6.2	Project risks	Shall	Shall	Shall
6.2.7	Test strategy	Shall	Shall	Shall
6.2.7.1	Test sub-processes	Shall	Shall	Shall
6.2.7.2	Test deliverables	Shall	Shall	Shall
6.2.7.3	Test design techniques	Shall	Shall	Shall
6.2.7.4	Test completion criteria	Shall	Shall	Shall
6.2.7.5	Metrics to be collected	Shall	Shall	Shall
6.2.7.6	Test data requirements	Shall	Shall	Shall
6.2.7.7	Test environment requirements	Shall	Shall	Shall
6.2.7.8	Retesting and regression testing	NA	Shall	Shall
6.2.7.9	Suspension and resumption criteria	NA	Shall	Shall
6.2.7.10	Deviations from the Organizational Test Strategy	NA	NA	Shall
6.2.8	Testing activities and estimates	NA	NA	Shall

ISO/IEC/IEEE 29119-3 requirement reference number	ISO/IEC/IEEE 29119-3 Requirement	Low risk rating	Medium risk rating	High / very high risk rating
6.2.9	Staffing	Shall	Shall	Shall
6.2.9.1	Roles, activities, and responsibilities	Shall	Shall	Shall
6.2.9.2	Hiring needs	NA	NA	Shall
6.2.9.3	Training needs	NA	NA	Shall
6.2.10	Schedule	NA	NA	Shall
6.3	Test Status Report	NA	NA	Shall
6.3.4	Test status	NA	NA	Shall
6.3.4.1	Reporting period	NA	NA	Shall
6.3.4.2	Progress against Test Plan	NA	NA	Shall
6.3.4.3	Factors blocking progress	NA	NA	Shall
6.3.4.4	Test measures	NA	NA	Shall
6.3.4.5	New and changed risks	NA	NA	Shall
6.4	Test Completion Report	Shall	Shall	Shall
6.4.4	Testing performed	Shall	Shall	Shall
6.4.4.1	Summary of testing performed	Shall	Shall	Shall
6.4.4.2	Deviations from planned testing	Shall	Shall	Shall
6.4.4.3	Test completion evaluation	Shall	Shall	Shall
6.4.4.4	Factors that blocked progress	NA	Shall	Shall
6.4.4.5	Test measures	Shall	Shall	Shall
6.4.4.6	Residual risks	Shall	Shall	Shall
6.4.4.7	Test deliverables	Shall	Shall	Shall
6.4.4.8	Reusable test assets	Shall	Shall	Shall

ISO/IEC/IEEE 29119-3 requirement reference number	ISO/IEC/IEEE 29119-3 Requirement	Low risk rating	Medium risk rating	High / very high risk rating
6.4.4.9	Lessons learned	NA	Shall	Shall
7.2	Test Design Specification	NA	Shall	Shall
7.2.4	Feature sets	NA	Shall	Shall
7.2.4.2	Unique identifier	NA	Shall	Shall
7.2.4.3	Objective	NA	Shall	Shall
7.2.4.4	Priority	NA	Shall	Shall
7.2.4.5	Specific strategy	NA	Shall	Shall
7.2.4.6	Traceability	NA	Shall	Shall
7.2.5	Test conditions	Shall	Shall	Shall
7.2.5.2	Unique identifier	Shall	Shall	Shall
7.2.5.3	Description	Shall	Shall	Shall
7.2.5.4	Priority	Shall	Shall	Shall
7.2.5.5	Traceability	Shall	Shall	Shall
7.3	Test Case Specification	Shall	Shall	Shall
7.3.4	Test coverage items	NA	Shall	Shall
7.3.4.2	Unique identifier	NA	Shall	Shall
7.3.4.3	Description	NA	Shall	Shall
7.3.4.4	Priority	NA	NA	Shall
7.3.4.5	Traceability	NA	Shall	Shall
7.3.5	Test cases	Shall	Shall	Shall
7.3.5.2	Unique identifier	Shall	Shall	Shall
7.3.5.3	Objective	Shall	Shall	Shall

ISO/IEC/IEEE 29119-3 requirement reference number	ISO/IEC/IEEE 29119-3 Requirement	Low risk rating	Medium risk rating	High / very high risk rating
7.3.5.4	Priority	NA	NA	Shall
7.3.5.5	Traceability	Shall	Shall	Shall
7.3.5.6	Preconditions	Shall	Shall	Shall
7.3.5.7	Inputs	Shall	Shall	Shall
7.3.5.8	Expected results	Shall	Shall	Shall
7.3.5.9	Actual results and test result	Shall	Shall	Shall
7.4	Test Procedure Specification	Shall	Shall	Shall
7.4.4	Test sets	NA	Shall	Shall
7.4.4.2	Unique identifier	NA	Shall	Shall
7.4.4.3	Objective	NA	Shall	Shall
7.4.4.4	Priority	NA	Shall	Shall
7.4.4.5	Contents (Traceability)	NA	Shall	Shall
7.4.5	Test procedures	Shall	Shall	Shall
7.4.5.1	Overview	Shall	Shall	Shall
7.4.5.2	Unique identifier	Shall	Shall	Shall
7.4.5.3	Objective	Shall	Shall	Shall
7.4.5.4	Priority	NA	NA	Shall
7.4.5.5	Start up	Shall	Shall	Shall
7.4.5.6	Test cases to be executed (Traceability)	Shall	Shall	Shall
7.4.5.7	Relationship to other procedures	NA	NA	Shall
7.4.5.8	Stop and wrap up	Shall	Shall	Shall
7.5	Test Data Requirements	NA	NA	Shall

ISO/IEC/IEEE 29119-3 requirement reference number	ISO/IEC/IEEE 29119-3 Requirement	Low risk rating	Medium risk rating	High / very high risk rating
7.5.4	Detailed test data requirements	NA	NA	Shall
7.5.4.2	Unique identifier	NA	NA	Shall
7.5.4.3	Description	NA	NA	Shall
7.5.4.4	Responsibility	NA	NA	Shall
7.5.4.5	Period needed	NA	NA	Shall
7.5.4.6	Resetting needs	NA	NA	Shall
7.5.4.7	Archiving or disposal	NA	NA	Shall
7.6	Test Environment Requirements	NA	Shall	Shall
7.6.4	Detailed test environment requirements	NA	Shall	Shall
7.6.4.2	Unique identifier	NA	Shall	Shall
7.6.4.3	Description	NA	Shall	Shall
7.6.4.4	Responsibility	NA	Shall	Shall
7.6.4.5	Period needed	NA	Shall	Shall
7.7	Test Data Readiness Report	NA	NA	Shall
7.7.4	Test data status	NA	NA	Shall
7.7.4.2	Unique identifier	NA	NA	Shall
7.7.4.3	Description of status	NA	NA	Shall
7.8	Test Environment Readiness Report	NA	NA	Shall
7.8.4	Test environment readiness	NA	NA	Shall
7.8.4.2	Unique identifier	NA	NA	Shall
7.8.4.3	Description of status	NA	NA	Shall
7.11	Test Execution Log	Shall	Shall	Shall

ISO/IEC/IEEE 29119-3 requirement reference number	ISO/IEC/IEEE 29119-3 Requirement	Low risk rating	Medium risk rating	High / very high risk rating
7.11.4	Events	Shall	Shall	Shall
7.11.4.2	Unique identifier	Shall	Shall	Shall
7.11.4.3	Time	Shall	Shall	Shall
7.11.4.4	Description	Shall	Shall	Shall
7.11.4.5	Impact	Shall	Shall	Shall
7.12	Test Incident Reporting	Shall	Shall	Shall
7.12.5	Incident details	Shall	Shall	Shall
7.12.5.1	Timing information	Shall	Shall	Shall
7.12.5.2	Originator	Shall	Shall	Shall
7.12.5.3	Context	Shall	Shall	Shall
7.12.5.4	Description of the incident	Shall	Shall	Shall
7.12.5.5	Originator's assessment of severity	Shall	Shall	Shall
7.12.5.6	Originator's assessment of priority	Shall	Shall	Shall
7.12.5.7	Risk	Shall	Shall	Shall
7.12.5.8	Status of the incident	Shall	Shall	Shall

8. Organisational test strategy

To ensure consistency of testing activities for all AEOs providing engineering services, an AEO's organisational test strategy shall be tailored (if necessary) to comply with the requirements of this section in addition to Section 5.3 of ISO/IEC/IEEE 29119-3:2013.

Derivative test documentation information items or test work products shall not deviate from the organisational test strategy where the organisational test strategy complies with a requirement stated in this section.

8.1. Generic risk management

During testing activities, risks shall be assessed using the risk matrix defined in Appendix B of 30-ST-164 *TfNSW Enterprise Risk Management (TERM) Standard*.

When the testing activities are concluded, residual risks shall be expressed using the criteria of the owner of the risk in the rail operational environment. The owner of the risk will generally be the rail operator, in which case residual risks shall be reported against the operator's published risk matrix.

8.2. Test selection and prioritisation

A requirements and risk based testing approach shall be used for the selection and prioritisation of tests. The test coverage of a requirement is determined from its relative priority, such as mandatory, desirable or optional and assessed risk.

8.3. Test documentation and reporting

The test documentation and reporting shall comply with Section 7 of this standard.

8.4. Test automation and tools

The following test process and documentation information items shall be implemented in a test management tool (Sections 7.2-7.4 and Sections 7.9-7.10 of ISO/IEC/IEEE 29119-3:2013):

- test design specification

- test case specification

- test procedure specification

- actual results

- test result

The organisational test strategy shall nominate the test management tool. Any test management tool used shall be able to import and export data to extensible markup language (XML) format with XML schema (XSD) defined in Appendix B.

Other tools such as automation, performance, security, and usability testing tools shall be nominated in the organisational test strategy.

8.5. Configuration management of test work products

All test work products required for test execution, including those pertaining to the test data and environment, shall be stored such that the test can be re-run by an independent third party.

Test work products are considered long-term value records and shall be managed in accordance with *State Records Policy on Digital Records Preservation*.

8.6. Incident management

Incidents shall be managed in an incident management tool. The organisational test strategy shall nominate the incident management tool. Any incident management tool used shall be able to import and export data to extensible markup language (XML) format with XML schema (XSD) defined in Appendix B.

Incident details shall include the categories indicating the assessment of severity from a requirements and risk perspective.

Table 3 shows the different severity levels and their definitions.

Table 3 - Severity levels

Severity	Definition
S1	Failure of any test covering a high or very high risk mandatory requirement.
S2	Failure of any test covering a medium risk mandatory requirement.
S3	Failure of any test covering a low risk mandatory requirement.
S4	All other issues, for example, failure of one or more tests covering a non-mandatory (desirable or optional) requirement.

Incident details shall include the incident status compliant with the minimum states and transitions.

Figure 2 shows the transition of different states of an incident.
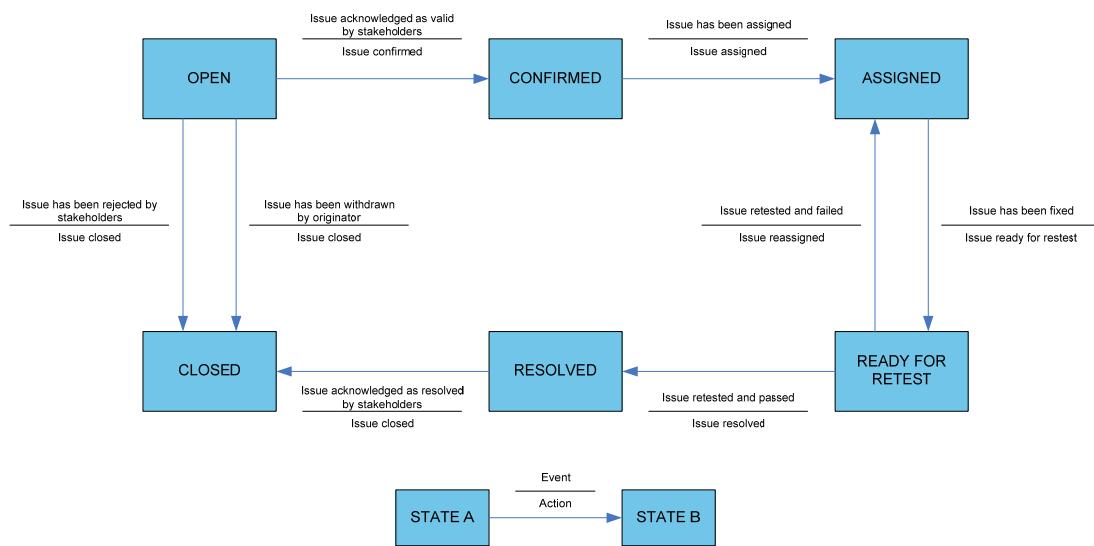
Figure 2 - Incident state transition diagram

8.7. Test sub-processes

The organisational test strategy shall contain the following minimum test sub-processes:

1. system testing sub-process (verification)

2. system integration testing sub-process (verification)

3. acceptance testing sub-process (validation)

   Note that the development model is not defined and need not be sequential. Test sub-processes may be repeated, for example, as part of iterative-incremental development model.

8.7.1. Entry and exit criteria

Verification test sub-processes shall contain the following entry and exit criteria:

- all S1 and S2 severity incidents raised in previous test sub-processes are in the 'RESOLVED' or 'CLOSED' state

- all S3 severity incidents raised in previous test sub-processes are in the 'ASSIGNED', 'READY FOR RETEST', 'RESOLVED' or 'CLOSED' state

- all S4 severity incidents raised in previous test sub-processes are in the 'CONFIRMED', 'ASSIGNED', 'READY FOR RETEST', 'RESOLVED' or 'CLOSED' state

Validation test sub-processes shall contain the following entry and exit criteria:

- all S1, S2, and S3 severity incidents raised in previous test sub-processes are in the 'CLOSED' state

- all S4 severity incidents raised in previous test sub-processes are in the 'CONFIRMED', 'ASSIGNED', 'READY FOR RETEST', 'RESOLVED' or 'CLOSED' state

8.7.2. Degree of independence

Figure 3 shows the minimum degree of independence for those performing the testing for non-safety related systems.
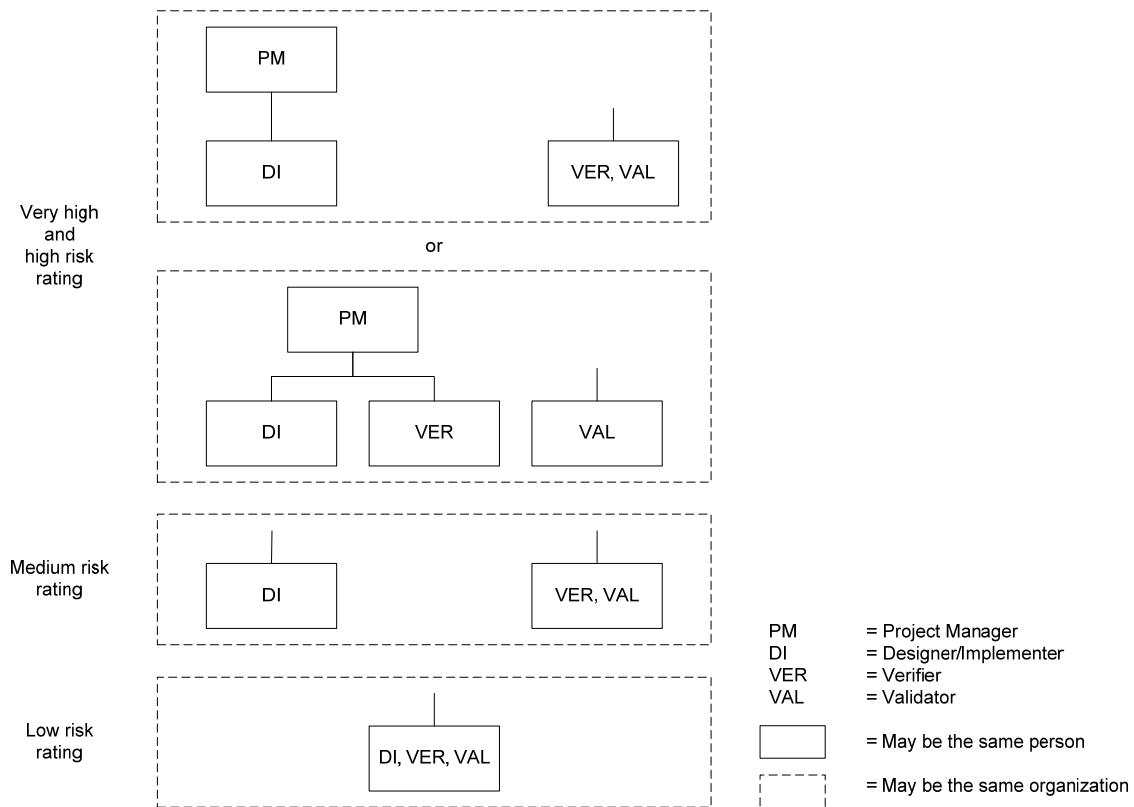

Figure 3 - Arrangements for independence (non-safety related systems)

Appendix A - Entity relationships (informative)

Figure 4 shows the entity relationship diagram (ERD) using crow's foot notation that illustrates the entity relationships used in the design of the XML Schema.
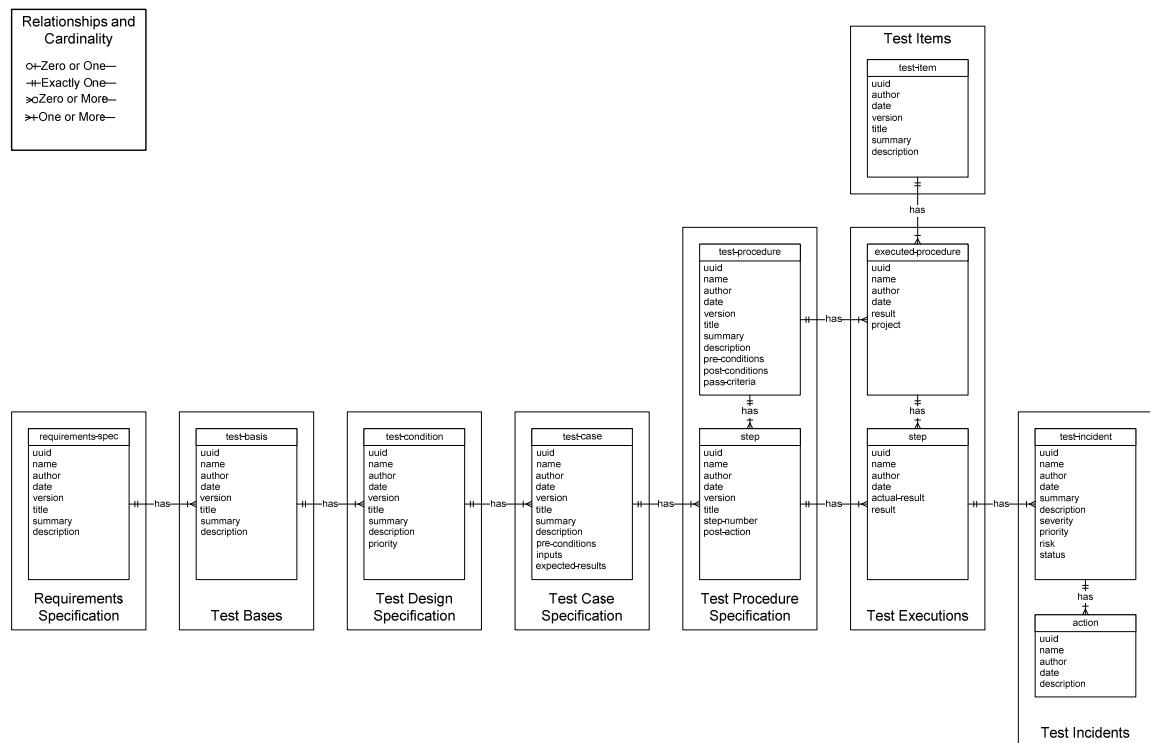
Figure 4 - Entity relationship diagram (ERD)

Appendix B – XML schema

B.1 Test management XML schema (normative)

```xml
<?xml version="1.0" encoding="utf-8"?>
<xs:schema
  xmlns="urn:au:gov:nsw:transport:test-management:1-0"
  xmlns:tm="urn:au:gov:nsw:transport:test-management:1-0"
  attributeFormDefault="unqualified"
  elementFormDefault="qualified"
  targetNamespace="urn:au:gov:nsw:transport:test-management:1-0"
  version="1-0"
  xmlns:xs="http://www.w3.org/2001/XMLSchema"
  xmlns:xhtml="http://www.w3.org/1999/xhtml">

  <xs:import namespace="http://www.w3.org/1999/xhtml" schemaLocation="http://www.w3.org/2002/08/xhtml/xhtml1-
strict.xsd" />

  <!-- simple types declaratons -->

  <xs:simpleType name="resultType">
    <xs:restriction base="xs:string">
      <xs:enumeration value="NONE" />
      <xs:enumeration value="PASS" />
      <xs:enumeration value="INCONCLUSIVE" />
      <xs:enumeration value="FAIL" />
      <xs:enumeration value="ERROR" />
      <xs:enumeration value="BLOCKED" />
    </xs:restriction>
  </xs:simpleType>

  <xs:simpleType name="riskType">
    <xs:restriction base="xs:string">
      <xs:enumeration value="A" />
      <xs:enumeration value="B" />
      <xs:enumeration value="C" />
```

```
          <xs:enumeration value="D" />
      </xs:restriction>
  </xs:simpleType>


  <xs:simpleType name="severityType">
      <xs:restriction base="xs:string">
          <xs:enumeration value="S1" />
          <xs:enumeration value="S2" />
          <xs:enumeration value="S3" />
          <xs:enumeration value="S4" />
      </xs:restriction>
  </xs:simpleType>


  <xs:simpleType name="priorityType">
      <xs:restriction base="xs:string">
          <!--xs:enumeration value="P1" />
          <xs:enumeration value="P2" />
          <xs:enumeration value="P3" />
          <xs:enumeration value="P4" /-->
      </xs:restriction>
  </xs:simpleType>


  <xs:simpleType name="incidentStateType">
      <xs:restriction base="xs:string">
          <xs:enumeration value="OPEN" />
          <xs:enumeration value="CONFIRMED" />
          <xs:enumeration value="ASSIGNED" />
          <xs:enumeration value="READY_FOR_RETEST" />
          <xs:enumeration value="RESOLVED" />
          <xs:enumeration value="CLOSED" />
      </xs:restriction>
  </xs:simpleType>


  <xs:simpleType name="uuidType">
      <xs:restriction base="xs:string">
          <xs:pattern value="(urn:uuid:)?[0-9a-fA-F]{8}-[0-9a-fA-F]{4}-[0-9a-fA-F]{4}-[0-9a-fA-F]{4}-[0-9a-fA-
F]{12}|\{[0-9a-fA-F]{8}-[0-9a-fA-F]{4}-[0-9a-fA-F]{4}-[0-9a-fA-F]{4}-[0-9a-fA-F]{12}\}" />
      </xs:restriction>
```

```
      </xs:simpleType>

      <!-- attribtue groups -->

      <xs:attributeGroup name="metadata">
        <xs:attribute name="uuid"    type="uuidType"   use="required" />
        <xs:attribute name="name"    type="xs:string"  use="required" />
        <xs:attribute name="author"    type="xs:string"   use="required" />
        <xs:attribute name="date"    type="xs:date"    use="required" />
        <xs:attribute name="title"   type="xs:string"  use="optional" />
        <xs:attribute name="version"  type="xs:string"  use="optional" />
        <xs:attribute name="orgname"  type="xs:string"  use="optional" />
      </xs:attributeGroup>

      <xs:attributeGroup name="exec-metadata">
        <xs:attribute name="uuid"    type="uuidType"    use="required" />
        <xs:attribute name="name"    type="xs:string"  use="required" />
        <xs:attribute name="author"    type="xs:string"   use="required" />
        <xs:attribute name="date"    type="xs:date"    use="required" />
      </xs:attributeGroup>

      <!-- complex types declaration -->

      <xs:complexType name="xhtmlBlock">
        <xs:complexContent>
          <xs:extension base="xhtml:Block"/>
        </xs:complexContent>
      </xs:complexType>

      <!-- document definition -->

      <xs:element name="test-management">

        <xs:complexType>

          <xs:all>

            <xs:element name="requirements-specs">
```

```xml
              <xs:complexType>
                <xs:sequence>
                  <xs:element name="requirements-spec" minOccurs="0" maxOccurs="unbounded">
                    <xs:complexType>
                      <xs:sequence>
                        <xs:element name="summary" type="xs:string" />
                        <xs:element name="description" type="xhtmlBlock" />
                      </xs:sequence>
                      <xs:attributeGroup ref="metadata" />
                    </xs:complexType>
                  </xs:element>
                </xs:sequence>
              </xs:complexType>
            </xs:element>

            <xs:element name="test-bases">
              <xs:complexType>
                <xs:sequence>
                  <xs:element name="test-basis" minOccurs="0" maxOccurs="unbounded">
                    <xs:complexType>
                      <xs:sequence>
                        <xs:element name="summary" type="xs:string" />
                        <xs:element name="description" type="xhtmlBlock" />
                      </xs:sequence>
                      <xs:attributeGroup ref="metadata" />
                      <xs:attribute name="requirements-spec-ref" type="uuidType" use="required" />
                    </xs:complexType>
                  </xs:element>
                </xs:sequence>
              </xs:complexType>
            </xs:element>

            <xs:element name="test-conditions">
              <xs:complexType>
                <xs:sequence>
                  <xs:element name="test-condition" minOccurs="0" maxOccurs="unbounded">
                    <xs:complexType>
                      <xs:sequence>
```

```xml
                    <xs:element name="summary" type="xs:string" />
                    <xs:element name="description" type="xhtmlBlock" />
                  </xs:sequence>
                  <xs:attributeGroup ref="metadata" />
                  <xs:attribute name="priority" type="priorityType" use="required" />
                  <xs:attribute name="test-basis-ref" type="uuidType" use="required" />
                </xs:complexType>
              </xs:element>
            </xs:sequence>
          </xs:complexType>
        </xs:element>

        <xs:element name="test-cases">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="test-case" minOccurs="0" maxOccurs="unbounded">
                <xs:complexType>
                  <xs:annotation><xs:documentation>ISO/IEC/IEEE 29119:2013
7_3_5</xs:documentation></xs:annotation>
                  <xs:sequence>
                    <xs:element name="summary" type="xs:string" />
                    <xs:element name="description" type="xhtmlBlock" />
                    <xs:element name="pre-conditions" type="xhtmlBlock" />
                    <xs:element name="inputs" type="xhtmlBlock" />
                    <xs:element name="expected-results" type="xhtmlBlock" />
                  </xs:sequence>
                  <xs:attributeGroup ref="metadata" />
                  <xs:attribute name="test-condition-ref" type="uuidType" use="required" />
                </xs:complexType>
              </xs:element>
            </xs:sequence>
          </xs:complexType>
        </xs:element>

        <xs:element name="test-procedures">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="test-procedure" minOccurs="0" maxOccurs="unbounded">
```

```
<xs:complexType>
  <xs:annotation><xs:documentation>ISO/IEC/IEEE 29119:2013
7_4_4</xs:documentation></xs:annotation>
  <xs:sequence>
    <xs:element name="summary" type="xs:string" />
    <xs:element name="description" type="xhtmlBlock" />
    <xs:element name="pre-conditions" type="xhtmlBlock" />
    <xs:element name="steps">
      <xs:complexType>
        <xs:sequence>
          <xs:element name="step" minOccurs="0" maxOccurs="unbounded">
            <xs:complexType>
              <xs:sequence>
                <xs:element name="post-actions" type="xhtmlBlock" />
              </xs:sequence>
              <xs:attributeGroup ref="metadata" />
              <xs:attribute name="step-number" type="xs:positiveInteger" use="required" />
              <xs:attribute name="test-case-ref" type="uuidType" use="required" />
            </xs:complexType>
          </xs:element>
        </xs:sequence>
      </xs:complexType>
    </xs:element>
    <xs:element name="post-actions" type="xhtmlBlock" />
    <xs:element name="pass-criteria" type="xs:string" />
  </xs:sequence>
  <xs:attributeGroup ref="metadata" />
</xs:complexType>
</xs:element>

<xs:element name="test-items">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="test-item" minOccurs="0" maxOccurs="unbounded">
        <xs:complexType>
```

```
            <xs:sequence>
              <xs:element name="summary" type="xs:string" />
              <xs:element name="description" type="xhtmlBlock" />
            </xs:sequence>
            <xs:attributeGroup ref="metadata" />
          </xs:complexType>
        </xs:element>
      </xs:sequence>
    </xs:complexType>
  </xs:element>

  <xs:element name="executed-procedures">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="executed-procedure" minOccurs="0" maxOccurs="unbounded">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="steps">
                <xs:complexType>
                  <xs:sequence>
                    <xs:element name="step" minOccurs="0" maxOccurs="unbounded">
                      <xs:complexType>
                        <xs:sequence>
                          <xs:element name="actual-results" type="xhtmlBlock" />
                        </xs:sequence>
                        <xs:attributeGroup ref="exec-metadata" />
                        <xs:attribute name="test-procedure-step-ref" type="uuidType" use="required" />
                        <xs:attribute name="result" type="resultType" use="required" />
                      </xs:complexType>
                    </xs:element>
                  </xs:sequence>
                </xs:complexType>
              </xs:element>
            </xs:sequence>
            <xs:attributeGroup ref="exec-metadata" />
            <xs:attribute name="project" type="xs:string" use="required" />
            <xs:attribute name="test-procedure-ref" type="uuidType" use="required" />
            <xs:attribute name="test-item-ref" type="uuidType" use="required" />
```

```xml
                    <xs:attribute name="result" type="resultType" use="required" />
                </xs:complexType>
            </xs:element>
        </xs:sequence>
    </xs:complexType>
</xs:element>

<xs:element name="test-incidents">
    <xs:complexType>
        <xs:sequence>
            <xs:element name="test-incident" minOccurs="0" maxOccurs="unbounded">
                <xs:complexType>
                    <xs:annotation><xs:documentation>ISO/IEC/IEEE 29119:2013
7_12</xs:documentation></xs:annotation>
                    <xs:sequence>
                        <xs:element name="summary" type="xs:string" />
                        <xs:element name="description" type="xhtmlBlock" />
                        <xs:element name="actions">
                            <xs:complexType>
                                <xs:sequence>
                                    <xs:element name="action" minOccurs="0" maxOccurs="unbounded">
                                        <xs:complexType>
                                            <xs:sequence>
                                                <xs:element name="description" type="xhtmlBlock" />
                                            </xs:sequence>
                                            <xs:attributeGroup ref="exec-metadata" />
                                        </xs:complexType>
                                    </xs:element>
                                </xs:sequence>
                            </xs:complexType>
                        </xs:element>
                    </xs:sequence>
                    <xs:attributeGroup ref="exec-metadata" />
                    <xs:attribute name="severity" type="severityType" use="required" />
                    <xs:attribute name="priority" type="priorityType" use="required" />
                    <xs:attribute name="risk" type="riskType" use="required" />
                    <xs:attribute name="status" type="incidentStateType" use="required" />
                    <xs:attribute name="executed-procedure-step-ref" type="uuidType" use="required" />
```

```
            </xs:complexType>
          </xs:element>
        </xs:sequence>
      </xs:complexType>
    </xs:element>

  </xs:all>

</xs:complexType>

<!-- key definitions -->

<xs:key name="requirements-spec-key">
    <xs:selector xpath=".//tm:requirements-specs/tm:requirements-spec"/>
    <xs:field xpath="@uuid"/>
</xs:key>
<xs:keyref name="requirements-spec-keyref" refer="requirements-spec-key">
    <xs:selector xpath=".//*"/>
    <xs:field xpath="@requirements-spec-ref"/>
</xs:keyref>

<xs:key name="test-basis-key">
    <xs:selector xpath=".//tm:test-bases/tm:test-basis"/>
    <xs:field xpath="@uuid"/>
</xs:key>
<xs:keyref name="test-basis-keyref" refer="test-basis-key">
    <xs:selector xpath=".//*"/>
    <xs:field xpath="@test-basis-ref"/>
</xs:keyref>

<xs:key name="test-condition-key">
    <xs:selector xpath=".//tm:test-conditions/tm:test-condition"/>
    <xs:field xpath="@uuid"/>
</xs:key>
<xs:keyref name="test-condition-keyref" refer="test-condition-key">
    <xs:selector xpath=".//*"/>
    <xs:field xpath="@test-condition-ref"/>
</xs:keyref>
```

```xml
<xs:key name="test-case-key">
    <xs:selector xpath=".//tm:test-cases/tm:test-case"/>
    <xs:field xpath="@uuid"/>
</xs:key>
<xs:keyref name="test-case-keyref" refer="test-case-key">
    <xs:selector xpath=".//*"/>
    <xs:field xpath="@test-case-ref"/>
</xs:keyref>

<xs:key name="test-procedure-key">
    <xs:selector xpath=".//tm:test-procedures/tm:test-procedure"/>
    <xs:field xpath="@uuid"/>
</xs:key>
<xs:keyref name="test-procedure-keyref" refer="test-procedure-key">
    <xs:selector xpath=".//*"/>
    <xs:field xpath="@test-procedure-ref"/>
</xs:keyref>

<xs:key name="test-procedure-step-key">
    <xs:selector xpath=".//tm:test-procedures/tm:test-procedure/tm:steps/tm:step"/>
    <xs:field xpath="@uuid"/>
</xs:key>
<xs:keyref name="test-procedure-step-keyref" refer="test-procedure-step-key">
    <xs:selector xpath=".//*"/>
    <xs:field xpath="@test-procedure-step-ref"/>
</xs:keyref>

<xs:key name="executed-procedure-step-key">
    <xs:selector xpath=".//tm:executed-procedures/tm:executed-procedure/tm:steps/tm:step"/>
    <xs:field xpath="@uuid"/>
</xs:key>
<xs:keyref name="executed-procedure-step-keyref" refer="executed-procedure-step-key">
    <xs:selector xpath=".//*"/>
    <xs:field xpath="@executed-procedure-step-ref"/>
</xs:keyref>

<xs:key name="test-item-key">
```

```
        <xs:selector xpath=".//tm:test-items/tm:test-item"/>
        <xs:field xpath="@uuid"/>
</xs:key>
<xs:keyref name="test-item-keyref" refer="test-item-key">
        <xs:selector xpath=".//*"/>
        <xs:field xpath="@test-item-ref"/>
</xs:keyref>

<xs:unique name="uuid">
  <xs:selector xpath=".//*"/>
```

B.2   Mapping of XML schema (normative)

A summary of key mappings from the XML schema to ISO/IEC/IEEE 29119-3:2013 items is provided in Table 4 through Table 12. The attributes and elements in these tables do not map the complete XML schema. Schema attributes are denoted with the '@' symbol.

Table 4 - Test conditions - //test-conditions/test-condition

Schema attribute/element	ISO/IEC/IEEE 29119-3:2013 reference number and requirement
@author	7.2.2.2 Unique identification of document
@date	7.2.2.2 Unique identification of document
@version	7.2.2.2 Unique identification of document
@title	7.2.2.2 Unique identification of document
summary	7.2.5.1 Overview
@uuid	7.2.5.2 Unique identifier
description	7.2.5.3 Description
@priority	7.2.5.4 Priority
@test-basis-ref	7.2.5.5 Traceability

Table 5 - Test cases - //test-cases/test-case/

Schema attribute/element	ISO/IEC/IEEE 29119-3:2013 reference number and requirement
@author	7.3.2.2 Unique identification of document
@date	7.3.2.2 Unique identification of document
@version	7.3.2.2 Unique identification of document
@title	7.3.2.2 Unique identification of document
summary	7.3.5.1 Overview
@uuid	7.3.5.2 Unique identifier
description	7.3.5.3 Objective
@test-condition-ref	7.3.5.5 Traceability
pre-conditions	7.3.5.6 Preconditions
inputs	7.3.5.7 Inputs
expected-results	7.3.5.8 Expected results

Table 6 - Test procedure - //test-procedures/test-procedure/

Schema attribute/element	ISO/IEC/IEEE 29119-3:2013 reference number and requirement
@author	7.4.2.2 Unique identification of document
@date	7.4.2.2 Unique identification of document
@version	7.4.2.2 Unique identification of document

Schema attribute/element	ISO/IEC/IEEE 29119-3:2013 reference number and requirement
@title	7.4.2.2 Unique identification of document
summary	7.4.5.1 Overview
@uuid	7.4.5.2 Unique identifier
description	7.4.5.3 Objective
pre-conditions	7.4.5.5 Start up
post-actions	7.4.5.8 Stop and wrap up
pass-criteria	Not defined

Table 7 - Test step - //test-procedures/test-procedure/steps/step

Schema attribute/element	ISO/IEC/IEEE 29119-3:2013 reference number and requirement
@author	7.4.2.2 Unique identification of document
@date	7.4.2.2 Unique identification of document
@version	7.4.2.2 Unique identification of document
@title	7.4.2.2 Unique identification of document
@uuid	7.4.5.2 Unique identifier
@step-number	7.4.5.6 Test cases to be executed (Traceability)
@test-case-ref	7.4.5.6 Test cases to be executed (Traceability)
post-actions	7.4.5.6 Test cases to be executed (Traceability)

Table 8 - Test items - //test-items/test-item/

Schema attribute/element	ISO/IEC/IEEE 29119-3:2013 reference number and requirement
@uuid	6.2.2.2 Unique identification of document
@author	6.2.2.2 Unique identification of document
@date	6.2.2.2 Unique identification of document
@version	6.2.2.2 Unique identification of document
@title	6.2.2.2 Unique identification of document
summary	6.2.4.2 Test item(s)
description	6.2.4.2 Test item(s)

Table 9 - Executed procedure - //executed-procedures/executed procedure

Schema attribute/element	ISO/IEC/IEEE 29119-3:2013 reference number and requirement
@author	7.4.2.2 Unique identification of document
@date	7.4.2.2 Unique identification of document
@uuid	7.4.5.2 Unique identifier
@test-procedure-ref	7.4.5.6 Test cases to be executed (Traceability)

Schema attribute/element	ISO/IEC/IEEE 29119-3:2013 reference number and requirement
@test-item-ref	6.2.4.2 Test item(s)
@result	7.10 Test result
@project	Not defined

Table 10 - Executed step - //executed-procedures/executed procedure/steps/step

Schema attribute/element	ISO/IEC/IEEE 29119-3:2013 reference number and requirement
@author	7.4.2.2 Unique identification of document
@date	7.4.2.2 Unique identification of document
@uuid	7.4.5.2 Unique identifier
@test-procedure-step-ref	7.4.5.6 Test cases to be executed (Traceability)
actual-results	7.9 Actual results
@result	7.10 Test result

Table 11 - Test incidents - //test-incidents/test-incident/

Schema attribute/element	ISO/IEC/IEEE 29119-3:2013 reference number and requirement
@uuid	7.12.3.2 Unique identification of document
@date	7.12.5.1 Timing information
@author	7.12.5.2 Originator
summary	7.12.5.3 Context
description	7.12.5.4 Description of the incident
@severity	7.12.5.5 Originator's assessment of severity
@priority	7.12.5.6 Originator's assessment of priority
@risk	7.12.5.7 Risk
@status	7.12.5.8 Status of the incident
@executed-procedure-step-ref	7.12.5.3 Context

Table 12 - Test incident action - //test-incidents/test-incident/action

Schema attribute/element	ISO/IEC/IEEE 29119-3:2013 reference number and requirement
@uuid	Not defined
@author	Not defined
@date	Not defined
description	Not defined

Appendix C - Example showing a sub-set of dynamic test processes documentation

An example showing a sub-set of the dynamic test processes documentation, specifically Sections 7.2-7.4, Sections 7.9-7.10, and Section 7.12 of ISO/IEC/IEEE 29119-3:2013 is provided for the following items:

- test design specification

- test case specification

- test procedure specification

- actual results

- test result

- incident report

The example is mapped directly to ISO/IEC/IEEE 29119-3:2013.

Table 13 through Table 21 lists the requirements from ISO/IEC/IEEE 29119-3:2013 along with example values.

The example focuses on content and includes document specific information (such as issuing organisation, approval authority, or change history) or introduction (such as scope, references, or glossary).

The example is not intended to convey information about the presentation of the content.

The example may not be internally consistent or complete.

The example given is of a math library as part of a condition monitoring system. A new 'square root' feature has recently been added. For the purpose of the example, the scope of the testing is limited to the 'square root' feature.

Table 13 – Test features

ISO/IEC/IEEE 29119-3:2013 reference number and requirement	Value
7.2.4.1 Overview	Square root (SQRT).
7.2.4.2 Unique identifier	tf_1
7.2.4.3 Objective	To perform the square root math operation.
7.2.4.4 Priority	P1
7.2.4.5 Specific strategy	Equivalence partitioning and boundary value analysis.
7.2.4.6 Traceability	tb_1

Table 14 - Test condition 1

ISO/IEC/IEEE 29119-3:2013 reference number and requirement	Value
7.2.5.1 Overview	Must calculate the square root of a 16-bit signed integer to a minimum of 4 significant figures.
7.2.5.2 Unique identifier	td_1
7.2.5.3 Description	Must calculate the square root of a 16-bit signed integer (input) to a minimum of 4 significant figures (output).
7.2.5.4 Priority	P1
7.2.5.5 Traceability	tb_1

Table 15 – Test condition 2

ISO/IEC/IEEE 29119-3:2013 reference number and requirement	Value
7.2.5.1 Overview	Must calculate the square root of a 32-bit float to a minimum of 4 significant figures.
7.2.5.2 Unique identifier	td_2
7.2.5.3 Description	Must calculate the square root of a 32-bit float (input) to a minimum of 4 significant figures (output).
7.2.5.4 Priority	P1
7.2.5.5 Traceability	tb_1

Table 16 – Test coverage item 1

ISO/IEC/IEEE 29119-3:2013 reference number and requirement	Value
7.3.4.1 Overview	Equivalence partitioning has been used to identify valid and invalid partitions of the SQRT math function.
7.3.4.2 Unique identifier	tci_1
7.3.4.3 Description	Valid EP: input=+10, expected result=+3.162 (4-sf) Invalid EP: input=-10, expected result=ERROR
7.3.4.5 Traceability	td_1

Table 17 - Test coverage item 2

ISO/IEC/IEEE 29119-3:2013 reference number and requirement	Value
7.3.4.1 Overview	2-BVA has been used to identify boundary values of the SQRT math function.
7.3.4.2 Unique identifier	tci_2
7.3.4.3 Description	Valid: input=0, expected result=0 Invalid: input=-1, expected result=ERROR
7.3.4.5 Traceability	td_1

Table 18 - Test coverage item 3

ISO/IEC/IEEE 29119-3:2013 reference number and requirement	Value
7.3.4.1 Overview	2-BVA has been used to identify boundary values of the input values.
7.3.4.2 Unique identifier	tci_3
7.3.4.3 Description	Valid: input=+32,767, expected result=+181.0 (4-sf) Invalid: input=+32,768 NOT TESTABLE
7.3.4.5 Traceability	td_1

Table 19 – Test cases

ISO/IEC/IEEE 29119-3:2013 reference number and requirement	Value
7.3.5.1 Overview	To test the valid and invalid values for the SQRT math function.
7.3.5.2 Unique identifier	tc_1
7.3.5.3 Objective	To test the valid and invalid values for the SQRT math function.
7.3.5.5 Traceability	Test condition 'td_1' (test coverage items 'tci_1', 'tci_2')
7.3.5.6 Preconditions	Test harness to call SQRT function in math library.
7.3.5.7 Inputs	Use the test harness to call the SQRT function with the following inputs in order: +10; -10; 0; -1
7.3.5.8 Expected results	Check that the functions returns in order: +3.162 (4-sf); ERROR; 0; ERROR

Table 20 - Test procedures

ISO/IEC/IEEE 29119-3:2013 reference number and requirement	Value
7.4.5.1 Overview	To test the SQRT math function.
7.4.5.2 Unique identifier	tp_1
7.4.5.3 Objective	To test the SQRT math function.
7.4.5.5 Start up	Test harness to call SQRT function in math library.
7.4.5.6 Test cases to be executed (Traceability)	Step 1 Execute test case 'tc_1' Step 2 Execute test case …
7.4.5.8 Stop and wrap up	None
Not defined – pass criteria	Must pass all test cases.

Table 21 - Actual results and test results

ISO/IEC/IEEE 29119-3:2013 reference number and requirement	Value
7.4.5.2 Unique identifier	te_1
7.4.5.6 Test cases to be executed (Traceability)	test procedure 'tp_1'
6.2.4.2 Test item(s)	Math library version 1.2.3
7.10 Test results	Execution of procedure: PASS
7.9 Actual results	Execution of step 1 returned in order: +3.162 (4-sf); ERROR; 0; ERROR
7.10 Test results	Execution of step 1: PASS