

Primary information	
Type of product being suggested:	Standard
Title of product being suggested:	Complex System Integration in Railways
Date of suggestion:	30 March 2017, February 2018
Reason for suggestion:	<p>The purpose of this document is establish industry standards for the following:</p> <ol style="list-style-type: none"> i. Managing the risks associated with integrating complex systems. ii. Managing the following aspects of complex system integration: <ol style="list-style-type: none"> a. Design and implementation of complex system interfaces; and b. Planning, conducting and reporting on system integration testing (SIT).
Railway discipline area:	Infrastructure, train control, safety
Scope:	
<p>The document covers the management of the following stages in integrating complex systems:</p> <p>Complex system interface design</p> <p>The design stage needs include the following aspects/management process:</p> <ul style="list-style-type: none"> • Management of the risks associated with failures of system interfaces. • Management of system interface design that are completed by multiple parties. • Management of system interface compatibility with legacy systems. • System construction / implementation. <p>Planning for system integration testing.</p> <p>The planning stage needs include the following aspects/management process:</p> <ul style="list-style-type: none"> • Management of the risks associated with conducting the testing activities; • Management of the traceability between system and safety requirements with testing activities; • Management of testing resource competency and capacity, as well as roles and responsibilities; • Formulation of testing regime (e.g. positive testing, negative testing, black-box testing, regression testing, etc.); and • Management of testing coverage (e.g. number of safety functions that will be included in the regression testing). <p>Conducting system integration testing.</p> <p>The testing stage needs to include the following aspects / management process:</p> <ul style="list-style-type: none"> • Management of any faults, defects and corrective actions; and • Safety impact assessment of the faults and defects. <p>Reporting of system integration testing.</p> <p>The reporting stage needs to include the following aspects / management process:</p> <ul style="list-style-type: none"> • Approval and acceptance of test results by the appropriate authorities; and • Management of any conditions/restrictions of use due to outstanding faults and defects. 	

The document is applicable to any complex railways systems, such as but not limited to:

- Rolling stock;
- Train communications;
- Train control systems;
- Signalling systems; and
- Train protection systems.

Objective:

Hazard identification:

1	5.0 Rolling Stock - All the hazards associated with rolling stock identified in RISSB hazard register.	6	
2	6.0 Infrastructure - All the hazards associated with infrastructure identified in RISSB hazard register.	7	
3	8.0 Operation - All the hazards associated with operations identified in RISSB hazard register.	8	
4	9.0 Signals Infrastructure - All the hazards associated with signals infrastructure identified in RISSB hazard register.	9	
5	10.0 Degraded Working - All the hazards associated with degraded working identified in RISSB hazard register.	10	

Benefits:

Safety

- i) Provide common approach in managing the risks associated with the design and testing of complex system integration.
- ii) Systems approach to manage the faults and defects when integrating complex systems, which may result in the risks of systematic and random failures.
- iii) Inclusion of safety verification and validation as part of system integration testing.

Interoperabilityⁱ / harmonisationⁱⁱ

Provide common approach in managing the interface compatibility between complex systems and legacy systems.

Financial

- i) Reduction in the systematic and/or random failures of integrated systems, which may lead to suspension of train operation.
- ii) Reduction in costs of redesign/rework due to incompatibility between system interfaces.

Impacts:

- The developed standard needs to cover issues relating to integration with legacy systems. Currently there are variety of different legacy systems with specific interfaces.
- Each rail organisation has its own specific process and procedure to manage testing activities, system faults and defects. However, these existing process and procedure may not be compatible. In addition, changing these existing processes and procedures may be challenging, as the system integration testing activities may be specific to the rail systems that are currently in used.

i **Interoperability** is the ability of a process, system or a product to work with other process, systems or products (aka compatible systems through managed interfaces).

ii **Harmonisation** - the act of bringing into agreement so as to work effectively together (aka uniformity of systems).