



Standards affecting the introduction of Cross-Industry Remote Condition Monitoring

T1010-03

This document lists existing standards that are relevant to the introduction of Cross-Industry Remote Condition Monitoring Systems as well as suggesting modifications to those standards and new standards

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1 Introduction

1.1 Background

This document discusses relevant Railway Group Standards (RGS) and Rail Industry Standards (RIS) identified as part of the T1010 work, and proposes new RISs that would assist with the implementation of a cross-industry RCM data sharing architecture.

This report has been produced as part of the RSSB T1010 research project 'Cross-Industry Remote Condition Monitoring, Phase 2'. T1010 included four work packages:

1. Data sharing architecture
2. Commercial considerations
3. Standards and good practice guide (which includes this report)
4. A guide to business case assessment of cross-industry RCM projects.

Detailed reports for each of these work packages have been published on RSSB's web portal SPARK.

1.2 Standards affecting cross-industry RCM

The T1010 project has proposed a data sharing architecture for cross industry RCM and a template contract that can be used to develop agreements for collaboration between industry parties who wish to set up cross-industry RCM systems. As there is a need for collaboration between a number of parties, it may also be beneficial to develop standards that will help define the technical requirements that will control that collaboration.

Collaboration between parties to achieve cross-industry RCM projects is outside the scope of Railway Group Standards which can only contain mandatory national rules. Standards defining how industry bodies can collaborate on an optional basis are best delivered in the form of RISs. New standards proposed as a result of the T1010 work will be RISs.

2 Inputs into a cross-industry RCM system

In addition to the measured asset condition data produced by a cross-industry RCM system, the cross-industry RCM data sharing architecture defined in 'T1010-01 Architecture Principles and Requirements'^[1] requires a number of inputs, including:

1. Vehicle Identification (for vehicles being monitored from the trackside)
2. Train location service (for infrastructure being monitored from train mounted equipment)
3. Weather data
4. Asset (and sensor) unique identifiers
5. Rail system ontology

2.1 Vehicle identification

Railway Group Standard GM/RT2453 'Registration, Identification and Data to be Displayed on Rail Vehicles'^[2] includes requirement on the identification of rail vehicles through the unique identifier of a European Vehicle Number (EVN) and the registration of those vehicles in the Rolling Stock Library (RSL).

'T1010-01 Review of RCM Developments'^[3] suggested a key dependency for a RCM data sharing architecture will be a means of automatically linking measured data to the vehicle being monitored, i.e. Automatic Vehicle Identification (AVI). The UIC Harmonisation of Running Behaviour and noise measurement sites^[4] recommends use of the GS 1 standard^[5] which uses a radio-frequency identification (RFID) tag on each vehicle to identify the vehicle with the EVN.

It may be beneficial to produce a Rail Industry Standard (RIS) for AVI, reflecting the need to use the GS1 protocol and including any necessary considerations for the compatibility with other RFID systems in use on the railways*.

2.2 Train location service

'T1010-01 Review of RCM Developments'^[3] also recommends that a train location service is a key dependency for the RCM data sharing architecture. This service would enable a GPS location to be converted into a location in the railway format based on Engineering Line Reference (ELR) and location in that ELR, traditionally measured in miles and chains (though some railways are now moving to km and m). Based on this system measurements concerning the condition of the infrastructure taken from train borne sensors can be linked to the correct location of the piece of infrastructure they are monitoring.

RSSB research project T990 'Development of a strategy on train positioning'^[6] produced a specification for train location service. A RIS detailing the necessary formats for communicating with a system of this nature may be beneficial to ensure industry wide compatibility.

* The RSSB facilitated Cross-Industry RCM Strategy Group is currently planning some testing of compatibility of the proposed AVI system with other RFID systems in use and the results of that testing will need to be incorporated into the proposed RIS.

2.3 Weather data format

Weather data will also be an input into the RCM data sharing architecture as some asset condition measures may be affected by the weather. A standard format for the communication of weather data, including units and data structure, would simplify the integration of this data into national decision making tools. A RIS defining the format of weather data to be used within the rail industry may be beneficial. The RIS should refer to an existing data format that is already widely used.

2.4 Unique Asset identifiers

'T1010-01 Architecture Principles and Requirements'^[1] recommends all asset are allocated a unique identifier (such as the EVN for rail vehicles) to allow individual assets to be clearly tracked and the condition data allocated to the appropriate assets. A RIS defining the naming convention and structure would encourage a common approach to asset identification and the compatibility of those asset identifiers across the data sharing architecture and other asset management systems.

2.5 Ontology

'T1010-01 Architecture Principles and Requirements'^[1] also recommends a rail system ontology to be defined in the Web Ontology Language (OWL), this could be defined based on the unique asset identifiers mentioned in 2.4. A RIS defining the format of the ontology would encourage a common approach which would be compatible across the industry; RailML should be considered when developing the standard.

3 Existing Relevant Standards

'T1010-01 Review of RCM Developments'^[3] included a list of existing (at the time of publication) RGS, RIS and Guidance Notes, that could affect the sharing of condition data, as shown in Table 1 (duplicated from Table 3 of 'T1010-01 Review of RCM Developments'^[3]).

Document	Relevance to RCM Data Architecture
GC/RT5021 Issue 5 12/2011: Track System Requirements.	Important elements of data required to describe track.
GE/RT8054 Issue 2 09/2011: Management of Shared Information Systems.	The primary requirement for safety in the management of IT systems; the need to set up a System Management Group, jointly between Railway Undertakings and Infrastructure Manager, for shared systems.
GE/GN8565 Issue 1 06/2004: Guidance on the Retention of Design Information for the Validation of Technical Change and Configuration Management	The need to maintain a history of asset configuration to enable assets to be tracked over time.
GE/RT8047 Issue 6 12/2013: Reporting of Safety Related Information	Key safety-related systems: SMIS, FMS, Control Log; the duty to report safety infringements and near misses; information to be recorded.
GE/RT8250 Issue 2 06/2007: Reporting High Risk Defects.	The role of the National Incident Register Online; the duty to report vehicle faults immediately if serious fault found; the need to share information industry-wide.
GE/RT8014 Issue 2 06/2011: Axlebox Condition Monitoring – Hot Axlebox Detection; GE/GN8614 Issue 1 06/2011: Guidance on GE/RT 8014; BS EN 15437-1:2009 Railway applications - Axlebox condition monitoring - Interface and design requirements.	Types of Hot Axlebox Detector equipment; the need to communicate expected temperature ranges for known stock classes and bearings; functions, thresholds and alarms for each type of HABD; temperature measurement standards; correction for ambient temperature.

Document	Relevance to RCM Data Architecture
GM/RT2466 Issue 3 02/2010: Railway Wheelsets; GM/RC2496 Issue 2 02/2010 Recommendations for Railway Wheelset Maintenance	Data requirements for identifying and tracking wheelsets and their components; thresholds / exceedances for different types of problem; times to remove from service if damaged.
GM/RT2472 Issue 1 06/2002: Data Recorders on Trains – Design Requirements; GO/RT3272 Issue 3 06/2002: Data Recorders on Trains – Operating Requirements.	On-train Data Recorders: data items stored; data extraction requirements; data storage requirements.
GE/RT8270 Issue 2 10/2007: Assessment of Compatibility of Rolling Stock and Infrastructure.	The requirement that information regarding rolling stock compatibility with infrastructure needs to be kept on the Rolling Stock Library; how that should be done.
GE/RT8106 Issue 2 12/2011: Management of Safety Related Control, Command and Signalling (CCS) System Failures	The data required to be transferred between safety duty holders for cross-industry faults.
GM/RT2453 Issue 2: 09/2011: Registration, Identification and Data to be Displayed on Rail Vehicles	The data items and formats of rolling stock data to be shown on the vehicles themselves.
RIS-2706-RST Issue 1 03/2013: Rail Industry Standard for Recording of Rolling Stock Data	Data items mandated and advised to be made available for sharing about rail vehicles.

Table 1: Existing standards to be considered when sharing asset condition data

4 Proposed new RIS for the data sharing architecture

‘T1010-01 Architecture Principles and Requirements’^[1] defines a specification for the proposed data sharing architecture. The specification includes data formats and structures that should be used to communicate with data sharing architecture; it would be beneficial to record these processes in a RIS for communicating asset condition data with the data sharing architecture.

If a prototype system has successfully been trialled, the suitability of the data formats and structure specified in 'T1010-01 Architecture Principles and Requirements'^[1] can be confirmed and defined in a RIS.

5 Summary

As a result of the T1010 project, new RISs are proposed to define necessary systems that form inputs to a cross-industry data sharing architecture:

1. Automatic Vehicle Identification systems
2. Train location service
3. Standard weather data format for use in cross-industry systems
4. Format for rail industry asset unique identifiers, and a rail system ontology

These new RISs will be useful to define these systems either as inputs to a cross-industry RCM data sharing architecture, or systems in their own right.

In addition to the RISs defining the input systems, a RIS to define the data formats and structure to be used when communicating with a cross-industry RCM data sharing architecture is recommended.

Further development work, including the trial of a RCM data sharing architecture, is required before these proposed RISs can be developed.

6 References

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- [1] Johnson, P., T1010-01 Architecture Principles and Requirements, May 2015, [hyperlink to spark?](#)
- [2] Railway Group Standard GM/RT2453, Issue 2, Registration, Identification and Data to be Displayed on Rail Vehicles, September 2011, http://www.rgsonline.co.uk/Railway_Group_Standards/Rolling%20Stock/Railway%20Group%20Standards/GMRT2453%20Iss%202.pdf
- [3] Johnson, P., T1010-01 Review of RCM Developments, May 2015, [hyperlink to spark?](#)
- [4] UIC Project HRMS – Harmonisation of Running Behaviour and noise measurement sites, International Union of Railways/Union Internationale des Chemin de fer (UIC), http://uic.org/com/IMG/pdf/tra2014_hrms01_uic.pdf [accessed 30/4/15]
- [5] European Guideline for the Identification of Railway Assets using GS1 Standards, <http://gs1.eu/?page=&tudasbазis=60&lister=224> [accessed 30/4/15]
- [6] T990 Development of a strategy on train positioning, August 2014, <http://www.rssb.co.uk/library/research-development-and-innovation/research-brief-T990.pdf>