RAIL INDUSTRY SAFETY AND STANDARDS BOARD

Condition Monitoring of Rolling Stock

Guideline

This Rail Industry Safety and Standards Board (RISSB) product has been developed using input from rail experts from across the Rail Industry. RISSB wishes to acknowledge the positive contribution of all subject matter experts and DG representatives who participated in the development of this product.

The RISSB Development Group for this guideline consisted of representatives from the following organisations:

TfNSW	Downer Group	Bradken
ARTC	Queensland Rail	Roy Hill
Pacific National	Aurizon	Sydney Trains
Monash Institute of Railway Technology		

Development of this guideline was undertaken in accordance with RISSB's accredited processes. It was approved by the Development Group, endorsed by the Standing Committee, and approved for publication by the RISSB Board.

I commend this guideline to the Australasian rail industry as it represents industry good practice and has been developed through a rigorous process.

Damien White
CEO
Rail Industry Safety and Standards Board

Notice to users

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The information provided by this guideline is intended to be technology agnostic, i.e. the vendor equipment examples in this guideline does not constitute a recommendation by RISSB and are included as examples only. Trade or manufacturers' names appear herein solely because they are considered essential to the objective of this guideline.

Companies and parties have contributed to the material in this guideline where noted by the annotation ❶ and they are used with permission. Illustrations and figures so marked are used as indicative of technologies on the market and are for illustrative purposes only. These parties are listed in Appendix B, Bibliography and Appendix C, Acknowledgements.

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1 Introduction

1.1 Purpose

There have been significant technological advancements in wayside condition monitoring (CM) in the past 30 years. Technology has had a particularly dramatic impact on the ability to statically and dynamically monitor the performance of railway rolling stock. This has enabled much improved quantification of the impact of vehicle/track interaction on the safety and efficiency of wheels, rails, and railway operations in general.

This guideline describes the techniques and measures that are used for wayside CM of railway rolling stock and details how these measures can be implemented and applied to manage risk, minimise network incidents and delays and lower maintenance costs in a condition based maintenance regime.

This guideline is intended as a general overview to acquaint the reader with techniques and methods that are currently being used to monitor rolling stock condition, to identify key measures and data, and to discuss considerations that need to be made in designing or implementing CM.

1.2 Objective

The primary objective of this guideline is to build upon other RISSB guidelines that discuss CM as well as risk analysis and management (RAM). This guideline introduces the methods and measures to assist the development of CM strategies to:

- ensure compliance with existing codes of practice and standards, or
- target specific problem areas that the reader may be seeking advice on.

1.3 Scope

CM as it is applied in the railway environment can be grouped into four categories:

1) Railway infrastructure - Track & structures and maintenance of way.
2) Wayside monitoring - Rolling stock components from wayside.
3) In train monitoring - On board systems.
4) Data systems - Systems and data, analysis and use.

This guideline covers wayside monitoring (2). The CM subjects for each of the four categories are tabled in Appendix A. Refer to Section 2 for clarification of CM in the context of this guideline.

CM of rolling stock has developed and expanded dramatically since 1990 and is a discipline that continues to rapidly evolve. Some of those developments have yet to become standardized, are not readily implemented or continue to evolve and those are excluded from the scope for that reason. Other aspects of CM that are installed in vehicles are also out of the scope of this guideline. For each topic covered, wherever possible the following has been included:

- Subject – what is being monitored.
- Discussion of purpose and primary measures.
- Overview of methods and technologies and variables affecting performance.
- Benefits for risk and damage reduction, support of condition and predictive maintenance.
- Site selection and design considerations (power, communications, and maintenance requisites).

The case studies that are presented in section 15 are intended to provide an insight into the complex interaction between track and supporting infrastructure, vehicles, and how this interaction is managed in the context of both technical and commercial requirements. Management of the wheel/rail interface is a topic in itself and the IHHA has published a series of texts [20] and guidelines on this topic and they are recommended for readers seeking to understand the combined rolling stock/track system.

1.4 Abstract

The use of technology to monitor rolling stock has grown dramatically and this trend will continue. CM of rolling stock was initially implemented about 1985 for bearings and then the wheel/rail interface. The understanding of how to manage the wheel/rail interface continues to rapidly change as the technologies develop. These developments have led to improved understanding and management as well as reduced life cycle costs and control of safety risks. Manual inspections and scheduled maintenance have been augmented or replaced by automated health monitoring systems. Laser and machine visions systems are now being increasingly used. This guideline's subject matter is therefore evolving and so the focus is on what to measure and 'why' more than 'how' the measures are made. Each technology has strengths and weaknesses as well as specific site requisites and the most significant of these are discussed to guide new system planning. The guideline intentionally avoids as much as possible areas that are subject to significant change or are heavily prescribed by unique corporate IT strategies.

1.5 Who should use this guideline and why

As rolling stock is an above rail asset, CM of rolling stock is relevant to the rolling stock operators (RSO). However, the rail infrastructure manager (RIM) hosts and often funds the installation of the CM equipment to ensure that alarm conditions can be identified for rolling stock that causes infrastructure damage and the RIM then provides the CM data as a service. The benefits of CM of rolling stock will impact on the infrastructure therefore the RIM should also use the guideline.

1.6 How to use this guideline

This is a guideline and therefore nothing within it is mandatory, however it is suggested that the information within it represents current best practice which could be applied with confidently with appropriate experience in rolling stock engineering and condition monitoring.

1.7 Method

A rolling stock component-based structure is used in this document because that is consistent with the current technologies, measuring products and data measures.

For example, basing the structure of the document on problems will each refer to multiple rolling stock components which then refer to multiple measures which then refer to multiple methods. This would result in repetition and confusion. This guideline is therefore structured on components and their measures. Selected case studies are included to illustrate interactions, component degradation over time, and relevance to risk and cost models.

Wherever there is a standard or a RISSB document for a topic this guideline will refer to those as the definitive source material.

Finally, one important aspect is a discussion on wayside site requisites and typical common problems that need to be considered when specifying and implementing a new wayside site.