RISSB Product Proposal (and Prioritisation)

(The information you provide in this form will be used to help stakeholders determine where this project sits within the railway's priorities.

The more thorough your submission, the better the decision-making process in prioritising new ideas.

Light blue italicised text is for guidance and can be deleted as the form is completed. Feel free to write more words, text boxes will expand as necessary.)

Primary information	
Type of product being suggested:	Guideline
Title of product being suggested:	Guideline- Condition Monitor of Rolling Stock Equipment
Date of suggestion:	14/02/2019
Reason for suggestion:	Conditional monitoring is an increasing area of focus in Rail, with the aim of improving safety, asset integrity, and maintenance costs. A guideline would provide clarity and standardisation around best practices in applying conditional monitoring techniques and technology to the rail industry, as they emerge. Conditional Monitoring is a topic that is discussed once a significate incident occurs. It is also a topic is that is raised when we discuss proactive/ preventative maintenance of rolling stock. While there are many benefits of condition monitoring the adoption within the rail industry has been slow, this could be due to the unknow, lack of clear direction, how a system can be applied or the cost of implementing such a program.
Railway discipline area:	Infrastructure, rolling stock and safety

Scope:

Scope: This guideline covers the applications of conditional monitoring equipment to rollingstock assets within the context of the Australian rail industry.

Conditional monitoring techniques/hardware covered will include vibration analysis, temperature analysis, WILD impacts, rolling stock performance (i.e. tractive effort, brake pipe pressure monitoring), tribology, and acoustics (rail BAM).

Develop a guideline that the rail industry can utilise (Network owners and providers) when determine the most appropriate conditional monitoring of rolling stick equipment required to be implemented within the Australia rail network. Provide a clear direction (advantages and limitations) on how conditional monitoring systems can be best applied, focused on hardware (sensors for vibration, tribology, acoustics etc) and the data management and analytics that the hardware would provide.

The guideline would highlight the benefits to the rail providers regarding increased utilisation of rolling stock equipment, which could lead to increased services and product movement. The other benefit is the safety improvement, rolling stock issues identified early prior to an incident.

Additionally, a guide to best practices in data management and analytics is provided for the trending and interpretation of the data gained from conditional monitoring. This will include common means of data transmission, means of deriving actionable limits to monitored indicators, and standards identified for the acquisition and interpretation of specific trends (ISO 10816 for vibration monitoring).

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The set-up of software suites (i.e. fleet dashboards) will be discussed.

The particular limitations of technologies to rail will be identified (i.e. limitations and complications from vibration analysis on a moving set). Common strategies in overcoming or mitigating these limitations with the technologies will also be discussed.

Logistical issues commonly encountered in conditional monitoring will be discussed. Such examples include data processing capabilities, transition to condition-based maintenance from scheduled maintenance business models, etc.

A snapshot of current and near-future technologies will be provided for greater context.

Out of scope: the guideline would not recommend one product or one provider, rather an overall view of the different hardware currently available to the network owners and the rail providers.

Objective:

What: The guideline aims to provide a general road map to the implementation and management of conditional monitoring techniques and technology. The guide will be aimed at rolling stock designers and maintainers that aim to improve Set safety, availability and maintainability. This will assist in bridging the gap between advances in conditional monitoring (in both hardware and data analytics) and its application in the rail industry.

Audience: Rail network owners and rail providers. Both the network owners and the rail providers (passenger and freight) will need to work jointly to ensure that a conditional monitoring of rolling stock equipment system can be implemented and that the benefits of such a system will benefit all parties. It would require a joint effort when it comes to implementing a system, how the notification can be communicated and how the data can be analysed to best serve all parties and highlight the systems over effectives.

Why: in the Australian rail industry currently, the inspection of rolling stock is completed manually, this has two significate downfalls, cost and unnecessary down time, rail providers also cannot predict unexpected damage occurring during operations, there for maintenance scheduling are usually overly completed with decreased focused and expensive.

Having an automated condition monitoring system looks at predictive maintenance methods, therefore costs can be saved, and the equipment life span is likely to increase, also saving money, but the one overall benefit for both network owners and providers is a condition monitoring system will decrease the overall network delays caused by incidents e.g. derailments etc.

Hazard identification: *(what safety hazards would the proposed document seek to address)*

1	Random failure of rollingstock equipment	6	Damage caused to track from defective rolling stock
2	Maintenance induced error (from unnecessary planned maintenance)	7	Effect from Human Error
3	Undetected damage to rollingstock	8	
4	Latent design issues	9	
5	Environmental damage from wasteful maintenance practices	10	

Benefits: *(enter wherever applicable in below categories)*

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Safety

- Reduced random failure of rolling stock systems, increasing the safety profile of trains.
- Reduced risk of maintenance induced error (from unnecessary planned maintenance).
- Reduced risk of undetected design issues – trending across a fleet can give wider view of issues.
- Reduce the effect of human error.

Interoperability[i] / harmonisation[ii]

One of the key advantages of condition monitoring is the ability to harmonise observations on rollingstock equipment with other data. This could be in the form of understanding the link between tractive effort on motors and gearbox vibration spectra, or the link between bearing temperature and noise. This allows for interoperability of multiple streams of train data.

Financial

- Significant capital outlay would be required to set up; conditional monitoring equipment is expensive, and the human capital outlay involved in training analysts is significant.
- However, significant savings in labour, materials, and availability payments can be made by moving to condition-based maintenance regimes.
- Additionally, the investment in human capital has wider economic benefits in the improvement of Australia's technical capability.
- Sourcing of conditional monitoring equipment could create significant demand within Australia, having the potential to stimulate growth in this sector of the economy.
- Development of this area also poses significant export potential in the services sector.
- Asset utilisation will increase, rail providers would able to get longer out of their assets.

Environmental

Environmental benefits would be substantial, as disposal of consumables and parts will be reduced by moving to condition-based maintenance. This has the potential to significantly offset the minor environmental impacts from production and operation of conditional monitoring equipment.

Impacts:

There may be a number of potential issues with this product:

- Commercial considerations for companies involved in developing best practices
- Multiplicity of state level regulations to be negotiated by a national guideline
- A significant outlay would be required to properly resource and research the product during its development
- Data validation and storage, access for all relevant parties and ensuring the data is kept secure

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).

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Other items to aid RISSB project planning

(This information will help RISSB plan the project should it be successful at prioritisation.)

Structure:

1. Conditional Monitoring Techniques
    a. Description and applications
        - Vibration analysis
        - Tribology
        - Acoustics
        - Temperature analysis
        - WILD impacts
        - Ultrasound
    b. Limitations
2. Data management
    a. Data transmission
    b. Actionable limits for data signals
    c. Data analytics
    d. Software considerations – Dashboards
3. Logistical issues
    a. Commonly encountered issues
        - Data processing limitations
        - Transition of maintenance regimes
    b. Strategies for addressing logistical issues

Training and qualification requirements

Reference / source materials: *(This is very important; it will directly impact the tone/style/flavour of the product. It will also have a big impact on the research we will ask our Author to undertake and therefore impact timescales/cost. Do this section carefully because addition of new material later could impact on those. It may also be important here to stipulate reference / source materials that the SC would like to avoid.)*

#	Reference / source material	Available from
1	AS ISO 18436 pts 1 - 8	SAI global
2	ISO 17359, Condition monitoring and diagnostics of machines — General guidelines	SAI global
3	ISO 13373, Mechanical vibration and shock - Vibration condition monitoring of machines	SAI global
4	ISO 13379, Data interpretation and diagnostic techniques which use information and data related to the condition of a machine.	SAI global
5	ISO 13381, Condition monitoring and diagnostics of machines - Prognostics	SAI global
6	ISO 18436 Part II, Accreditation of organizations and training and certification of personnel - Part II — General requirements for training and certification - Vibration Analysis	SAI global
7	ISO 18436 Sub Parts under development for Oil Analysis and Thermal Imaging	SAI global

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8	Modern techniques for condition monitoring of railway vehicle dynamics, R W Ngigi1, C Pislaru, A Ball and F Gu	Journal of Physics: Conference Series, Volume 364, conference 1

Assumptions:

- Assumes that there is sufficient consensus on the application of these technologies/techniques to provide a "best practice" guide.
- Assumes enough adoption in industry to provide backing data for guide to draw on.
- Providers can see the benefit of implementing such a system.

Constraints:

- Constrained by the willingness of industry partners to contribute to this guideline.
- Access to currently rolling stock variations (providers to provide information).
- Implementation costs can be high.

Australian Standards considerations: (only applies if proposed product is to be a Standard)

Does proposed Standard duplicate an existing Australian Standard *(Where such duplication occurs, justification or explanation shall be included in the standard)*	No. There are no industry specific guidelines for conditional monitoring programs currently
(if yes – please list)	
Will proposed Standard be developed for conformance assessment purposes? *(relates only to inspection and testing activities subject external certification)*	No
(if yes – please detail expected certification activities)	
Are there are any International Standards on the same subject	No
(if yes – could Int.std.be adopted or used as a basis for this development	-
(if no – please provide reasons) Currently there is nothing from an industry specific holistic approach available	

Expected effort required at key stages:

Activity *(There are other activities in a RISSB project which are well understood and easier to control. This section relates to some of the more variable activities.)*	# Days
The Author's research into the reference / source materials.	80
The Author's further (if required) development of draft headings for the document (including any work that may be required on the scope, purpose and hazard references).	20
The Author's production of the draft content building on the above.	120
The Author's production of a further draft based on Development Group comments on the above.	80
The Author's development of the 'post public consultation' draft based on the guidance of the Development Group in addressing public comments. *(Try to imagine the subject of the product, how complex/political it is and therefore what the reaction might be at public consultation.)*	80
Independent validation[iii] (applies only to standards).	-
The Author's finalisation of the product incorporating Development Group's validation comments.	40

[iii] Independent validation is to:

1. Check that clauses relate to the identified hazards
2. Check that the standard is of comparable quality to other similar domestic / international standards
3. Check that the standard is fit for the Australian railway (and is therefore nationally applicable)
4. Provide a recommendation for any deficiencies from the above