16-020 – New RIS for Axlebox Bearing Condition Monitoring

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Purpose:	Approval to publish		
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Lead industry committee:	Rolling Stock Standards Committee (RST SC)	**Date:**	09 March 2023
Supporting industry committee:	Infrastructure Standards Committee (INS SC)	**Date:**	14 March 2023
Supporting industry committee:	Traffic Operation and Management Standards Committee (TOM SC)	**Date:**	28 March 2022
Supporting industry committee:	Control, Command and Signalling Standards Committee (CCS SC)	**Date:**	09 March 2023
Supporting industry committee:	Plant Standards Committee (PLT SC)	**Date:**	02 March 2023

Decision

Rolling Stock Standards Committee (RST SC) is asked to:

- **COMMENT** on the proposed responses to comments received during consultation.
- **APPROVE** with or without modification the proposed responses to comments received during consultation.
- **DECIDE** if the proposed new issue of RIS-2714-RST issue one delivers its intentions.
- **APPROVE** the proposed new issue of RIS-2714-RST issue one for authorisation to publish.
- **APPROVE** the proposed withdrawal of GERT8014 issue two.
- **APPROVE** the proposed withdrawal of GEGN8614 issue one.

Supporting Standards Committees (INS SC, TOM SC, CCS SC and PLT SC) are asked to:

- **COMMENT** on the proposed responses to comments received during consultation.
- **SUPPORT** with or without modification the proposed responses to comments received during consultation.
- **DECIDE** if the proposed new issue of RIS-2714-RST issue one delivers its intentions.
- **SUPPORT** the proposed new issue of RIS-2714-RST issue one for authorisation to publish.
- **SUPPORT** the proposed withdrawal of GERT8014 issue two.
- **SUPPORT** the proposed withdrawal of GEGN8614 issue one.

16-020 – New RIS for Axlebox Bearing Condition Monitoring

This business case for change has been developed to support standards committees in taking decisions related to changes to standards, it includes an assessment of the predicted impacts arising from the change.

Proposed documents

Number	Title	Issue
RIS-2714-RST	Axle Bearing Condition Monitoring	One

Documents for withdrawal

Number	Title	Issue
GERT8014	Axlebox Condition Monitoring – Hot Axlebox Detection	Two
GEGN8614	Guidance on Axlebox Condition Monitoring – Hot Axlebox Detection	One

Summary

Background and change

Project 16-020 was initiated to review and revise the RSSB standard GERT8014 issue two and guidance note GEGN8614 issue one. These documents were last revised in 2011, to permit the use of onboard monitoring systems, and to align with BS EN 15437-1:2009. Parts of this EN (clause 5.1 and 5.2) are required by the LOC & PAS NTSN (clause 4.2.3.3.2.2) and the WAG NTSN (clause 4.2.3.4). Requirements for onboard systems are set out in BS EN 15437-2:2012 which is not currently called up in either NTSN.

Network Rail are undertaking trials with Acoustic Bearing Monitoring (ABM), in combination with Automatic Vehicle Identification (AVI) as an additional / alternative means of Remote Condition Monitoring (RCM) for bearings. Although there are not currently any agreed alert levels for bearing noise, it is considered important to acknowledge that new systems may make use of emerging technologies instead of or complementing Hot Axle Box Detectors (HABDs).

Correcting references to relevant GB legislation will be undertaken as part of the project; it is anticipated that this will have no material impact on the technical content of the Rail Industry Standard, for example TSI references changed to NTSN.

To address the issues and opportunities highlighted above, it is proposed a new Rail Industry Standard (RIS) on Remote Condition Monitoring of Axleboxes is developed and published.

Industry impact due to changes

Impact areas	Scale of impact	Estimated value £ 000's
A. Legal compliance and assurance	N/A	
B. Health, safety and security	Low	£25,200 over a five-year period
C. Reliability and operational performance	Low	£500,000 over a five-year period
D. Design and maintenance	Medium	£700,000 over a five-year period
E. People, process and systems	Neutral	No benefit claimed
F. Environment and sustainability	N/A	
G. Customer experience and industry reputation	N/A	
Total value of industry opportunity =		**£1,225,200 over a five-year period**

The standards change contribution to the total value of industry opportunity				
☐ None or low	☐ Minor but useful	☑ Moderate	☐ Important / essential	☐ Urgent / critical

Detail

1. What are the objectives associated with this change?

Objective 1 – Develop a new standard which allows the use of alternatives to Hot Axle Box Detection

1.1 HABD, whether trackside or vehicle mounted, is only one means of remotely monitoring for potential axle bearing failure.

1.2 Alternative RCM systems are already being used to complement HABD, for example ABM and axlebox mounted sensors (accelerometers and thermocouples). These can result in earlier detection of defective bearings.

1.3 The new standard will allow the use of these alternative means of detecting bearing failures. In addition, the need for the development of new operational rules associated with these other means of detection will be identified.

Objective 2 – Align the requirements and content of the new standard with the GB legislative framework following the UK's exit from the EU

1.4 Railway Group Standards (RGSs) can only contain National Technical Rules. As none of the requirements in GERT8014 issue two meet these criteria GERT8014 issue two will be withdrawn and replaced by a Rail industry Standard (RIS).

1.5 The transition period associated with the Withdrawal Agreement for the UK leaving the EU (the Transition Period) came to an end on 31 December 2020. The new RIS will reference and be aligned with the regulatory regime following the UK's departure from the EU.

Objective 3 - Review and address relevant recommendations from RSSB Research Report T857

1.6 The project team will work closely with stakeholders including the Cross Industry Remote Condition Monitoring Strategic Group (XIRCMSG) to review and address the recommendations from RSSB research reports under RSSB research project T857 (2018) which provide a detailed review of selected RCM areas.

2. How does the content in the standard need to change to achieve the objective?

Objective 1 - Develop a new standard which allows the use of alternatives to Hot Axle Box Detection

2.1 RIS-2714-RST issue one sets out specific requirements and guidance for HABDs as used by IMs for operational control, and then sets out generic requirements for all axle bearing condition monitoring equipment by other means, such as dynamic frequency monitoring equipment.

2.2 Part 5 of RIS-2714-RST issue one includes information specific to dynamic frequency monitoring equipment, which provides good practice as guidance for all known emerging technologies other than HABDs.

2.3 Appendix A table A2 gives details on guidance retained from GEGN8614 issue one that remains relevant or withdrawn if no longer applicable. Appendix A table A3 gives details on new requirements and guidance that has been added, including that for the use of alternatives to Hot Axle Box Detection.

Objective 2

2.4 Content from GERT8014 issue two and GEGN8614 issue one has been incorporated into RIS2714-RST issue one, where appropriate. Appendix A table A1 gives justification for each requirement being removed from the RGS and why it is no longer acceptable as an NTR.

2.5 All references to TSIs have been removed and replaced with references to NTSNs.

2.6 Additional references to the WAG NTSN have been added, where they were previously missing.

Objective 3 - Review and address aspects of recommendations from RSSB Research Report T857

2.7 The recommendations from RSSB research project T857 (2018) have been incorporated into RIS-2714-RST issue one, including:

i. Signposting to RIS-0796-CCS for the use of AVI tags in association with axle bearing condition monitoring systems.
ii. Guidance informing stakeholders of the capability to combine different technologies to realise a greater system benefit.
iii. The setting out of requirements, rationale and guidance that support the sharing of data requirements that drive the functional specifications for a holistic RCM system development approach.
iv. Outlining of dynamic frequency monitoring systems as those that support a prognostic approach to bearing maintenance.

3. How urgently does the change need to happen to achieve the objectives?

3.1 The development of a RIS to support axle bearing condition monitoring was not identified as urgent in the Rolling Stock Standards Committee March 2022 strategy.

3.2 Network Rail trials of Acoustic Bearing Monitoring (ABM), coupled with Automatic Vehicle Identification (AVI), are on-going and the findings will not be available in time to meet the publication date of RIS-2714-RST. The 12-month review will seek progress on the findings of the trials and if available consider their implication for RIS-2714-RST.

4. What are the positive and negative impacts of implementing the change?

Justification of impact, scale and quantification for the seven impact areas

A. Legal compliance and assurance

4.1 The current arrangement of HABDs complemented with onboard hot axlebox detection systems is sufficient to comply with the legal requirements.

4.2 Between January 2021 and January 2022 there have been seven axlebox bearing failures. It is incumbent upon the industry to seek improvements.

B. Health, safety and security

4.3 The consequence of axle bearing failure could be catastrophic with axle seizure or fracture leading to derailment and potential multiple fatalities.

4.4 RSSB's Safety Risk Model (SRM, version 8.5.02, table B1) lists several consequences of axle bearing failure, leading to a cumulative Fatalities & Weighted Injuries (FWI) value of 0.024 per year. Based on the 2021 Value of Preventing a Fatality (VPF) of approximately £2.1M, this represents £50,400 per year. If the changes to the standard contribute and help the industry in reduced axle bearing failure risk by 10% then that would be a benefit of £25,200 over a five-year period.

4.5 There are 135 recorded NIRs over 26 years (approximately five per year), associated with axlebox bearings, that could have led to in service failure, however it is likely the case that more failures than this have occurred as only the first instance of a failure is recording in NIR online.

4.6 Use of alternative systems could reduce the need for train drivers to physically inspect vehicles, avoiding the associated hazards of being on or near the line. It is not considered proportionate to attempt to quantify this benefit because there is no data on the failure rate of bearing using alternative systems involving condition monitoring.

C. Reliability and operation performance

4.7 When a hot axlebox is detected, the train driver is required to stop the train and investigate the cause by physical inspection. This leads to delays and potentially the affected train being taken out of service or running at a slow speed for the remainder of its journey.

4.8 Operational data for 2018/19, acquired from RSSB PERFORM research programme data, for all confirmed train borne safety system faults (not cab based) includes 52,660 delay minutes. On the assumption that 10% of these delay minutes are HABD related and that the cost is £50 per delay minute, the cost to industry associated with HABD faults is £263,000 for this year. For the same year, operational data for all confirmed infrastructure system faults for HABD/Panchex/WILD/Wheelchex includes 11,941 delay minutes. On the assumption that 25% of these delay minutes are infrastructure HABD related, the cost to industry associated infrastructure HABD faults is £149,200 per year, totalling £412,200 for train system and infrastructure system faults. Additionally, the costs for the subsequent years using the same assumptions are:

i. For 2019/20 operational data, 10% of train borne safety system faults (not cab based) includes 6,212 minutes and 25% of infrastructure system faults includes 1,770 minutes, totalling £399,100.
ii. For 2020/21 operational data, 10% of train borne safety system faults (not cab based) includes 2,999 minutes and 25 % of infrastructure system faults includes 1,392 minutes, totalling £219,500

4.9 ABM and other systems have the potential to detect bearing deterioration earlier than using HABD alone. Early detection of bearing deterioration could facilitate preventative maintenance, potentially avoiding HABDs being triggered.

4.10 There are reliability problems with existing trackside HABDs, and use of complementary technologies could improve early detection of bearing deterioration and imminent bearing failure and reduce the industry's reliance on trackside HABDs. The results from the Network Rail trials and details of the reliability of the equipment, detection of fault conditions and incidence of false indications should provide data to enable the method for RCM of axle bearings to be optimised.

4.11 It is judged that wider adoption of alternative and complementary systems to trackside HABDs could save around 25% of the three-year averaged annual delay costs of £340,000 attributed to HABD which is of the order of £85,000 and represents a benefit of £425,000 over a five-year period, based on costs discovered through the RSSB 'PERFORM' research challenge.

D. Design and maintenance

4.12 Trackside HABDs use infrared thermal sensing and therefore require unobscured 'visibility' of sufficient surface of the axlebox; the dimensions are set out in BS EN 15437-1:2009. Permitting the use of alternative trackside or onboard systems that reduce the reliance on HABDs could therefore reduce the constraints on bogie and axlebox design.

4.13 There is a potential for decreasing vehicle maintenance costs by using complementary or alternative axlebox bearing monitoring technologies. For example, one railway undertaking's business case for implementing trackside ABM was based on the benefits associated with increasing the mileage between wheelset overhauls and this benefit is currently in the process of being realised.

4.14 Wheelset maintenance is a major cost to the industry. RSSB research report T842 (2009) put the annual wheelset costs at £140M. If it is assumed that 10% of this is associated with maintenance, and that conservatively a 1% saving on maintenance could be achieved, this gives a potential saving of £140,000 per year, which is equivalent to £700,000 over a five-year period.

4.15 Some of these savings could be offset by the operational and maintenance costs associated with the new equipment, but in the absence of data these potential costs have not been addressed in the benefits.

E. People, process and systems

4.16 Savings could be offset by the costs of training and operation of the RCM systems, consequently the benefit has been categorised as neutral.

F. Environment and sustainability

4.17 These changes are not directly relevant to environment and sustainability.

G. Customer experience and industry reputation

4.18 Early detection of bearing deterioration has the potential to reduce the incidence of trains being stopped in service which reduces delay minutes and their resultant cost to industry as

well as improving journeys for passengers and freight. The benefits associated with a reduction in delay minutes have been considered above, under the heading 'Reliability and operation performance' and no additional benefit is claimed in respect of customer experience and industry reputation.

5. What is the contribution of this standards change in realising the value to industry opportunity?

5.1 The total value of the industry opportunity has been categorised as moderate.

5.2 An approach to axle bearing condition monitoring that includes methods other than HABD has the potential to detect bearing deterioration earlier than using HABD alone.

5.3 RIS-2714-RST issue one supports a prognostic approach to the replacement of axle bearings and will enable industry to identify the most appropriate method of remote condition monitoring for axlebox bearings which it is estimated could realise a benefit of £1,440,000 over a five-year period.

6. What was the effort required by RSSB to make the change?

6.1 RIS-2714-RST issue one was developed by a rolling stock technical specialist with support from a project manager.

6.2 Drafting group meetings that included the relevant stakeholders including Network Rail and railway undertakings were carried out to support the development of the content for RIS-2714-RST issue one.

7. Can RSSB deliver against industry's expected timescales?

7.1 The baseline publication date of September 2022 has been rescheduled to June 2023 to enable agreement on how to best address the recommendations from the RSSB research project T857 (2018).

8. How will the industry implement the change?

8.1 Some railway undertakings are already using onboard systems in parallel with HABD, or where there are no trackside HABD installations for example in areas of third rail DC electrification.

8.2 RIS-2714-RST issue one will support railway undertakings in the approach they take to the monitoring of axle bearings.

9. How will RSSB assess whether the change is achieving the objectives?

9.1 RSSB will review how the industry is using the new RIS at the 12-month review post publication. Especially valuable will be feedback from specific projects on how the new standard has been useful and applied.

Appendix A

Table A1: GERT8014 issue two to RIS-2714-RST issue one

From GERT8014 issue two	To RIS-2714-RST issue one	Way forward	Comments	BCfC Objective
Part 1 Purpose and introduction	Part 1 Purpose and introduction	No change.	Title only.	
1.1 Purpose	1.1 Purpose	No change.	Title only.	
1.1.1		Withdrawn.	Purpose is for RIS instead of RGS.	
1.2 Introduction	1.2 Introduction	No change.	Title only.	
1.2.1 Background		Withdrawn.	The background section has been withdrawn as this discussed the revision of RGSs following the implementation of TSIs and the strategy on how this would be achieved.	2
1.2.2 Principles		Withdrawn.	The principles section withdrawn as this discussed the mandating of requirements and the need for duty holders to cooperate, which is set out in ROGS and was duplicated in this section.	3
1.2.3 Support to essential requirements		Withdrawn.	Support to essential requirements section withdrawn as this discussed support of TSIs and the essential requirements set out in Directive 2008/57/EC, which is not applicable to a RIS.	2
1.2.4 Supporting documents		Withdrawn.	Supporting documents section withdrawn as there are no domestic standards that support the new RIS.	
1.3 Approval and authorisation of this document	1.6 Approval and authorisation of this document	No change.	Title only.	
1.3.1	1.6.1	No change.	Redrafted with corrected date.	
1.3.2	1.6.2	No change.	Redrafted with corrected date.	
Part 2 Requirements for the Rolling Stock Subsystem	Part 2 Rolling Stock	Redrafted.	Title only.	

From GERT8014 issue two	To RIS-2714-RST issue one	Way forward	Comments	BCfC Objective
2.1 The rolling stock interface for hot axlebox detection	2.2 Rolling stock interface for trackside hot axle bearing detection systems	Redrafted.	Title only.	
2.1.1		Withdrawn.	This requirement duplicated LOC&PAS NTSN clauses 4.2.3.3.2(3) and 4.2.3.3.2.1(1) and WAG NTSN part 4.2.3.4.	2
2.1.2		Withdrawn.	This requirement duplicated LOC&PAS NTSN clause 4.2.3.3.2(2).	2
2.2 The rolling stock interface to infrastructure		Withdrawn.	The interface to and from the infrastructure from the vehicle has been combined under one section in the new RIS, therefore this title is no longer necessary.	3
2.2.1		Withdrawn.	This requirement duplicated LOC&PAS NTSN clauses 4.2.3.3.2(3) and 4.2.3.3.2.1(1) and WAG NTSN part 4.2.3.4.	2
2.2.2	3.2.2.4	Redrafted.	For clarity only.	3
2.3 Rolling stock fitted with onboard axle bearing monitoring system	2.3 Onboard detection systems	Revised.	Title only.	
2.3.1	2.3.2	No change.		3
2.3.2	G 2.3.12	Converted to guidance.	Redrafted as guidance. It was considered that the requirement originally set out was not possible to achieve by the RU.	3
2.3.3	2.3.3	Redrafted.	Requirement no longer considered an NTR. The requirement for onboard detection systems is set out in LOC&PAS NTSN clause 4.2.3.3.2. The RIS requirement is a way of technically meeting the LOC&PAS NTSN requirement.	3
Part 3 Requirements for the Infrastructure Subsystem	Part 3 Infrastructure	Redrafted.	Title only.	
3.1 The infrastructure interface to rolling stock	3.2 Infrastructure to rolling stock interface	Redrafted.	Title only.	

From GERT8014 issue two	To RIS-2714-RST issue one	Way forward	Comments	BCfC Objective
3.1.1	3.2.1.1	Redrafted.	Requirement no longer considered an NTR. The requirement for compatibility with trackside HABDs is set out in LOC&PAS NTSN clause 4.2.3.3.2. The RIS requirement is a way of technically meeting the LOC&PAS NTSN requirement. Part b of this requirement moved to 3.2.2.1 in the RIS.	3
3.1.2	3.2.2.2	Redrafted.	Requirement no longer considered an NTR. The requirement for onboard detection systems is set out in LOC&PAS NTSN clause 4.2.3.3.2. The RIS requirement is a way of technically meeting this. Responsibility also taken off an infrastructure manager for setting alarm types.	3
3.1.3	3.2.2.3	Revised.	Requirement no longer considered an NTR. The requirement for onboard detection systems is set out in LOC&PAS NTSN clause 4.2.3.3.2. The RIS requirement is a way of technically meeting this. Updated to include options of where information may be requested from.	3
3.2 Provision of information on trackside HABDs	3.3.1 Provision of information on trackside equipment	Redrafted.	Title only.	
3.2.1	3.3.1.1	Revised.	This requirement does not address a specific case, open point, or provide a means to achieve technical compatibility, and therefore cannot be considered as a NTR. This requirement has also been updated to remove specifics on HABDs.	3
Part 4 - Requirements for the Infrastructure Manager		Withdrawn.	Title only.	3
4.1 Requirements when trackside HABDs are out of service	3.3.2 Management and repair of out of service trackside equipment	Redrafted.	Title only.	
4.1.1	3.3.2.1	Redrafted.	This requirement does not address a specific case, open point, or provide a means to achieve technical compatibility, and therefore cannot be considered as an NTR. Redrafted for clarity.	3
4.1.2	3.3.2.2	Redrafted.	This requirement does not address a specific case, open point, or provide a means to achieve technical compatibility, and therefore cannot be considered as an NTR. Redrafted for clarity.	3

From GERT8014 issue two	To RIS-2714-RST issue one	Way forward	Comments	BCfC Objective
Part 5 - Application of this document		Withdrawn.	This part is covered by the information now provided as a template for a RIS.	
Definitions	Definitions	Revised.		
References	References	Revised.		

Table A2: GEGN8614 issue one to RIS-2714-RST issue one

From GEGN8614 issue one	To RIS-2714-RST issue one	Way forward	Comments	BCfC Objective
Part 1 Introduction	Part 1 Purpose and introduction	Redrafted.	Title only.	
1.1 Purpose of this document	1.1 Purpose	Redrafted.	Title only.	
1.1.1		Withdrawn.	This clause provided information on how to use the guidance note and is no longer relevant.	
1.1.2		Withdrawn.	As per 1.1.1.	
1.1.3		Withdrawn.	This clause provided information on where the requirements are relating to the guidance note (in the RGS) and is no longer relevant.	
1.2 Copyright		Withdrawn.	Section now included in template RIS text.	
1.3 Approval and authorisation of this document	1.6 Approval and authorisation of this document	No change.	Title only.	
1.3.1	1.6.1	Redrafted.	Date corrected.	
1.3.2	1.6.2	Redrafted.	Date corrected.	
Part 2 Guidance on Hot Axlebox Detection		Withdrawn.	Title only.	
2.1 Objectives and background		Withdrawn.	Title only.	
2.1.1 Objectives		Withdrawn.	Title only.	

From GEGN8614 issue one	To RIS-2714-RST issue one	Way forward	Comments	BCfC Objective
2.1.1.1	1.1.2	Revised.	To include systems other than HABDs, as well as additional information on the purpose of the document.	1
2.1.2 Background		Withdrawn.	Title only. Background sections are included in each chapter.	
2.1.2.1	1.2.1	Redrafted.	For clarity.	3
2.1.2.2		Withdrawn.	This clause was a broad statement regarding trackside HABDs being the most common system used to detect faulty bearings. This has been withdrawn as other technology is now available and may become incorrect in the future.	1
2.1.2.3		Withdrawn.	Duplicates requirements set out in the LOC&PAS and WAG NTSNs.	2
2.1.2.4	G 2.1.4	Revised.	Reference to LOC&PAS NTSN clause 4.2.3.3.2(2) included.	2
2.1.2.5		Withdrawn.	This guidance added no value.	
2.1.2.6		Withdrawn.	This clauses states that the document gives guidance that is specific to HABD equipment, which is no longer correct.	1
Part 3 Guidance on the Rolling Stock Subsystem	Part 2 Rolling Stock	Redrafted.	Title only.	
3.1 The rolling stock subsystem	2.2 Rolling stock interface for trackside hot axle bearing detection systems	Redrafted.	Title only.	
GN1		Withdrawn.	The guidance is captured elsewhere within the standard.	3
GN2	G 2.2.2	Redrafted.	For clarity, with reference given to a specific clause in BS EN 15437-1:2009 that was previously missing.	3
Figure 1	Figure 1	Revised.	Inclusion of dimensions on figure to add clarity for reader.	3

From GEGN8614 issue one	To RIS-2714-RST issue one	Way forward	Comments	BCfC Objective
GN3	G 2.2.7	Redrafted.	For clarity.	3
GN4	G 2.2.4 G 2.2.6	Redrafted.	For clarity.	3
GN5	G 2.2.5	Redrafted.	For clarity.	3
GN6	G 2.2.3 Table 1	Redrafted.	For clarity. Elements of the guidance have been tabulated by the request of stakeholders.	3
GN7	G 2.3.8	Redrafted.	Changed to rationale instead of guidance.	3
GN8		Withdrawn.	Guidance no longer relevant as it discusses measurement typically by temperature, which is not correct.	1
GN9	2.3.2	Converted to requirement.	Converted as an alarm in the event of a failed axle was considered a must by the working group.	3
GN10		Withdrawn.	This guidance states fact as is set out by LOC&PAS and WAG NTSN requirements and is redundant.	2
GN11		Withdrawn.	The guidance is captured elsewhere within the standard.	3
GN12	G 2.2.9	Redrafted.	Redrafted with inclusion of reference to BS EN 15437-1:2009.	3
GN13	3.2.2.3 G 3.2.2.6 G 3.2.2.15	Redrafted and converted to requirement.	For clarity, with 3.2.2.3 part of the guidance changed to a requirement as this was considered beneficial to industry to have a maximum design operating temperature.	3
GN14	2.3.3 G 2.3.13	Redrafted and converted to requirement.	Redrafted for clarity with one part of the guidance converted to a requirement as an alert to the driver in the event of a failed axle was considered a must by the working group.	3
GN15	2.3.5	Converted to requirement.	Converted as it is important for isolation equipment associated with the axle bearing monitoring system to be visible and accessible to staff and emergency services.	3
GN16		Withdrawn.	This guidance placed a responsibility on the RU which is out of their control.	3
Part 4 Guidance on the Infrastructure Subsystem	Part 3 Infrastructure	Redrafted.	Title only.	

From GEGN8614 issue one	To RIS-2714-RST issue one	Way forward	Comments	BCfC Objective
4.1 The infrastructure subsystem	3.2 Infrastructure to rolling stock interface	Redrafted.	Title only, redrafted.	
GN17	G 3.2.1.4	Redrafted.	For clarity.	3
GN18	G 3.2.1.6	Redrafted.	For clarity.	3
GN19	G 3.2.1.5	Redrafted.	For clarity.	3
GN20		Withdrawn.	Duplication of guidance given in G4 / G 2.2.7.	3
GN21	G 3.2.2.12	Redrafted.	For clarity.	3
GN22	G 3.2.2.13	Revised.	Redrafted for clarity and guidance expanded.	3
GN23	G 3.2.2.10	Revised.	The guidance given has been updated with explicit values of temperatures provided with reference to a Network Rail document.	3
GN24	G 3.3.1.5	Revised,	Redrafted for clarity and guidance expanded.	3
GN25	G 3.3.1.6	Revised.	Redrafted for clarity and guidance expanded.	3
GN26	G 3.3.1.3	Revised.	Redrafted as rationale from guidance.	3
GN27	G 3.3.1.7	No change.		3
Part 5 Guidance on Requirements for the Infrastructure Manager		Withdrawn.	Merged into 'infrastructure'.	3
5.1 Requirements for the infrastructure manager	3.3.2 Management and repair of out of service trackside equipment	Redrafted.	Title only.	
GN28		Withdrawn.	This guidance repeats RIS requirement 3.3.2.1.	3
GN29		Withdrawn.	Statement of fact that adds no value as guidance.	3
GN30	G 3.3.2.7	Revised.	To include updated information on the daily report.	3

From GEGN8614 issue one	To RIS-2714-RST issue one	Way forward	Comments	BCfC Objective
Part 6 Guidance on Applications for Deviations		Withdrawn.	Deviations are not applicable to RISs.	
Definitions	Definitions	Revised.		
References	References	Revised.		

Table A3: RIS-2714-RST issue one new content

	To RIS-2714-RST issue one	Way forward	Comments	BCfC Objective
New.	1.1.1	New.	Document context added.	
New.	1.1.3	New.	Purpose of system added.	
New.	1.1.4	New.	Exclusions from scope added.	
New.	1.1.5	New.	Adopters of document added.	
New.	1.2.2	New.	Description of system added.	
New.	1.2.3	New.	Description of document layout added.	
New.	1.2.4	New.	Reference text added at request of BSI.	
New.	1.3 Application of this document	New.	Standard text.	
New.	1.4 Health and safety responsibilities	New.	Standard text.	
New.	1.5 Structure of this document	New.	Standard text.	
New.	G 2.1.1	New.	General information on the risks associated with axle bearings that have failed or are failing.	3
New.	G 2.1.2	New.	Information on the basic function of a hot axle box detector.	3
New.	G 2.1.3	New.	Outline of the differences between trackside and onboard hot axle box detectors.	3
New.	G 2.1.4	New.	Signpost to the WAG NTSN on requirements for fitment of axle bearing condition monitoring.	2
New.	G 2.1.5	New.	Outline of the purpose of section 2.2 of the standard.	2
New.	G 2.1.6	New.	Outline of the purpose of section 2.3 of the standard.	2
New.	G 2.2.1	New.	Information the LOC&PAS NTSN requirements that the subsequent guidance supports.	2
New.	Table 1	New.	Included at the request of the working group, tabulated dimensions of the target area.	3
New.	Table 2	New.	Tabulated dimensions for the target area for units operating at greater speeds than 250 km/h.	3
New.	G 2.2.9	New.	Reference given to a specific clause in BS EN 15437-1:2009 that was previously missing.	3
New.	Figure 2	New.	Included to provide the dimensions of the prohibitive zone, where figure 1 provides dimensions of the target zone.	3
New.	Table 3	New.	Included by request of the working group, tabulated dimensions of the prohibitive zone.	3
New.	2.3.1	New.	Requirement added giving reference for onboard detection systems, signposting to design and reliability criteria set out in BS EN 15437-2:2012.	3
New.	2.3.4	New.	Requirement added for vehicles operating in multiple where there is a need for a driver in the leading vehicle to be able to identify faulty bearings on trailing vehicles.	3

	To RIS-2714-RST issue one	Way forward	Comments	BCfC Objective
New.	2.3.6	New.	Requirement added to guarantee a driver is aware of a bearing monitor being faulty or isolated as this may affect safe decision making.	3
New.	2.3.7	New.	Requirement added so that information on conditions that trigger bearing alarms are available to all affected parties.	3
New.	G 2.3.9	New.	Improved rationale with inclusion of reference to the WAG NTSN.	2
New.	G 2.3.10	New.	Rationale added for requirements 2.3.1-2.3.7.	3
New.	G 2.3.12	New.	Statement of fact informing stakeholders of the impact of the system on railway safety.	3
New.	G 2.3.14	New.	Good practice on how to best use low power wireless technologies.	3
New.	G 2.3.15	New.	Reference to RSSB research project T326 (2006) added to give good practice on alarms and alerts for onboard detection systems.	3
New.	G 2.3.16	New.	Good practice on vehicle design to support failed vehicles in service.	3
New.	G 2.3.17	New.	Considerations included as guidance for how isolation systems may be sealed.	3
New.	G 2.3.18	New.	Statement of fact on what a broken seal indicates.	3
New.	G 2.3.19	New.	Guidance added to support system design.	3
New.	G 2.3.20	New.	Guidance added to support system design.	3
New.	G 2.3.21	New.	Inclusion of guidance to support the sharing of information with the appropriate stakeholder groups.	3
New.	G 2.3.22	New.	Guidance to support a driver in taking safe and appropriate decisions and interventions at the right times.	3
New.	G 2.3.23	New.	Good practice on equipment tolerances added.	3
New.	G 2.2.24	New.	Guidance added on moving powered down vehicles and the risks involved in doing so if reliant on on-board bearing monitoring equipment.	3
New.	3.1 Background	New.	Title added.	
New.	G 3.1.1	New.	Purpose of system added.	3
New.	G 3.1.2	New.	Variations of types of trackside systems added.	1
New.	G 3.1.3	New.	Assumptions of RUs on the operation of trackside HABDs added for information.	3
New.	G 3.1.4	New.	Outline of the purpose of Part 3 of the standard.	
New.	G 3.1.5	New.	Signpost for users of dynamic frequency monitoring equipment added.	1
New	G 3.1.6	New.	Signpost to GIRT7073 for clearances between trackside equipment and rolling stock.	1
New.	3.2.1 Infrastructure HABD design	New.	Title added.	
New.	G 3.2.1.2	New.	Rationale added for clarity.	3

	To RIS-2714-RST issue one	Way forward	Comments	BCfC Objective
New.	G 3.2.1.3	New.	Rationale added for clarity.	3
New.	G 3.2.1.6	New.	Good practice added for HABDs that use multiple sensors.	3
New.	G 3.2.1.7	New.	Good practice added for HABD design.	3
New.	G 3.2.1.8	New.	Good practice added for HABD design that considers operational requirements of the railway.	3
New.	G 3.2.1.9	New.	Good practice added for HABD design.	3
New.	G 3.2.1.10	New.	Signpost added for RIS-0796-CCS when using AVI tags.	3
New.	3.2.2 Trackside HABD alarms	New.	Title added.	
New.	G 3.2.2.5	New.	Rationale added relating to support of the LOC&PAS NTSN.	2
New.	G 3.2.2.7	New.	Rationale added identifying clauses that support RIS-8270-RST.	3
New.	G 3.2.2.8	New.	Rationale added relating to support of the LOC&PAS and WAG NTSNs.	2
New.	G 3.2.2.9	New.	Signpost added for BS EN 15437-1:2009.	3
New.	G 3.2.2.11	New.	Inclusion of guidance to support the setting of alarm levels.	3
New.	G 3.2.2.14	New.	Good practice added to support co-operation amongst all RUs operating on a route.	3
New.	G 3.2.2.15	New.	Inclusion of sources of information for existing alarm levels.	3
New.	3.3 Infrastructure manager	New.	Title added.	
New.	G 3.3.1.2	New.	Rationale added for clarity.	3
New.	G 3.3.1.4	New.	Inclusion of sources of information for existing alarm types.	3
New.	G 3.3.2.3	New.	Rationale added for clarity.	3
New.	G 3.3.2.4	New.	Rationale added for clarity.	3
New.	G 3.3.2.5	New.	Rationale added for clarity.	3
New.	G 3.3.2.6	New.	Good practice added for IMs for the management of out of service equipment.	3
New.	G 3.3.2.8	New.	Signpost added for the control centre incident log.	3
New.	G 3.3.2.9	New.	Signpost added to GEGN8646.	3
New.	G 3.3.2.10	New.	Guidance added to indicate that information on out of service equipment may not be immediately shared with Rus.	3
New.	G 3.3.2.11	New.	Signpost to Network Rail document NR/LP/OPS/045.	3
New.	G 3.3.2.12	New.	Good practice on testing repaired equipment.	3
New.	G 3.3.2.13	New.	Information provided on updates on out of service equipment.	3

	To RIS-2714-RST issue one	Way forward	Comments	BCfC Objective
New.	Part 4 - Dynamic frequency monitoring systems	New.	Title added.	
New.	4.1 General	New.	Title added.	
New.	G 4.1.1	New.	Guidance added for dynamic frequency monitoring systems.	1
New.	G 4.1.2	New.	Guidance added for dynamic frequency monitoring systems.	1
New.	G 4.1.3	New.	Guidance added for dynamic frequency monitoring systems.	1
New.	G 4.1.4	New.	Guidance added for dynamic frequency monitoring systems.	1
New.	G 4.1.5	New.	Guidance added for dynamic frequency monitoring systems.	1
New.	G 4.1.6	New.	Guidance added for dynamic frequency monitoring systems.	1
New.	G 4.1.7	New.	Guidance added for dynamic frequency monitoring systems.	1
New.	G 4.1.8	New.	Guidance added for dynamic frequency monitoring systems.	1