21-013 Mitigation of GSM-R failure: Use of a competent person in non-leading cab

Version:	2.08		
Purpose:	Approval to proceed to consultation		
Authors:	Laura Fernandez – Principal Rail Operations Specialist		
Sponsor:	Tom Lee – Director of Standards		
Sponsor's agent:	James Webb – Professional Head of Rail Operations		
Lead industry committee:	Traffic Operation and Management Standards Committee (TOM SC)	**Date:**	28 March 2023
Supporting industry committee:	Control, Command and Signalling Standards Committee (CCS SC)	**Date:**	06 April 2023
Supporting industry committee:	Rolling Stock Standards Committee (RST SC)	**Date:**	13 April 2023
Supporting industry committee:	Plant Standards Committee (PLT SC)	**Date:**	By correspondence

Decision

Traffic Operation and Management Standards Committee (TOM SC) is asked to:

DECIDE if the proposed revisions of RIS-3780-TOM, GERT8000-TW1 and GERT8000-TW5 deliver the intentions of the proposal for change.

DECIDE if the proposed revisions of RIS-3780-TOM, GERT8000-TW1 and GERT8000-TW5 are in a suitable state for consultation.

APPROVE that the proposed revisions of RIS-3780-TOM, GERT8000-TW1 and GERT8000-TW5 are consulted on.

IDENTIFY any specific organisations or individuals to be included in the consultation.

The supporting committees are asked to:

SUPPORT that the proposed revisions of RIS-3780-TOM, GERT8000-TW1 and GERT8000-TW5 are consulted on.

IDENTIFY any specific organisations or individuals to be included in the consultation.

21-013 Mitigation of GSM-R failure: Use of a competent person in non-leading cab

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-3780-TOM	Operational Requirements for GSM-R Radio	2
GERT8000-TW1	Preparation and movement of trains	19
GERT8000-TW5	Defective or isolated vehicles and on-train equipment	12

Superseded documents

Number	Title	Issue
RIS-3780-TOM	Operational Requirements for GSM-R Radio	1
GERT8000-TW1	Preparation and movement of trains	18.1
GERT8000-TW5	Defective or isolated vehicles and on-train equipment	11

Summary

Background and change

RSSB received a request for help highlighting a concern about trains being able to operate with a defective Global System for Mobile Communications-Railway (GSM-R) radio in the leading cab. It also mentioned that a train operator already makes use of a competent person positioned in a non-leading cab of the train to operate a working GSM-R radio in case of emergency. This practice was originally anticipated, and included as part of the cab radio design, however, it is not yet incorporated into the rules.

To allow this mitigation measure to be extended to industry, RSSB performed the appropriate risk assessments to ascertain the benefits of this practice. Once complete, it was established that the use of portable equipment or hand-portable devices provides higher levels of protection to manage the risks associated with a lead cab GSM-R radio failure; this is because they remain in the hands of the driver. However, when this is not possible, the use of a competent person that is able to operate an alternative radio in case of emergency will remain an alternative option to give railway undertakings an extra tool to mitigate on-board GSM-R radio failures. This option will not replace other existing operational mitigations currently in place; and, when portable GSM-R equipment can be collected within the existing limits of 75 miles previously imposed, this should be done rather than relying on a competent person.

The required instructions and guidance have now been incorporated into the relevant documents for this purpose.

Industry impact due to changes

Impact areas	Scale of impact	Estimated value £
A. Legal compliance and assurance	Low	Not quantified
B. Health, safety and security	Medium	Not quantified
C. Reliability and operational performance	Medium	£491,606
D. Design and maintenance	N/A	N/A
E. People, process and systems	Medium	Not quantified
F. Environment and sustainability	N/A	N/A
G. Customer experience and industry reputation	Low	Not quantified
Total value of industry opportunity =		**£491,606 over 5 years**

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 were the objectives associated with this change?

Objective 1 – to include the use of a competent person other than the driver as a mitigation for GSM-R radio failure

1.1 RSSB received a request for help highlighting a concern about how trains operate under GSM-R failure conditions, particularly focusing on the leading cab contingency arrangements.

1.2 The request for help specifically referred to rules governing the running of trains on single lines, branch lines and long cross-country routes where no signals are provided, or areas where successive stop signals are a long distance apart. These locations also often have very poor or no mobile phone signal.

1.3 A stakeholder meeting highlighted that South Western Railway's contingency arrangements allow for a competent person to operate another working cab radio elsewhere in the train in case of GSM-R failure affecting the leading cab.

1.4 Such mitigation did not form part of current rules or standards.

2. How has the content in the standard changed to achieve the objectives?

Objective 1 – to include the use of a competent person other than the driver as a mitigation for GSM-R radio failure

2.1 RSSB undertook a review using the GSM-R Failure Risk Model to assess the potential mitigation benefits of the use of a competent person and whether it should be considered good practice for further use. This person shall be competent to initiate and receive railway emergency group calls (REC) using safety critical communications protocols, understand how to stop a train in an emergency, and be positioned in an alternative cab with a working GSM-R radio.

2.2 The risk model was used to understand the risks associated with a train travelling around the network with a GSM-R failure in the leading cab, by dividing them into two main scenarios:

- A train having an accident requiring emergency communication or emergency protection, to warn approaching trains of the line being unsafe; and
- An oncoming train not being able to be warned they are heading towards the scene of an accident.

2.3 The risk model work was based on certain assumptions on possible response times of the competent person and types of location where the incident may happen, with special attention paid to single lines, branch lines and lines with signals a long distance apart. These were agreed with a selected group of industry representatives relevant to the task.

2.4 Based on these assumptions, the outcome of this work (see Appendix B of this document) highlighted that there are situations in which having a competent person who is able to

initiate or receive a Railway Emergency Call (REC) is a suitable mitigation for a GSM-R radio failure, subject to the following:

a) Any proposed changes will remain an alternative option to manage the risks associated with a lead cab GSM-R radio failure and will not replace other existing operational mitigations currently in place. When equipment that can be collected within the existing limits (75 miles) is available, this should be done rather than relying on a competent person;
b) The use of a competent person in a non-leading cab will only be acceptable if the driver and competent person have access to direct means of communication between cabs (cab-to-cab communication). This is a means of communication that allows instructions or information to be shared between parties, and not just a train buzzer or bell;
c) The competent person will only be allowed to use the GSM-R radio equipment from a non-leading cab in an emergency. This is to monitor the radio to bring the train to a stand upon receiving a REC, and to operate the radio to initiate a REC as a means to stop approaching trains in an emergency;
d) The requirement for the driver to bring the train to a stand immediately and listen to the message upon receiving a REC should also apply to a competent person;
e) The proposed changes are beneficial from a safety perspective if the competent person can remain continuously in the cab or if they are able to return immediately when not carrying out another task. The competent person would only be able to undertake safety-critical tasks. In the case of a guard in charge of dispatch, they may continue to perform dispatch duties if they are able to return to the non-leading cab without having to travel through multiple carriages; and
f) The use of a competent person as a mitigation measure is considered effective if the person is already on-board or available within 15 miles, whichever comes first, and will not be used for distances over 180 miles before portable or transportable equipment is collected.

2.5 These results required the update of the relevant sections in several documents:

- RIS-3780-TOM *Operational Requirements for GSM-R Radio* issue 1. It was anticipated that this RIS would require minimal change to introduce the use of a competent person as an alternative mitigation measure. However, the opportunity was used to completely revise the document. Apart from the introduction of the additional mitigation measure, the document was subject to editorial changes to make it consistent with the current RIS style and format, containing requirements addressed to the entity responsible, rationale and guidance. In addition, outdated references were also updated, for example: “TSI” was replaced by “NTSN”, and “in service” was replaced by “during a journey”. Imperial metrics were also supplemented by the inclusion of their metric equivalents.
- GERT8000-TW1 issue 18, section 39 and GERT8000-TW5 issue 11, section 25 were updated to incorporate instructions now addressed to a competent person in addition to the driver.

- RIS-3437-TOM issue 3, section 4.27. While originally anticipated an update would be required, the outcome of the review identified that, since the content of the section refers to RIS-3780-TOM for any requirements, no changes were necessary.

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

3.1 South Western Railway already uses a competent person in the rear cab in some cases of GSM-R failure. The outcomes from this project aimed to highlight any risks of this mitigation measure. Applying the changes to the existing rules will extend the benefits to the wider industry. Although there was no defined urgency or expectation from industry for this project to be expedited, since the changes affect Rule Book modules, the aim is to target September 2023 publication dates.

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 It is a requirement of the OPE NTSN to have a working radio or another means of emergency communication. The mitigation provided by the use of a competent person will assist railway undertakings in complying with their legal obligations in case of a radio defect by adopting a proportionate whole-system approach. However, consideration will need to be given to the impact of providing a competent person, as it may impact on the person's normal activities. In addition, it may not be possible for a competent person to be provided immediately; therefore, contingency arrangements need to consider such scenarios.

B. Health, safety and security

4.2 A train operating without a working GSM-R radio is at risk of secondary collision, either by having an incident and not being able to warn other approaching trains, or by not being able to be warned they are approaching the scene of another incident.

4.3 The use of a competent person to operate an alternative radio will be able to provide protection in situations where a train would have continued without a working radio, as the current rules allow a train to operate for up to 75 miles without a working radio. If a competent person is provided, the risk will be immediately reduced.

C. Reliability and operation performance

4.4 GSM-R delays cause a considerable number of delay minutes per year. Due to the categories in which delays are attributed, it is difficult to quantify what percentage of these would represent a failure of the radio in the leading cab, where other radios on the train formation are still in operation and available for the competent person to use. However, if we looked at the GSM-R delays that were attributed to 'fleet causes', which is where a number of these types of delays may be allocated, a very conservative 10% reduction of these delays in the

areas of interest as a result of this standards change would result in £491,606 of benefit to industry over 5 years[1].

D. Design and maintenance

4.5 This area is not applicable to the changes.

E. People, process and systems

4.6 The introduction of this new mitigation measure will have an impact on people and processes. Staff will need to be trained to perform the role of a competent person, and the relevant processes will need to be updated. Safety critical staff working on trains normally cover basic GSM-R functions in their competence training. So, although the required updates may incur a cost, all the other benefits already mentioned, including the safety benefits, will outweigh this cost.

4.7 The additional format changes applied to RIS-3780-TOM issue 2 detailed in clause 2.5 of this document will assist the user in identifying the entity responsible for any requirements, making the document more useful and easier to apply.

F. Environment and sustainability

4.8 This area is not applicable to the changes.

G. Customer experience and industry reputation

4.9 The use of a competent person has the potential to reduce the number of trains that would need to be cancelled due to a defect of a GSM-R radio, improving the customer experience. If an alternative means of communication, for example, a portable radio, is not available, a train can only continue a maximum of 75 miles. If a competent person is provided, in certain circumstances, the train may be able to continue for the rest of the day.

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

5.1 By implementing the changes, railway undertakings will have extra measures available to mitigate GSM-R radio failures. However, this mitigation may not always be available to all railway undertakings. For example, in driver-only operation (DOO), the competent person may not be available immediately; also, in operations where a competent person is available, the railway undertaking will need to consider the balance between the tasks that will need to be suppressed to allow a member of staff to perform the tasks of the competent person operating the radio.

5.2 The additional editorial changes introduced will assist the document user to clearly identify responsibilities.

[1] Data extracted from Network Rail's 'total performance dataset'. (PfPI minutes used = total delay including cancelations) 2020/21 shows a total of 496 GSM-R-related incidents attributed to M (fleet), causing a total of 786,570 minutes delay = £39,328,500. RSSB uses a measure of £50 per performance minute delay.

Assumption that 5% of these delays took place in areas of single or branch lines or where signals are a long distance apart (=£983,213). 10% reduction worked on this 5% of the fleet delays (=£491,606). Totals over a 5-year period.

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

6.1 Although the practice is already in use by an operator, the lack of supporting information meant that RSSB had to carry out the relevant risk assessments for the practice to be extended to industry.

6.2 The first phase of the project required RSSB risk specialists to engage with industry representatives to determine the implications of the change and the list of assumptions to be worked with when using the RSSB GSM-R Failure Risk Model.

6.3 During the second phase, a rail operations specialist incorporated the required amendments into the relevant sections of RIS-3780-TOM issue 2, GERT8000-TW5 issue 12 and GERT8000-TW1 issue 19. RIS-3437-TOM issue 3 was also considered, but no changes were deemed necessary (see comments in clause 2.5 of this document).

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

7.1 When presented at the different Standards Committees, the lead Standards Committee gave the project a 'medium' priority. All the proposed changes have now been made and the project is currently on track to achieve September 2023 publication.

8. How will the industry implement the change?

8.1 Railway undertakings will be able to use the content supplied by RSSB to update their contingency plans.

8.2 Railway undertakings will need to identify if this mitigation measure will be of use for their operation and the method of application that will be suitable for them; for example, if they would use a competent person and who could fulfil this role. If required, some personnel will need to be trained or upskilled to be able to cover the position.

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

9.1 RSSB will review RIS-3780-TOM issue 2, and Rule Book modules GERT8000-TW1 issue 19 and GERT8000-TW5 issue 12 one year after publication to assess whether their content remains fit for purpose. We will seek specific feedback from railway undertakings that have adopted and implemented the changes, particularly operators of the areas where the benefits were identified.

Appendix A Disposition Table

Table A1: RIS-3780-TOM issue 1 to RIS-3780-TOM issue 2

From RIS-3780-TOM issue 1	To RIS-3780-TOM issue 2	Way forward	Comments
Part 1			
1.1.1	**1.1.1**	No change	
1.1.2	**1.1.2**	No change	
1.1.3	**1.1.3**	No change	
1.2.1	**1.2.1**	No change	
1.2.2	**1.2.2**	No change	
1.2.3	**1.2.3**	No change	
1.2.4	**1.2.4**	No change	
1.2.5	**1.2.5**	Redrafted	Insertion of the name of the model, for added clarity.
n/a	**1.2.6**	New	New clause to introduce the new risk assessment work that introduces the use of a competent person as a mitigation measure.
1.2.6	**1.2.7**	Redrafted	Minor editorial changes to reflect that issue 2 is based on two risk analyses.
1.2.7	**1.2.8**	Revised	Deletion of 'signallers and drivers'. There are more users of the radio, like controllers and the competent person.
1.3.1	**1.3.1 and 1.3.2**	Revised	Content updated to current generic RIS text.
1.4.1	**1.4.1**	No change	
1.5.1	**1.5.1 and 1.5.2**	Revised	Content updated to current generic RIS text.
1.6.1	**1.6.1**	Revised	Approval date updated.
1.6.2	**1.6.2**	Revised	Authorisation date updated.
Part 2			
2.1.1	**G 2.1.4**	Converted to guidance	Requirement clause more suited to guidance to support an updated, overarching requirement that a train may not start a journey from a maintenance depot with a defective train radio (section 2.1.1 of issue 2, which was redrafted from section 2.3.1 of issue 1). The requirement in the NTSN prohibits a train to enter operations with this defect; the different types of displayed information are normally covered in the user manuals and this clause is therefore more suited to guidance.

From RIS-3780-TOM issue 1	To RIS-3780-TOM issue 2	Way forward	Comments
G 2.1.2	**G 2.1.5**	Redrafted	Rationale clause more suited to guidance supporting the updated requirement 2.1.1 in issue 2.
G 2.1.3	**n/a**	Withdrawn	Clause no longer valid, as there is now guidance relevant to the requirement.
2.2.1	**2.1.2**	Redrafted	Redrafted to make clear that the requirement applies to railway undertakings.
G 2.2.2	**G 2.1.6**	Redrafted	• Rationale clause more suited to guidance supporting the updated requirement 2.1.1. • Minor editorial corrections.
G 2.2.3	**n/a**	Withdrawn	Clause no longer valid, as there is now guidance relevant to the requirement.
2.3.1	**2.1.1**	Redrafted	• Requirement redrafted to new style – now addressed to the RU responsible. • Terminology 'enter service' amended to 'start a journey' to align with current issue of RIS-3437-TOM.
G 2.3.2	**G 2.1.3**	Revised	Rationale revised to update TSI to NTSN.
G 2.3.3	**n/a**	Withdrawn	Withdrawn in line with current style – no direct quotations from other documents (for example OPE TSI or OPE NTSN) to avoid the standard becoming obsolete if the document referenced is updated.
G 2.3.4	**G 2.1.7**	Redrafted	• Rationale clause more suited to guidance supporting the updated requirement 2.1.1. • Terminology 'enter service' amended to 'start a journey' to align with current issue of RIS-3437-TOM.
G 2.3.5	**G 2.1.8**	Revised	• Terminology 'enter service' amended to 'start a journey' to align with current issue of RIS-3437-TOM. • Additional explanation added to improve the content of this guidance. • Final sentence deleted as this was in an incorrect style, containing the word 'should', and simply restated requirement 2.1.1.
G 2.3.6	**G 2.1.9**	Revised	Reworded to clarify the guidance.
n/a	**G 2.1.10**	New	New guidance clause to support requirement 2.1.1.
n/a	**G 2.1.11**	New	New guidance signposting flowchart in appendix A.
2.4.1	**2.2.1**	Revised	• Requirement redrafted to new style – now addressed to the RU responsible. • Terminology 'enter service' amended to 'start a journey' to align with current issue of RIS-3437-TOM.

From RIS-3780-TOM issue 1	To RIS-3780-TOM issue 2	Way forward	Comments
			• Requirements 2.4.1 and 2.6.1 from issue 1 now merged in a single requirement 2.2.1 in issue 2. This is for consistency of style with other documents, such as the current issue of RIS-3437-TOM, where 'starting from other than a maintenance depot or during a journey' are covered in one section. • Measurements in km now added, in line with current style. • Addition of competent person mitigation measure.
	G 2.2.10	Converted to guidance	Sentence referring to available illustration in Appendix A moved to guidance clause, as it was not a requirement.
G 2.4.2	**G 2.2.2**	Revised	• Rationale revised to update TSI to NTSN. • Quotation deleted in line with current style – no direct quotations from other documents (for example OPE TSI or OPE NTSN) to avoid the standard becoming obsolete if the document referenced is updated.
G 2.4.3	**n/a**	Withdrawn	Withdrawn in line with current style – no direct quotations from other documents (for example OPE TSI or OPE NTSN) to avoid the standard becoming obsolete if the document referenced is updated.
G 2.4.4	**G 2.2.4**	Revised	Terminology 'enter service' amended to 'start a journey' to align with current issue of RIS-3437-TOM.
	G 2.2.5	Revised	Final sentence of G 2.4.4 in issue 1 moved to standalone guidance clause and merged with clauses G 2.4.5 of issue 1. This follows the merger of requirements 2.4.1 and 2.6.1 from issue 1 to form requirement 2.2.1 in issue 2.
G 2.4.5	**G 2.2.5**	Revised	Guidance merged with final sentence of G 2.4.4 to form new clause G 2.2.5 in issue 2. This follows the merger of requirements 2.4.1 and 2.6.1 from issue 1 to form requirement 2.2.1 in issue 2.
2.5.1	**2.3.3**	Redrafted	Redrafted for clarity.
G 2.5.2	**G 2.3.8**	Redrafted	• Rationale clause better suited to guidance in support of requirement 2.3.3. • Content improved by adding 'identification' to existing 'rectification' for a more comprehensive reflection of reality. • Terminology updated – 'as soon as' replaced by 'so far as', as per definition.
G 2.5.3	**G 2.2.5**	Revised	Guidance merged with final sentence of G 2.4.4 from issue 1 to form new clause G 2.2.5 in issue 2.
n/a	**G 2.2.6**	New	Content added to refer the reader to the relevant requirements if transportable or portable GSM-R equipment is provided as an operational mitigation.

From RIS-3780-TOM issue 1	To RIS-3780-TOM issue 2	Way forward	Comments
n/a	**G 2.2.7**	New	Content relevant to the introduction of a competent person as a mitigation measure.
n/a	**G 2.2.8**	New	Content relevant to the introduction of a competent person as a mitigation measure.
n/a	**G 2.2.9**	New	Content added to refer the reader to the relevant requirements if a competent person is provided as an operational mitigation.
2.6.1	**2.2.1**	Revised	• Requirement redrafted to new style – now addressed to the RU responsible. • Terminology 'enter service' amended to 'start a journey' to align with current issue of RIS-3437-TOM. • Requirements 2.4.1 and 2.6.1 from issue 1 now merged in a single requirement 2.2.1 in issue 2. This is for consistency of style with other documents, such as the current issue of RIS-3437-TOM, where 'starting from other than a maintenance depot or during a journey' are covered in one section. • Measurements in km now added, in line with current style. • Addition of competent person mitigation measure.
G 2.6.2	**G 2.2.3**	Revised	• Rationale revised to update TSI to NTSN. • Quotation deleted in line with current style – no direct quotations from other documents (for example OPE TSI or OPE NTSN) to avoid the standard becoming obsolete if the document referenced is updated.
G 2.6.3	**G 2.2.5**	Revised	• Quotation deleted in line with current style – no direct quotations from other documents (for example OPE TSI or OPE NTSN) to avoid the standard becoming obsolete if the document referenced is updated. • Guidance merged with final sentence of G 2.4.4 to form new clause G 2.2.5 in issue 2. This follows the merger of requirements 2.4.1 and 2.6.1 from issue 1 to form requirement 2.2.1 in issue 2.
G 2.6.4	**G 2.2.5**	Revised	Guidance merged with final sentence of G 2.4.4 to form new clause G 2.2.5 in issue 2. This follows the merger of requirements 2.4.1 and 2.6.1 from issue 1 to form requirement 2.2.1 in issue 2.
G 2.6.5	**n/a**	Withdrawn	Clause no longer valid, as there is now guidance relevant to the requirement.
2.7.1	**2.3.1**	No change	Clause renumbered, no change to content.
2.7.2	**2.3.2**	No change	Clause renumbered, no change to content.
G 2.7.3	**G 2.2.3**	Revised	• Rationale revised to update TSI to NTSN.

From RIS-3780-TOM issue 1	To RIS-3780-TOM issue 2	Way forward	Comments
			• Quotation deleted in line with current style – no direct quotations from other documents (for example OPE TSI or OPE NTSN) to avoid the standard becoming obsolete if the document referenced is updated.
G 2.7.4	**G 2.2.5**	Revised	• Quotation deleted in line with current style – no direct quotations from other documents (for example OPE TSI or OPE NTSN) to avoid the standard becoming obsolete if the document referenced is updated. • Guidance merged with final sentence of G 2.4.4 to form new clause G 2.2.5 in issue 2.
G 2.7.5	**G 2.2.5**	Revised	Guidance merged with final sentence of G 2.4.4 to form new clause G 2.2.5 in issue 2.
n/a	**G 2.3.6**	New	New guidance added to support requirement 2.3.1.
G 2.7.6	**G 2.3.7**	Revised	Reworded as guidance – 'It is good practice for transport operators to…' rather than 'Transport operators should…'.
n/a	**2.4**	New	New section added, setting out requirements (clauses 2.4.1 – 2.4.3), rationale (clauses G 2.4.4 – G 2.4.6) and guidance (clauses G 2.4.7 – G 2.4.12) for using a competent person as an operational mitigation in the event of GSM-R failure in the leading cab of a train.
Part 3			
3.1.1	**3.1.1**	Revised	Requirement revised to current RIS style – now addressed to the IM responsible.
3.1.2	**G 3.1.7**	Converted to guidance	This clause gave information to support the requirement in clause 3.1.1 of issue 1 but was not a requirement. It has therefore been reclassified as guidance and the text remains unchanged.
3.1.3	**3.1.2**	Revised	Requirement revised to current RIS style – now addressed to the IM responsible.
G 3.1.4	**G 3.1.5**	Revised	Rationale revised to update TSI to NTSN.
G 3.1.5	**G 3.1.6**	Redrafted	Rationale redrafted to include 'safety management system' as well as 'SMS'.
G 3.1.6	**G 3.1.8**	Redrafted	Editorial changes. It is convention not to use 'should' in guidance content.
n/a	**G 3.1.9**	New	Clause signposting subsequent requirements sections, to improve clarity and assist the user of the document.
n/a	**G 3.1.10**	New	New clause added signposting supporting illustration in Appendix B.
3.2.1	**3.1.3, 3.1.4**	Redrafted	• Minor editorial changes.

From RIS-3780-TOM issue 1	To RIS-3780-TOM issue 2	Way forward	Comments
			• Redrafted as separate requirements for infrastructure managers (3.1.3 in issue 2) and transport operators (3.1.4 in issue 2). • Requirements 3.1.3 and 3.1.4 in issue 2 now appear under the heading 'Notification of failures of the GSM-R network', as these relate more closely to this than 'Alternative means of communication'.
n/a	**3.2.1**	New	New requirement. This explicitly states that transport operators shall have contingency plans to manage failures of the GSM-R fixed network. This requirement was implied, but not explicit, in issue 1.
3.2.2	**3.2.2**	Redrafted	• Redrafted for clarity, no change to requirement. • Content redrafted to new style – now addressed to the transport operators to highlight entity responsible.
3.2.3	**3.2.3**	Redrafted	• Content redrafted to new style – now addressed to the railway undertaking to highlight entity responsible. • Minor editorial corrections.
G 3.2.4	**G 3.2.4**	Redrafted	Minor editorial changes.
G 3.2.5	**G 3.2.5**	Revised	• Reclassified from guidance to rationale in support of requirement 3.2.3. • Minor editorial changes.
n/a	**G 3.2.6**	New	New clause inserted to indicate that, following the reclassification of G 3.2.5 as rationale rather than guidance, there is no additional guidance in support of requirements 3.2.1 – 3.2.3.
3.3.1	**3.3.1**	Redrafted	• Metric units added. • Minor editorial changes.
G 3.3.2	**G 3.3.4**	Redrafted	• Clause reclassified from rationale to guidance. • Metric units added.
G 3.3.3	**G 3.1.5**	Redrafted	Converted to rationale. Content already covered in previous section, so link inserted to avoid duplication.
G 3.3.4	**G 3.1.6**	Redrafted	Converted to rationale. Content already covered in previous section, so link inserted to avoid duplication.
G 3.3.5	**G 3.1.6**	Redrafted	Converted to rationale. Content already covered in previous section, so link inserted to avoid duplication.
3.4.1	**3.4.1**	Redrafted	• Metric units added. • Minor editorial changes.

From RIS-3780-TOM issue 1	To RIS-3780-TOM issue 2	Way forward	Comments
G 3.4.2	**G 3.4.4**	Redrafted	• Clause reclassified from rationale to guidance. • Metric units added. • Minor editorial changes.
G 3.4.3	**G 3.4.5**	Redrafted	• Clause reclassified from rationale to guidance. • Minor editorial changes.
G 3.4.4	**G 3.1.5**	Redrafted	Converted to rationale. Content already covered in previous section, so link inserted to avoid duplication.
G 3.4.5	**G 3.1.6**	Redrafted	Converted to rationale. Content already covered in previous section, so link inserted to avoid duplication.
G 3.4.6	**G 3.1.6**	Redrafted	Converted to rationale. Content already covered in previous section, so link inserted to avoid duplication.
n/a	**G 3.4.6**	New	New guidance clause signposting flowchart for dealing with GSM-R fixed network failures in Appendix B.
3.5.1	**3.5.1**	Redrafted	• Metric units added. • Minor editorial changes.
3.5.2	**3.5.2**	No change	
G 3.5.3	**G 3.5.5**	Redrafted	• Clause reclassified from rationale to guidance. • Minor editorial changes.
G 3.5.4	**G 3.5.6**	Redrafted	Clause reclassified from rationale to guidance.
G 3.5.5	**G 3.1.6**	Redrafted	Converted to rationale. Content already covered in previous section, so link inserted to avoid duplication.
G 3.5.6	**G 3.1.6**	Redrafted	Converted to rationale. Content already covered in previous section, so link inserted to avoid duplication.
G 3.5.7	**G 3.5.7**	Redrafted	• Reference updated as flowchart now in Appendix B. • Minor editorial changes.
G 3.5.8	**G 3.1.5**	Redrafted	• Converted to rationale. Content already covered in previous section, so link inserted to avoid duplication. • Order of clauses amended so they follow on naturally from one another.
Part 4			
4.1.1	**4.1.1**	Revised	Requirement revised to current RIS style – now addressed to the entity responsible.

From RIS-3780-TOM issue 1	To RIS-3780-TOM issue 2	Way forward	Comments
4.1.2	**4.1.2**	Revised	Requirement revised to current RIS style – now addressed to the entity responsible.
4.1.3	**4.1.3**	Revised	Requirement revised to current RIS style – now addressed to the entity responsible.
4.1.4	**4.1.4**	Revised	Requirement revised to current RIS style – now addressed to the entity responsible.
G 4.1.5	**G 4.1.5**	Redrafted	Editorial changes to improve clarity.
G 4.1.6	**G 4.1.6**	No change	
G 4.1.7	**G 4.1.7**	No change	
G 4.1.8	**G 4.1.8**	No change	
G 4.1.9	**G 4.1.9**	No change	
n/a	**G 4.1.10**	New	New clause signposting subsequent requirements sections to assist users of the document.
n/a	**G 4.1.11**	New	New guidance clause signposting RS523 as a further resource.
4.2.1	**4.2.1**	Revised	Requirement revised to current RIS style – now addressed to the entity responsible.
G 4.2.2	**G 4.2.2**	No change	
G 4.2.3	**G 4.2.3**	No change	
4.3.1	**4.3.1**	Revised	Requirement revised to current RIS style – now addressed to the entity responsible.
G 4.3.2	**G 4.3.2**	Redrafted	Minor editorial change.
G 4.3.3	**G 4.3.3**	No change	
4.4.1	**4.4.1**	Revised	Requirement revised to current RIS style – now addressed to the entity responsible.
4.4.2	**4.4.2**	Revised	Requirement revised to current RIS style – now addressed to the entity responsible.
4.4.3	**4.4.3**	No change	
G 4.4.4	**G 4.4.4**	Redrafted	Minor editorial changes to improve the clarity of the clause.
G 4.4.5	**G 4.4.5**	No change	
G 4.4.6	**G 4.4.6**	Redrafted	Minor editorial changes to improve the clarity of the clause.
G 4.4.7	**G 4.4.7**	No change	
4.5.1	**4.5.1**	Revised	Requirement revised to current RIS style – now addressed to the entity responsible.
4.5.2	**4.5.2**	Revised	Requirement revised to current RIS style – now addressed to the entity responsible.
4.5.3	**4.5.3**	Revised	Requirement revised to current RIS style – now addressed to the entity responsible.
4.5.4	**4.5.4**	Revised	Requirement revised to current RIS style – now addressed to the entity responsible.
G 4.5.5	**G 4.5.5**	No change	

From RIS-3780-TOM issue 1	To RIS-3780-TOM issue 2	Way forward	Comments
G 4.5.6	**G 4.5.6**	No change	Minor editorial change to improve the clarity of the clause – inclusion of reference to relevant requirement.
G 4.5.7	**G 4.5.7**	No change	
4.6.1	**4.6.1**	Revised	Requirement revised to current RIS style – now addressed to the entity responsible.
4.6.2	**4.6.2**	Revised	Requirement revised to current RIS style – now addressed to the entity responsible.
G 4.6.3	**G 4.6.3**	No change	
G 4.6.4	**G 4.6.4**	No change	
4.7.1	**4.7.1**	Revised	Requirement revised to current RIS style – now addressed to the entity responsible.
G 4.7.2	**G 4.7.2**	No change	
G 4.7.3	**G 4.7.3**	No change	
4.8.1	**4.8.1**	Revised	Requirement revised to current RIS style – now addressed to the entity responsible.
G 4.8.2	**G 4.8.2**	No change	
G 4.8.3	**G 4.8.3**	No change	
4.9.1	**4.9.1**	Revised	• Requirement revised to current RIS style – now addressed to the entity responsible. • Minor editorial correction – 'person in charge of possession (PICOP)' amended to 'persons in charge of possession (PICOPs)' for consistency with other staff grades referred to in the clause.
G 4.9.2	**G 4.9.2**	No change	
G 4.9.3	**G 4.9.3**	No change	
4.10.1	**4.10.1**	Revised	Requirement revised to current RIS style – now addressed to the entity responsible.
4.10.2	**4.10.2**	Revised	Requirement revised to current RIS style – now addressed to the entity responsible.
G 4.10.3	**G 4.10.3**	No change	
G 4.10.4	**G 4.10.4**	No change	
G 4.10.5	**G 4.10.5**	No change	
Appendix A Entering Service with an On-board Train Radio Failure	**Appendix A On-board Train Radio Failure**	Revised	• Content of appendix A 'entering service' and appendix B 'while in service' now merged. • Steps for provision of a competent person now added. • Distances updated to incorporate metric as well as imperial measurements.

From RIS-3780-TOM issue 1	To RIS-3780-TOM issue 2	Way forward	Comments
			• Note removed: definitions for 'journey' and 'competent person' are included within the definition section and do not need to be duplicated here.
Appendix B On-board Train Radio Failure While in Service	**n/a**	Revised	Content merged with appendix A.
Appendix C Failures of the GSM-R Fixed Network Equipment	**Appendix B Failures of the GSM-R Fixed Network Equipment**	Revised	• Content updated to include the complete process. • Distances updated to incorporate metric as well as imperial measurements. • Renumbered to Appendix B.
Definitions	**Definitions**	Revised	Content updated.
References	**References**	Revised	Content updated.

Table A2: GERT8000-TW1 issue 18 to GERT8000-TW1 issue 19

From GERT8000-TW1 issue 18	To GERT8000-TW1 issue 19	Way forward	Comments
Page 1	**Page 1**	Revised	Introduction of 'competent person' as one of the people the module is addressed to.
39. Train radio equipment	**39. Train radio equipment**	Revised	Introduction of 'competent person' as the people responsible.
39.6 Railway emergency group call (REC)	**39.6 Railway emergency group call (REC)**	Revised	Introduction of 'competent person' as the people responsible and within the content of 39.6 b).
NA	**39.7 Duties of the competent person**	New	New section to include the responsibilities of the competent person.

Table A3: GERT8000-TW5 issue 11 to GERT8000-TW1 issue 12

From GERT8000-TW5 issue 11	To GERT8000-TW5 issue 12	Way forward	Comments
Page 1	**Page 1**	Revised	Introduction of 'competent person' as one of the people the module is addressed to.
25.2 Starting a journey from somewhere other than a maintenance depot	**25.2 Starting a journey from somewhere other than a maintenance depot**	Revised	Introduction of instructions for when a competent person has been provided.
25.3 During a journey	**25.3 During a journey**	Revised	Introduction of instructions for when a competent person has been provided.

Appendix B Supporting risk assessment work

Safety Review Report

21-013 - Mitigation of GSM-R failure - Use of a competent person in non-leading cab

Written by:

Vincent Ganthy, Lead System Safety Engineer, RSSB

Issue record:

Issue	Date	Prepared	Reviewed	Approved
Draft 1 for internal review	28/10/2022	Vincent Ganthy		
Version 1.0 (addressing internal comments, for use by the standards team)	03/11/2022	Vincent Ganthy	David Griffin	

Executive Summary

A review has been carried out to consider the possibility to rely on a competent person as an alternative to having to collect portable or transportable radio equipment, in case of lead cab radio failure.

The potential change would be limited to the circumstances where equipment may be collected:

Entering service from somewhere other than maintenance depot.

Failure while in service.

The risk assessment comprised both a qualitative assessment of the proposed change (via stakeholder engagement and review of existing operational rules), and a quantitative assessment using the RSSB GSM-R Failure Risk Model.

0 summarises all the recommendations, including the appropriate section which can be consulted for further information.

List of recommendations

#	Recommendation	Report Section
1	Proposed changes to the standards should be reviewed to mitigate the risk of potential unwanted interactions or confusion between the findings of project 21-013 and 19-005.	0
2	Any proposed change to the rule book or railway industry standards should remain an alternative option to manage the risks associated to a lead cab GSM-R radio failure. It shall not replace other existing operational mitigations currently in place.	0
3	Any proposed change to the rule book or railway industry standards should specify that a competent person would only be able to undertake safety-critical tasks (as clarified by the ORR, Ref. 13) whilst operating a non-leading cab radio. For instance, if the competent person is the guard in charge of dispatch, the change should not prevent that person from carrying out that existing duty.	0
4	The same requirements as for the driver should apply to a competent person upon receiving a REC (bringing the train to a stand immediately and listening to the message).	0
5	Any proposed change to the rule book or railway industry standards should only allow a competent person to use the GSM-R radio equipment from a non-leading cab in the context of an emergency (subject to the limitations identified within the quantitative risk assessment). This includes: monitoring the radio to bring the train to a stand upon receiving a REC, and operating the radio to initiate a REC as a means to stop approaching trains in an emergency.	0

#	Recommendation	Report Section
6	Any proposed change to the rule book or railway industry standards should specifically preclude the competent person from using the radio for any other purpose than an emergency (such as to pass messages between the signaller and the driver).	0
7	A review / consultation with stakeholders should be carried out to clarify potential risks surrounding the receipt of berth-triggered broadcasts (particularly unacknowledged) using unregistered radios (collected or in non-leading cab).	0
8	Any proposed change to the rule book or railway industry standards should make it clear that the presence of a competent person in a non-leading cab is beneficial from a safety perspective if either: the competent person is able to remain continuously in the cab; or, if the competent person is a guard in charge of dispatch, the person is able to return immediately to the non-leading cab when not carrying out dispatching duties.	0
9	Any proposed change to the rule book or railway industry standards should clarify that the immediate return would not include travelling through multiple carriages to return to the non-leading cab.	0
10	Any proposed change to the rule book or railway industry standards should clarify that the immediate return is also essential to allow the competent person to quickly initiate a REC in case of an emergency.	0
11	In the context of a proposed change to the rule book or railway industry standards, relying on a competent person in a non-leading cab rather than collecting equipment would be acceptable if the driver and competent person have access to a direct means of communication between cabs.	0
12	Any proposed change to the rule book or railway industry standards should make it clear that the means of communication would need to allow instructions and / or information to be shared between parties regarding the nature of the danger. That is, relying solely on the train buzzer or bell would not constitute a suitable means of communication.	0
13	Any proposed change to the rule book or railway industry standards should also clarify that, when relying on cab-to-cab communications, operational procedures should be in place to allow a competent person to initiate a REC if suspecting an incident has occurred and unable to contact the driver. This would cover the cases where the driver may be incapacitated as a result of the accident.	0
14	It is recommended that a proposed change to the rule book or railway industry standards should not allow relying on a competent person for the rest of the day as an alternative to collecting equipment when cab-to-cab communication is not available.	0

#	Recommendation	Report Section
15	Any proposed change to the rule book or railway industry standards should mention that, when equipment can be collected readily within the existing limits (i.e. 75 miles), this should be done rather than relying on a competent person.	0
16	Any proposed change to the rule book or railway industry standards should be only considered as a potential alternative when the competent person is already on-board, or available at the next available location / within 15 miles, whichever comes first.	0
17	Relying on a competent person operating a non-leading cab radio without means to communicate with the driver would still provide some level of risk mitigation. However, there is a lot of uncertainty around the actual effectiveness in those circumstances. This should not replace collecting radio equipment within the existing limitations of the railway standards.	0
18	Any proposed change to the rule book or railway industry standards should only allow relying on a competent person in a non-leading cab for up to 180 miles before portable or transportable equipment is collected. This would prevent trains travelling over much longer distances from relying on the less effective mitigation provided by a competent person.	0

1. Contents

1 Background and Scope

Background

An ASLEF letter addressed to the ORR highlighted a concern about how trains operate under GSM-R failure conditions (Ref. 1). It focused on failures in a leading cab where contingencies, whilst possibly complying with RSSB guidance, are not deemed sufficient.

It specifically referred to rules governing the running of trains on single lines, branch lines and long cross-country routes where no signals are provided or areas of low intensive signalling. The letter also noted that these same locations also often have very poor or no mobile signal.

Discussions with industry stakeholders highlighted that South Western Railway (SWR) rules allow for a guard to operate another cab radio in case of GSM-R failure affecting the leading cab. Such mitigation does not form part of current rules or standards. Further, this had not been considered in the original safety risk assessment work which led to the creation of the operational requirements for GSM-R radio (Ref. 2).

The RSSB Risk Safety and Intelligence team undertook a preliminary assessment of the measure. It aimed to investigate what potential benefits may exist. Subsequently, it reviewed whether an update to existing standards could be considered to allow further use of the mitigation by the industry.

The initial assessment formed the supporting basis for the request for help submitted by RSSB to carry out standards project 21-013 (Ref. 3). The present report provides a detailed write-up of the modelling carried out and conclusions on possible changes to applicable standards.

Scope of the review

Framing the safety review

The review has been carried out in relation to the current requirements for leading cab radio failure. It considered the possibility to rely on a competent person as an alternative to having to collect portable or transportable radio equipment.

The potential change may affect the following situations:

- Entering service from somewhere other than maintenance depot.
- Failure while in service.

The possible change does not affect:

- The existing rules applicable to trains entering service from a maintenance depot.
- The requirement to finish the train service at a location where repair can take place.

In both applicable cases, the railway standard currently allows a train experiencing a failure to travel for up to 75 miles limit to collect the radio equipment.

Two possible alternatives are reviewed for the proposed mitigation when relying on a competent person in a non-leading cab operating a working radio:

- Replace the need to collect portable / transportable radio equipment for the rest of the day.
- Temporarily rely on a competent person in another non-leading cab to extend the distance that can be travelled by a train before equipment has to be collected.

The assessment assumes that the competent person is able to use the GSM-R equipment to receive or initiate Railway Emergency Calls (REC). It will not define or specify the minimum training requirements.

The report does not make any recommendation for mandatory competent persons to be present on-board trains; nor does it recommend that all staff on-board trains need to be trained.

This assessment only aims to evaluate the potential safety benefits of such mitigation. That mitigation would be expected to remain optional, and in line with the current requirements associated to the provision of collectable equipment.

Potentially affected standards

The following standards have initially been referenced within the request for help:

- Operational requirements for GSM-R radio, RIS-3780-TOM (Ref. 2).
- Defective On-Train Equipment, RIS-3437-TOM (Ref. 4).
- Preparation and movement of trains: Defective or isolated vehicles and on-train equipment, GERT8000-TW5 (Ref. 5).
- Dealing with a train accident or train evacuation, GERT8000-M1 (Ref. 6).

The standard for defective on-train equipment is not expected to be affected by the scope of the proposed change. This is because rules for trains entering service from a maintenance depot are not subject to change.

Section 4.27 of the Defective On-Train Equipment standard cover train radio equipment failure. Paragraph 4.27.1.1 refers to rules when starting a journey from a maintenance depot. For other cases, the standard makes reference to RIS-3780-TOM.

Related RSSB projects

Another standard project is currently ongoing in RSSB in relation to the GSM-R provisions and alternative means of communications: project 19-005 - Secondary communications in the absence of GSMR.

The scope of both projects 21-013 and 19-005 do not overlap. However, both may be leading to proposed changes to similar standard documentation (e.g. GERT8000-M1, Ref. 6).

Recommendation: Proposed changes to the standards should be reviewed to mitigate the risk of potential unwanted interactions or confusion between the findings of project 21-013 and 19-005.

Risk Assessment Methodology

The risk assessment comprises both a qualitative assessment of the proposed change (via stakeholder engagement and review of existing operational rules), and a quantitative assessment using the RSSB GSM-R Failure Risk Model.

The quantitative assessment has been carried out using RSSB's GSM-R Failure Risk Model. This model has been used to provide the safety justification underpinning existing railway standards such as RIS-3780-TOM (Ref. 2) and module TW5 of the rule book (Ref. 5).

It allows understanding the effects of certain types of GSM-R equipment failure on the safety risk of train accidents.

The failure types considered include both local failures (such as train on-board equipment) as well as extended area failures affecting multiple trains on sections of a route (network outage).

The calculated risk is divided into two main contributions. One is the immediate train accident risk when travelling around the network and experiencing a specific GSM-R failure. The other is the knock-on risks caused by disruptions on the network as a result of chosen operational responses (train delays or cancellations).

Reference should be made to the original report on the GSM-R failure safety risk model for further details (Ref. 7).

The ability to account for leading cab radio failures is already included within the model. The report referenced above provides detailed information on the capability and original modelling results. Those are not repeated here.

The radio equipment can provide the ability to initiate a REC. Train drivers are expected to bring their train to a stop upon receiving such a call, reducing the likelihood of exposure of trains to the identified danger. The GSM-R failures risk model calculates the variation in train accident risk where GSM-R and/or other communication equipment are unavailable.

Qualitative review of proposed change

The qualitative assessment of the change supports the risk modelling activities by providing further context to the change and highlighting operational challenges and / or concerns. This supports the

correct interpretation of the outcomes of the quantitative analysis and to support taking safe decisions.

Industry stakeholder engagement meeting

The project team (Laura Fernandez and Vincent Ganthy) held a safety modelling validation workshop with industry stakeholders on Wednesday October 12th, 2022.

The following industry members attended the workshop:

Anthony Wells, ASLEF

Jonathan Havard, RMT

Colin Gibbons, Network Rail

Claire Repeti, Rail Partners

Paul Dixon, Rail Delivery Group

Richard Farish, LNER

Simon Jarret, Chiltern Railways

Tim Wells and Stephanie Smith, Govia Thameslink Railway

The key focus of the workshop was to consult with industry on the operational factors to be accounted for in relation to the change, to support the risk modelling activities. In particular, the discussions covered:

Whether or not the proposed mitigation addresses an actual operational issue with the industry.

The practicalities surrounding a competent person's ability to remain within a non-leading cab.

The practicalities surrounding a competent person's ability to use the emergency brake upon receiving a REC.

The practicalities surrounding a competent person's awareness of the need to initiate a REC following a hazardous event affecting the train.

The practicalities surrounding safety critical communications between the train and the wayside in the context of lead cab radio failure.

These individual discussion points are introduced in the following sections in turn. Each point is reviewed in relation to existing operational rules.

Is the change addressing an industry operational issue?

This particular question aimed to question whether the potential change and the review work could actually bring benefits to the industry. The view considered the reliability of the radio equipment and whether cab radio failures are a significant issue.

The discussion covered three points distinctly:

The mitigation has already been adopted by one train operating company. The work would produce a risk assessment of the ongoing practice in relation to the requirements included in the current rail industry standard (Ref. 2).

The availability of portable or transportable radio equipment can vary, as this equipment is owned by train operating companies. In some cases, provisions are limited and the alternative to rely on a competent person could provide further operational flexibility.

The considered change, if found beneficial, would only be another alternative to the existing list of mitigations available to train operators to manage the risk of lead cab radio failure. As such, its adoption would be entirely voluntary. Further, it would be dependent on the pre-existing company operating instructions (which may preclude adoption) and availability of such a competent person.

Lead cab radio failures can remain a fairly frequent occurrence when considering the whole of the GB network, even if they may appear of limited impact individually.

A known equipment manufacturer quotes over 250,000 hours of mean time between failures[2].

If one considers that: approximately 10,000 rolling stock or locomotive cabs are in operation around the network[3]; 5-10% of trains are not normally used (spares allowing train replacement in case of failures and / or allowing maintenance of parts of the fleet); and also assuming that only half, or even a quarter, of those cabs operate when trains are circulating (e.g. multiple units or coupled multiple units), that would equate to between an equivalent of 2500 to 5000 cabs in operation.

Considering trains circulating 360 days per year, with 18 hours of service per day, this leads to between 14.6 (2500 x 0.9 x 18 x 360) and 30.8 (5000 x 0.95 x 18 x 360) million hours of operation per year.

If all in-cab radio equipment achieves the mean time between failure of 250,000 hours, that would still equate (statistically) to between 58 and 123 failures per year. That translates on average to a failure every 3 to 6 days.

Current rules on defective on-train equipment (Ref. 4 and 5) would require locating portable or transportable GSM-R radio equipment to be provided to the driver within 75 miles of the failure to be able to continue their journeys for the rest of the day. Other alternatives exist, such as ensuring the cab will not be driven from for the rest of the day. On some trains, a competent person may be easily available to support operations on a contingency basis, offering additional flexibility. However,

[2] https://www.mobility.siemens.com/uk/en/portfolio/rail-solutions/automation/mobile-communications.html, consulted on October 21st, 2022

[3] An estimation of active rolling stock cabs was done to support analysis work to address the Rail Accident Investigation Board recommendation 11 from the Margam accident investigation.

this may not be practical for all train operations (e.g. for driver only operation or locomotive-hauled services).

Recommendation: Any proposed change to the rule book or railway industry standards should remain an alternative option to manage the risks associated to a lead cab GSM-R radio failure. It shall not replace other existing operational mitigations currently in place.

Can a competent person remain in a non-leading cab?

The study considers the benefit of any competent person available, either already on-board or purposefully joining the service. It is, however, recognised that where trains operate using guards, those could be a convenient person to rely on in case of lead cab radio failures.

Industry stakeholders highlighted the need for guards to perform dispatching duties from the platform. Such activities would thus require them to leave the cab temporarily. The estimated time for this would vary. Industry stakeholders mentioned that this time may be significant where trains are longer than the platform the train is alighting to. The guard would have to leave the cab before the train reaches the station and come back after the train has departed. An estimate of potentially 10 minutes, even up to 15 minutes could elapse in some circumstances.

Such durations present a challenge, as the train could travel significant distances whilst the guard would return to the non-leading cab. Additionally, industry members highlighted that not all stations have signals at platform ends, which could be set to danger by a signaller following a REC whilst the train is at a stand.

Requirements associated to train dispatch would require the person in charge of dispatch (which can be the train guard) to carry out duties from the platform (Ref. 8).

Recommendation: Any proposed change to the rule book or railway industry standards should specify that a competent person would only be able to undertake safety-critical tasks (as clarified by the ORR, Ref. 13) whilst operating a non-leading cab radio. For instance, if the competent person is the guard in charge of dispatch, the change should not prevent that person from carrying out that existing duty.

The quantitative assessment (in Section **Error! Reference source not found.**) reviews the effects of such prolonged absences on the risk. Any limitation to the time that can be spent away from the cab will be identified. This should assist in determining whether a train guard may be able to carry the duties of the competent person, or whether this should be limited to specific routes, avoiding locations where the guard would be remaining away for a significant amount of time. This may be translated into guidance for the purpose of the standard, if appropriate.

In practice, a REC could be received at any point in time whilst the train having a failed lead cab radio operates. As such, this may be whilst the competent person is monitoring the radio, or right after the person has left to attend dispatching duties.

As a result, the review will consider an average response time that can be expected from a competent person. Corresponding maximum time away from the cab may be determined by associating those averages to typical journey profiles (i.e. number of stops per journey and number of journeys per day).

The railway industry standard on GSM-R Train Voice Radio Systems (Ref. 10) specifies audible and visual signs which have to be present upon receipt of a REC. Whilst the audible alarm may have elapsed by the time the competent person returns, the flashing warning will remain active. A missed REC should therefore remain noticeable even if unanswered initially, upon return of the competent person to the non-leading cab.

The GSM-R Functional Requirements Specification (Ref. 11) requires speech connection to be made immediately following the warning tone. It is therefore possible that the competent person may return whilst the call is still ongoing and get additional signs that a REC has been received.

The same specification also requires that an audible and visual indication be also provided, should the radio move out of the area whilst the emergency call is in progress.

Both above requirements are included in GSM-R User Procedures (Ref. 12).

Can a competent person use the emergency brake upon receipt of a REC?

The industry stakeholders generally agreed that there is not necessarily an issue with a competent person in a non-leading cab activating the emergency brakes following the receipt of a REC. However, concerns were expressed that the person would not have the situational awareness of the driver when deciding to bring the train to a stand. Typically, the train could come to a stand in a sub-optimal location (e.g. within a tunnel, viaduct, or neutral section).

The project queried whether the competent person would attempt to contact the driver about the REC rather than use the brakes. Industry stakeholders highlighted that driver training could require the driver to ignore communications from the crew to focus on the immediate safety of the train. As such, a call from the competent person could remain ignored in some circumstances.

Operational rules require drivers to bring their train to a stand immediately upon receiving a REC and listen to the message (Section 39.6.a, Ref. 9). Such an instruction is not dependent on the particular location of the train, or its path when the REC is received. A train receiving a REC would have no prior indication of where the danger may lie, which could be very close. Drivers may however wish to bring their train to a stand using a service brake application rather than the emergency brake, allowing for greater flexibility with regards to the final stopping location.

In the context of the proposed change, upon receiving a REC, similar behaviour from a competent person as the driver should be expected. The competent person should also bring the train to a stand immediately and listen to the message.

There may be problematic locations for a train to stop (e.g. a tunnel), where, in particular, no GSM-R coverage may be available. Such areas are limited on the network. At most, this accounts for 6% of the network[4]. However, this includes routes not equipped with GSM-R coverage (e.g. sections of route using Radio Electronic Token Block signalling system in Scotland). For areas part of the GSM-R radio network, coverage is intended to be 100% with only local issues affecting coverage. In the absence of situational awareness from the competent person, a prudent course of action would remain bringing the train to a stop, using the emergency brake.

Recommendation: The same requirements as for the driver should apply to a competent person upon receiving a REC (bringing the train to a stand immediately and listening to the message).

Would a competent person be aware of the need to initiate a REC?

Similarly to the previous discussion point, concerns have been expressed about the potential lack of situational awareness of a competent person before initiating a REC. Specifically, the industry stakeholders expressed the expectation that a competent person should first attempt to contact the driver before taking action.

It was recognised that the time to get in touch with the driver could vary significantly depending on the circumstances (e.g. whether a hazardous event has actually occurred, what type of event occurred, and whether or not the driver may have been incapacitated). It was not clear how contact between the driver and the competent may be established, and this could significantly affect the time available to warn approaching trains.

The following hazardous events are modelled using the RSSB GSM-R Failure Risk Model:

Derailments (secondary collisions).

Train collisions (secondary collisions).

Collisions with object.

Train fires (uncontrolled evacuations).

Trespass.

Emergency evacuations.

The operational rules applicable to each hazardous event are reviewed in the following sections to determine qualitatively the likelihood of the competent person's awareness. This is done in combination with a review of the adopted assumptions within the original model (as used to determine current rules).

[4] https://www.networkrail.co.uk/running-the-railway/gsm-r-communicating-on-the-railway/ claims 15000+kms of lines covered. ORR Data Portal records 15935 kms of line in total. https://dataportal.orr.gov.uk/statistics/infrastructure-and-emissions/rail-infrastructure-and-assets/, consulted on October 21st, 2022

In the context of the rule book, the following events are termed train accidents in module M1 (Ref. 6): derailments, collision involving trains, collision with an object, train fires and evacuation on running lines. Module TW1 (Ref. 9) covers rules related to trespassers.

The quantitative assessment (in Section **Error! Reference source not found.**) reflects the way the proposed change can assist following a hazardous event, as assessed within the qualitative assessment of operational rules.

The means for driver and competent person to exchange information in the context of a hazardous event having taken place are likely to strongly influence the potential benefits of the competent person travelling in a non-leading cab during lead cab GSM-R failures.

It is worth pointing out a key limitation in the scope of the quantitative assessment using the GSM-R Failure Risk Model. It assesses the success of the train crew in providing emergency protection for a range of hazardous events. It does not split cases where the train crew would warn other approaching trains about dangers which may only affect them (and not the train reporting the danger).

This could be the case for instance if a driver were to spot a landslip or object affecting an adjacent line but not the line the train is currently running on.

In such cases, the driver could normally decide to initiate a REC. In the context of the proposed change, a competent person may remain completely unaware of those dangers to other trains unless communication can be established by the driver. Without the ability to communicate remotely with the competent person (via cab-to-cab communication), the driver would then only have limited alternatives, such as:

- Stopping at the next Signal Post Telephone to warn the signaller.
- Stopping the train and travelling back to the competent person’s cab to initiate a REC.

Note that the driver may also switch on the hazard warning indication (or a red light forward), to warn approaching trains.

The interpretation of the quantitative assessment results takes into account the potential added benefit of the driver being able to communicate with the competent person to warn approaching trains of dangers on other lines.

Derailment (secondary collisions) and train collisions (secondary collisions)

Train crew duties in relation to train derailments and collisions involving trains are included within Section 2 of Module M1 (Ref. 6).

The driver's duty is to tell the signaller about the accident, after switching on hazard warning indication or displaying a red light forward. The driver then needs to check if other lines are obstructed, then decide the quickest way to stop approaching trains. The driver needs to carry out

emergency protection if the signaller cannot provide signal protection or the driver cannot contact the signaller.

The guard's duty (when present) is to check if other lines are obstructed, then decide the quickest way to stop approaching trains, place track-circuit operating clips on obstructed lines, then contact the driver. The guard must also carry out the driver's instructions if the guard cannot contact the driver or the driver is unavailable.

In the context of the proposed change, the driver would not be able to let the signaller know immediately about the accident.

Should the competent person be aware of the initial accident, then the competent person should immediately initiate a REC on behalf of the train driver.

This would be the quickest way to warn the signaller in the absence of a lead cab radio. Train derailments and train collisions are rare. As a result, if the competent person was aware of such an accident, initiating a precautionary REC would be a reasonable response to mitigate potential risks to approaching trains on behalf of the driver.

There may, however, be cases where the competent person would not be immediately aware of the accident. This is more likely to be the case for longer trains (where effects on the non-leading cab may be limited), where the train may have appeared to come to a possibly abrupt stop. The competent person may then only suspect an unusual situation has occurred.

If the competent person has access to a means to communicate with the driver remotely without leaving the cab, the competent person should contact the driver using it. In such a case, the competent person could consider initiating a REC as a precaution if being unable to contact the driver within a given timeframe (to be assessed as part of the quantitative modelling).

Note that this would generally align with the guard’s duty when unable to contact the driver. A minute may pass before the competent person decides to try and contact the driver. The need to initiate a REC may be clarified within 30 seconds.

If no means of remote communication exists between the competent person and the driver (e.g. no cab-to-cab telephone or the equipment is non-functional), then the only way a competent person may become aware of the accident is by moving towards the driver’s location. The competent person may realise an accident has taken place before reaching the driver.

If the competent person realises an accident has taken place before reaching the driver, the competent person should return to the non-leading cab and initiate a REC.

The travelling time could take up to approximately 12 minutes[5]. This is not accounting for the additional one minute assumed before the competent person starts moving towards the front of the train, introduced above. This would form the upper limit of the range of response time that could be applied to the competent person when reviewing the absence of a means of cab-to-cab communication with the driver.

Original GSM-R Failure Risk Model assumptions: the driver may be incapacitated as a result of the initial accident. This is dependent on the initial speed of the train. Similarly, the radio may be broken as a result of the accident.

In the context of the proposed change, the radio in a non-leading cab would be assumed to be potentially broken as a result of the initial accident (e.g. the parts that may be broken as a result of the accident may be common to multiple cabs, such as an antenna). The original model, which considered the use of a guard, ignored the probability that the guard could be injured. This has been left unchanged in the context of a competent person sitting in a non-leading cab.

Collisions with object

The duties of the driver, signaller and guard are identical to those applied in case of derailments or collisions involving trains. Subsequently, the reasoning adopted for the previous hazardous events can similarly apply in this case.

However, the collision with an object may be less noticeable by a competent person in a non-leading cab compared to train derailments or collisions involving trains. This could be due to the nature of the object, its size or other factors. The colliding train would come to a stop, but this may appear like an abrupt / possibly emergency stop of the train (e.g. when approaching red signals).

The competent person may not immediately perceive this as a case requiring to warn approaching trains. The duration before the competent person attempts to contact the driver, or travel to the driver, could be assumed to be two minutes (i.e. one extra minute compared to the train derailment or train collision).

Original GSM-R Failure Risk Model assumptions: the driver is assumed not to be incapacitated, and the radio would remain operational. In the context of the proposed change, the radio in a non-leading cab would similarly be assumed to remain available for use by a competent person.

Train fires (uncontrolled evacuations)

Train crew duties in relation to train fires are included within Section 4 of Module M1 (Ref. 6), whilst duties in relation to uncontrolled evacuations are covered under Section 6.6 of Module M1.

[5] 12 coaches, each about 20 metres in length equals 240 metres to travel, each way. A typical human speed is 1 metre per second. Considering potential crowding slowing the competent person (assuming the speed being reduced by 1/3), this would require approximately 6 minutes each way. The competent person may notice the accident before reaching the driver location and return sooner (and it would take less time on shorter trains).

In the case of fires specifically (excluding uncontrolled evacuations), the driver is only expected to tell the signaller and carry out emergency protection when the fire is extinguished, but the train cannot proceed. Other occurrences are related to the need to carry out a controlled evacuation. For those cases, it would be expected that on-board personnel would be aware of the event and thus a competent person would be able to initiate a REC to warn the signaller if necessary (e.g. as part of the controlled evacuation process).

In the specific case of uncontrolled evacuations, it is the responsibility of the driver to inform the signaller to protect all lines that may be affected. If unable to contact the signaller (as would likely be the case without the in-cab radio), the driver must carry out emergency protection. In such a case, the competent person could initiate a REC as an alternative, replacing the need for the driver to contact the signaller / carry out emergency protection.

This will be dependent on the available means of communication between the driver and competent person, and whether the competent person may have left the cab initially to help tackle the initial fire.

Note that if the driver had left the leading cab to tackle the fire, the response time could be similar to that of a competent person having left a non-leading cab (i.e. needing to travel back to the cab to inform the signaller).

The time would be generally proportional to the distance to travel back to the cab. At the very most, a competent person may need to travel the whole length of the train to a back cab. For a 12-car unit, this could take up to approximately 6 minutes[6].

Original GSM-R Failure Risk Model assumptions: the driver is assumed not to be incapacitated, and the radio would remain operational. In the context of the proposed change, the radio in a non-leading cab would similarly be assumed to remain available for use by a competent person.

Trespass

The reporting of trespassers is a duty of the driver covered under Section 44 of Module TW1 (Ref. 9). The driver needs to inform the signaller immediately including various details about the situation. This includes as much details as are available on the location, direction of travel and appearance of trespassers. The duties do not include carrying out emergency protection (or initiation of a REC).

In the context of the proposed change, it cannot be expected that the competent person would have readily access to the situational information. It would require gathering all the detailed information from the driver first, prior to sharing it with the signaller. This falls outside of the intended scope of the use of the radio by the competent person. As such, any quantitative benefit from the use of a

[6] 12 coaches, each about 20 metres in length equals 240 metres to travel. A typical human speed is 1 metre per second. Considering potential crowding slowing the competent person (assuming the speed being reduced by 1/3), this would require approximately 6 minutes. If the fire took place from a random location, this could be about half on average (and less on shorter trains).

non-leading cab radio by a competent person should exclude cases involving trespassers. Further discussion on the role of a competent person in communicating with the wayside is included in section 0.

Original GSM-R Failure Risk Model assumptions: the driver is assumed not to be incapacitated, and the radio would remain operational. In the context of the proposed change, the radio in a non-leading cab would similarly be assumed to remain available for use by a competent person.

However, no benefit should be taken for the operation of a radio from a non-leading cab in the case of trespass.

There may be occurrences where drivers may want to use a REC in relation to trespassers. This could include for instance cases where trespassers are seen carrying out activities which may endanger other trains (e.g. deliberately placing objects on adjacent lines). In such cases, similar considerations as generally highlighted in Section 0 (considering the benefits of cab-to-cab communication) would apply.

Emergency evacuations

Duties in case of emergency evacuations are covered under section 6.4 of Module M1 (Ref. 6). The driver is normally expected to inform the signaller that an emergency evacuation is taking place and request signal protection on all lines that may be affected. If unable to contact the signaller, the driver is expected to carry out emergency protection. The guard (or the driver in driver-only operation) is responsible for passenger safety (Section 6.5, Ref. 6).

If a competent person is on-board the train, the person would likely be made aware of the need for an emergency evacuation before it takes place (either to assist the driver or undertake the relevant duties as a guard). In such a case, the competent person could initiate a REC before the emergency evacuation starts, hereby replacing the need for the driver to contact the signaller.

This will be dependent on the available means of communication between driver and competent person.

In practice, this would transfer the duty to provide emergency protection from the driver to the competent person.

This is dependent on the competent person either remaining in the cab until the evacuation is ready to take place, or returning to the cab before it starts. If the competent person has to travel back to the cab, the time needed may be similar to that estimated for train fires (uncontrolled evacuations).

Original GSM-R Failure Risk Model assumptions: the driver is assumed not to be incapacitated, and the radio would remain operational. In the context of the proposed change, the radio in a non-leading cab would similarly be assumed to remain available for use by a competent person.

What role would a competent person have when considering safety

critical communications between the train and the wayside?

A discussion took place considering how safety critical communications may take place between the driver and the wayside following a lead cab radio failure. The stakeholders expressed concerns that the competent person may be used as a third party to pass on messages (e.g. between the signaller and the driver). The project clarified that the intent is only to cover emergency cases (receipt or initiation of REC calls) with other means of communications remaining available to the driver to communicate.

Current operational rules cover the communications using GSM-R radio equipment (Section 39, Ref. 9). Section 39.2 requires the driver to use a signal-post telephone to communicate with the signaller if it is not possible to use the radio. Section 39.3 forbids the signaller from sending messages to the driver through anyone else.

The operational rules do not allow relying on third-parties to facilitate communications between the driver and the signaller. The proposed mitigation focuses on the use of the radio equipment by a competent person for emergency situations only. Section 39.2 allows the guard to use the radio and communicate with the signaller in such emergencies. Allowing a competent person from acting as a third party would introduce delays and potential confusion in communications, which is undesirable.

It is not clear whether berth-triggered broadcasts can be received by unregistered radios. In practice, this situation could impact both when collecting equipment and when relying on a competent person is a non-leading cab. In the case of acknowledged broadcasts, the train may be brought to a stand by the signalling system. The driver and signaller would then get in contact (stop and caution). This could constitute a performance issue, but not a safety issue. However, in the case of unacknowledged broadcasts, there would be no way of ensuring the driver is aware of the message. This could be for instance precautionary speed restrictions imposed as a result of extreme weather, as are now in use for intense rainfall events.

Recommendation: Any proposed change to the rule book or railway industry standards should only allow a competent person to use the GSM-R radio equipment from a non-leading cab in the context of an emergency (subject to the limitations identified within the quantitative risk assessment). This includes: monitoring the radio to bring the train to a stand upon receiving a REC, and operating the radio to initiate a REC as a means to stop approaching trains in an emergency.

Recommendation: Any proposed change to the rule book or railway industry standards should specifically preclude the competent person from using the radio for any other purpose than an emergency (such as to pass messages between the signaller and the driver).

Recommendation: A review / consultation with stakeholders should be carried out to clarify potential risks surrounding the receipt of berth-triggered broadcasts (particularly unacknowledged) using unregistered radios (collected or in non-leading cab).

Quantitative risk modelling approach

When considering the risk to trains and the impact of a lead cab radio failure, there are two separate cases which could apply to the affected train. The train impacted by the lead cab radio failure may be:

Heading towards a train accident location.

The train experiencing the accident or identifying the danger to other trains and needing to provide emergency protection.

In the case of the train heading towards an accident, the train is still able to rely on lineside signals. The assessment will identify the circumstances where a competent person operating the radio from a non-leading cab brings a safety benefit.

Following a REC, the signaller / controller would place signals to danger. When experiencing a lead cab radio failure, the approaching train can only rely on those signals to stop the train short of the obstruction on its line. Receiving a REC from a non-leading cab would increase the likelihood of the train stopping short.

When reviewing the case of the train providing emergency protection, the underlying assumption is that the radio failed prior to the initial accident. Only in such a case would a competent person be able to operate the radio from a non-leading cab. Other means of emergency protection remain available to the train crew (e.g. using a lineside telephone).

The cab radio may fail as a result of the train accident. Such occurrences are included in the model. However, the competent person would not be present already in the non-leading cab to operate another radio. This scenario is not within the scope of this assessment.

The GSM-R Failure Risk Model has been expanded to allow the above-described interventions by a competent person to be included in the chains of events which may occur to prevent a secondary collision.

The protection event tree in the model has been modified to include additional gates allowing a competent person to intervene. The ability to rely on the proposed change is configurable in the model to avoid optimism where such a measure is not implemented (and to allow comparison). Relevant pre-requisites and logic have been thoroughly tested for the variety of cases handled by the model. This ensured only relevant results were affected by the changes.

The model requires a number of input parameters and assumptions to operate. Those reflect possible system configurations, and are described in more detail in the following sections.

Inputs

The model input parameters have been reviewed to identify those which may have the greatest impact on the effect of the proposed measure. Sensitivities have been defined for each of the identified parameters to review their combined impact on the effectiveness of the proposed measure. The following inputs have been selected for review, including the range of values for sensitivities:

Line speed: 40 / 70 / 90 / 100 / 110 / 125 mph.

Headway between trains: 4 / 6 / 10 / 15 / 20 minutes.

Distance between signals / lineside telephones: 500 / 1065 / 2000 / 5000 metres.

Note that the effect of varying passenger loadings has also been investigated. However, those had no meaningful effect on the risk comparison. Results from varying the passenger loadings have therefore been excluded.

A few other parameters have been changed compared to original model set up that was used to support the existing railway standards. Namely:

The type of train modelled has changed from a driver-only operation to a guard-operated train. This was required to allow, in the logic, another person to operate the train equipment. It does not presume that the competent person needs to be a guard.

It is also assumed that the trains operated in an axle counter area, hence not allowing the use of track circuit operating devices.

All other parameters in the model have been left to their default values.

The model relies on a wide variety of inputs. These can include, for instance, probabilities of failures or response times. They have been reviewed and validated in dedicated workshops during the initial development of the GSM-R Failure Risk Model and are not considered affected by the proposed change.

Assumptions

General assumptions

The following general assumptions apply to the quantitative risk modelling:

The competent person operates non-leading cab radio only when lead cab radio GSM-R has failed:

There would be no benefit in case of infrastructure network outages.

There would be no benefit if the radio in the non-leading cab is broken as a result of the accident. This has been summarised by hazardous event in Section 0. The radio is otherwise assumed not to fail whilst being operated by a competent person[7].

The competent person normally remains in the non-leading cab:

The competent person is not performing other non-essential duties whilst the train is moving (such as fare checking).

The competent person can still perform essential station duties (if required). See also Section 0.

Assumptions applied for trains heading towards an accident

When the competent person is present within the non-leading cab, a maximum of 10 seconds are assumed to elapse to understand a REC has been received and to initiate the emergency braking.

This is considered conservative in light of the previously agreed modelling assumptions for a train driver to respond to a REC being 5 seconds.

As per Section 0, a competent person could be away from the non-leading cab for up to 15 minutes. For the purposes of the risk model, an equivalent average response time may be calculated. This reflects the fact that the REC may be received at any point during the train journey, rather than consider an absolute worst case.

The following assumptions have been considered to estimate the corresponding response times:

The response time is 10 seconds when the competent person is in the cab.

The response time is 45 seconds when the competent person is a guard performing dispatch duties in the immediate vicinity of the non-leading cab (the guard is assumed to spend one minute stop plus 15 seconds to get in and out of the cab. Whilst spending 90s away from the cab, the competent person would on average be 45s away from the radio).

The response time is 450 seconds when the competent person is a guard performing dispatch duties from a location away from the non-leading cab (e.g. at a short platform).

The equivalent response time is then dependent on the time spent in the cab and the time spent away to perform dispatching duties. The latter is dependent on the proportion of stations having short platforms encountered as part of the train service. 0below provides the sensitivities when varying both parameters. Areas left blank correspond to cases where the competent person would be continuously needed away from the cab.

[7] This is a reasonable assumption considering in-cab radio reliability (see also Section 0). The likelihood of two radios independently failing in the same train on the same day is considered to be negligible.

Illustrating the range of possible equivalent response times to receive a REC

Average minutes between stations	Proportion of short platforms to normal platforms: 0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
	Average response time (s)										
5	21	151	282								
10	15	81	146	212	277	343	408				
15	14	57	101	144	188	232	275	319	363	406	
20	13	45	78	111	144	176	209	242	275	307	340
25	12	38	64	91	117	143	169	195	222	248	274
30	12	34	55	77	99	121	143	165	186	208	230
35	12	30	49	68	86	105	124	142	161	180	199
40	11	28	44	60	77	93	110	126	142	159	175
45	11	26	40	55	69	84	98	113	128	142	157
50	11	24	37	50	63	77	90	103	116	129	142
55	11	23	35	47	59	70	82	94	106	118	130
60	11	22	33	44	55	65	76	87	98	109	120

Varying response times between 10 seconds and 400 seconds (10 / 50 / 100 / 200 / 300 / 400) are subsequently reviewed as part of the quantitative assessment.

The corresponding percentages of time spent inside the non-leading cab by the competent person, for the various operating conditions, are shown in 0below.

Corresponding percentage of time spent in the cab by a competent person

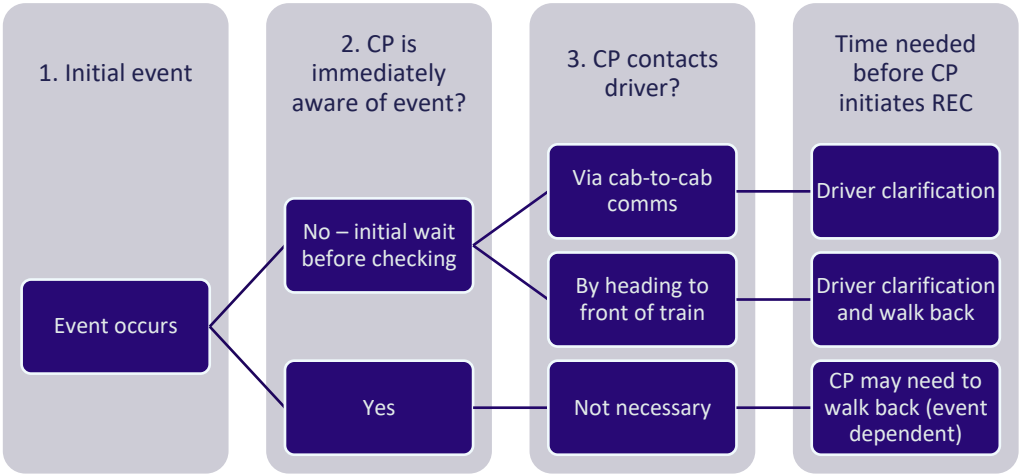
Average minutes between stations	Proportion of short platforms to normal platforms: 0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
	Percentage of time spent in the non-leading cab										
5	70%	43%	16%								
10	85%	72%	58%	45%	31%	18%	4%				
15	90%	81%	72%	63%	54%	45%	36%	27%	18%	9%	
20	93%	86%	79%	72%	66%	59%	52%	45%	39%	32%	25%
25	94%	89%	83%	78%	72%	67%	62%	56%	51%	45%	40%
30	95%	91%	86%	82%	77%	73%	68%	64%	59%	55%	50%
35	96%	92%	88%	84%	80%	76%	73%	69%	65%	61%	57%
40	96%	93%	90%	86%	83%	79%	76%	73%	69%	66%	63%
45	97%	94%	91%	88%	85%	82%	79%	76%	73%	70%	67%
50	97%	94%	92%	89%	86%	84%	81%	78%	75%	73%	70%
55	97%	95%	92%	90%	87%	85%	83%	80%	78%	75%	73%
60	98%	95%	93%	91%	89%	86%	84%	82%	80%	77%	75%

Assumptions applied for trains providing emergency protection

Assumptions surrounding the availability and use of the non-leading cab radio are included in Section 0.

The actual response times will be dependent on whether the competent person notices the hazardous event immediately, and whether cab-to-cab communication is available between the competent person and the driver. 0shows a high-level process to determine a range of realistic response times.

Chain of events before REC may be initiated by a competent person



The following notes apply in relation to the sequences displayed above:

When cab-to-cab communication is normally available, its use is dependent on:

The equipment surviving the event. The modelling assumes similar survivability as that used for the GSM-R radio equipment.

The driver is not incapacitated. Calculations account for potential driver impairment. Where a driver is impaired, the calculation assumes the competent person would try to contact the driver first. As this would fail and after some time, the competent person would issue a REC anyway before carrying other duties as required by the rule book.

When cab-to-cab communication is available, the driver (if not incapacitated) would be able to contact the competent person even. This could this avoid delays in response even if the competent person was initially unaware of the event.

The walking back times are calculated dependent on the number of carriages that may be separating the competent person from the driver. A number of alternatives are modelled for illustration, to gauge the effect of not having access to cab-to-cab communications.

The awareness of the initial event would be highly dependent on the event itself (see also Section 0, in particular regarding events not affecting the track the train is circulating on). Engineering judgement has been applied for the purpose of generating estimates.

Both train fires (uncontrolled evacuations) and emergency evacuations may require the competent person to walk back to a non-leading cab, even if initially aware of the event.

To evaluate the effectiveness of the mitigation in relation to train length, the modelling will consider a case where cab-to-cab communication would be available, against a variety of lengths when this is not available (namely, 2, 4, 6, 8 and 12 cars).

In practice, these distances reflect the separation between the competent person and the driver. The train could itself be longer (e.g. via two or more coupled units).

The likelihoods of noticing the event immediately, based on engineering judgment, are summarised in 0below.

Likelihood of noticing the event immediately

Hazardous event	Likelihood of noticing event immediately					
	Cab-to-cab communication available	2-car train	4-car train	6-car train	8-car train	12-car train
Train derailments	56%	90%	70%	55%	40%	25%
Collisions involving trains	56%	90%	70%	55%	40%	25%
Collisions with objects	28%	45%	35%	28%	20%	13%
Train fires (uncontrolled evacuations)	Not applicable					
Trespass	Not applicable					
Emergency evacuations	Not applicable					

The following notes apply:

- Averaged of the train configurations are used as likelihoods when cab-to-cab communications are available.
- Likelihoods decrease with longer trains as effects on non-leading cabs are likely to be less noticeable.
- The likelihood for collisions with objects is taken as half that for train derailments / collisions involving trains, as the effects on the train may vary depending on the object struck.
- Likelihoods are not used for train fires and emergency evacuations, based on the assessment in Section 0 (considering the competent person may be involved in the management of the incident).
- The measure is also not considered applicable for trespass, based on the assessment in Section 0.

0introduced the approach to estimated response times. Those represent typical estimated times, to determine a range of sensitivities to model. They are not expected to be used for any other purpose.

In addition to the arbitrary likelihoods, additional modelling parameters are summarised below.

- Coach length: assumed 20 metres in length.
- Walking speed: assumed 0.67 metres per second.

Driver incapacitation probability: dependent on modelled event and speed of accident, taken per existing approach. This only applies in the context of cab-to-cab communications.

30 seconds may elapse before a competent person initiates a REC, even if noticing the event.

When the competent person is not certain the event has occurred, a delay of either 60s (for train derailments and collisions involving trains) or 120s (for collisions with objects) is applied.

Time estimates and applicability to the various hazardous events being modelled are summarised in 0below.

Range of response times to initiate a REC

Hazardous event	Maximum response times using cab-to-cab communication (s)	Estimated response times - no cab-to-cab communication (s)				
		2-car train	4-car train	6-car train	8-car train	12-car train
Train derailments	56.4	45.0	111.0	205.5	336.0	592.5
Collisions involving trains	56.4	45.0	111.0	205.5	336.0	592.5
Collisions with objects	116.4	145.5	244.5	356.3	486.0	738.8
Train fires (uncontrolled evacuations)	30.0	90.0	150.0	210.0	270.0	390.0
Trespass	Not applicable	Not applicable				
Emergency evacuations	30.0	90.0	150.0	210.0	270.0	390.0

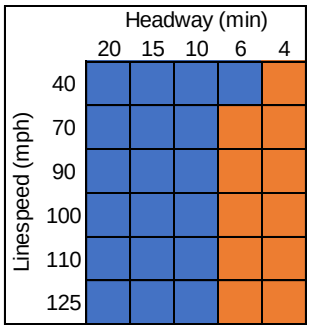
For the cab-to-cab communications, these times do not consider the likelihood that the driver is not incapacitated and may be able to reach out to the competent person (as the likelihood varies with the modelled incident).

Output format

Colour-coded maps are generated in a consistent format to assist with interpretation of the risk results which are expressed in the model in terms of Fatalities and Weighted Injuries.

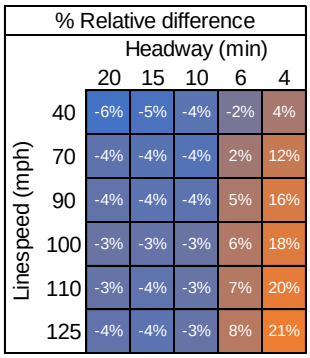
All maps display a comparison between two alternative options, with one always involving the competent person. The maps have two axes, one presenting variable headways or signal distances, the other variable linespeeds. 0shows a typical example, purposefully not including further details.

Example results map



Each colour corresponds to a mitigation providing better risk reduction than its alternative. Where this is necessary, a map showing the associated relative difference between the options may also be included. 0provides an example corresponding to the previous illustration.

Corresponding mapping of the relative difference in risk



Note that the positive and negative values only reflect one measure being better than the other. They do not imply one measure is inherently seen negatively.

Quantitative Risk Assessment Outcomes

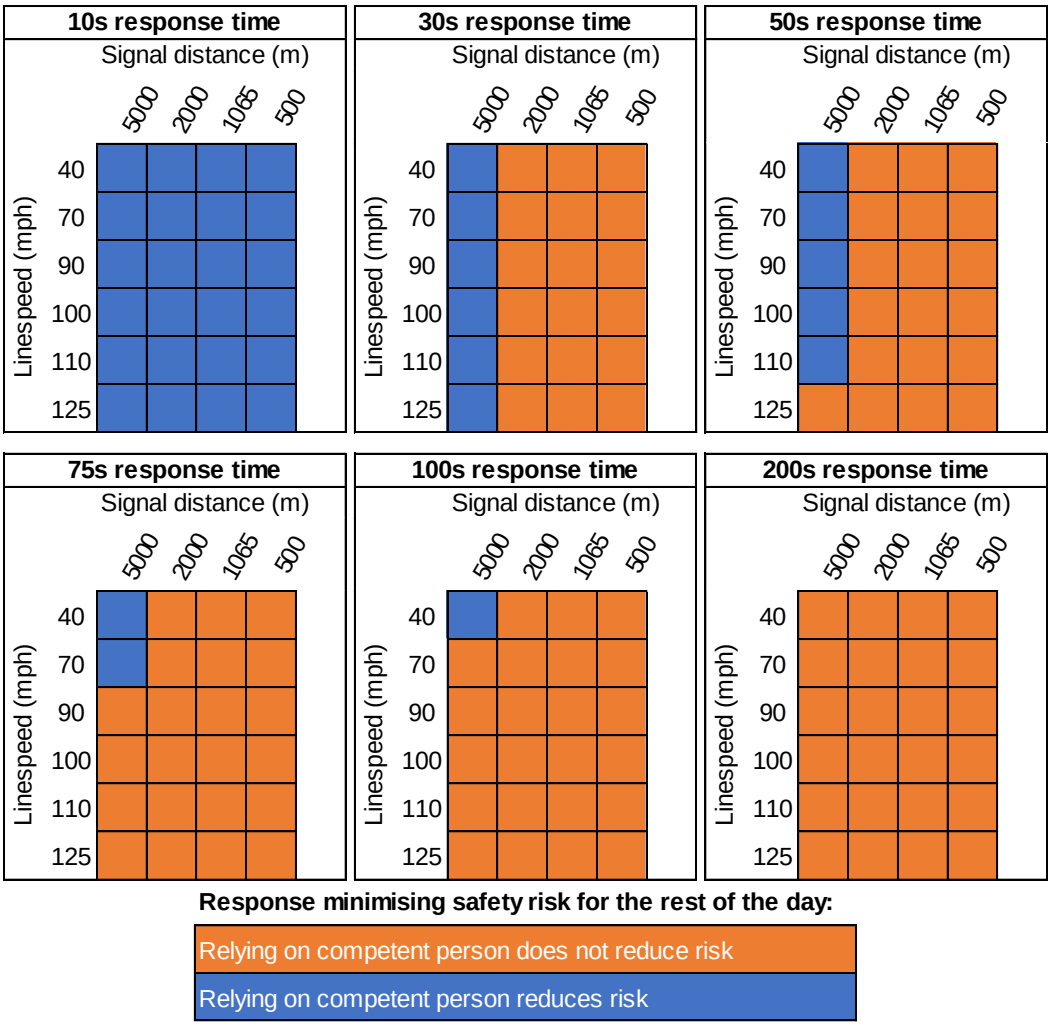
Results when heading towards an accident

This section reviews the effect of varying average response times on the benefit of having a competent person sitting in a non-leading cab to receive a REC compared to the driver only being able to rely on lineside signalling (i.e. without a radio).

Low response times allow the train to be brought to a stand faster than if waiting to come across a signal at danger. As a result, the key parameters of importance are related to the time needed for a driver to come across a signal. Those are namely the distance between signals, and the speed at which the train is travelling.

0presents the comparison between the varying response times on the effectiveness of the competent person.

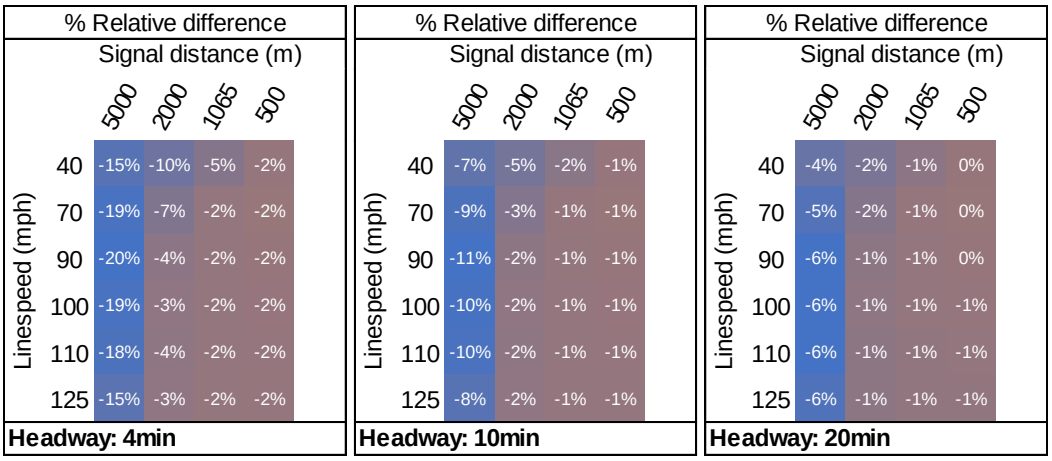
Effects of response time on the effectiveness of a competent person (receiving a REC)



The results show that the benefits of having a person in a non-leading cab are quickly lost when that person has to leave the cab regularly. Only for long signal sections does the person still bring benefits compared to the driver relying on signals being set to danger.

The headway between trains affect the available time to prevent exposure of trains to danger. However, this has no impact on the cases when relying on a competent person is best. It only affects the magnitude of the benefit (the incremental benefit is more important when little time is available to stop trains). 0illustrates this by showing the comparative relative benefits of having a competent person with a 10s response time for varying headways.

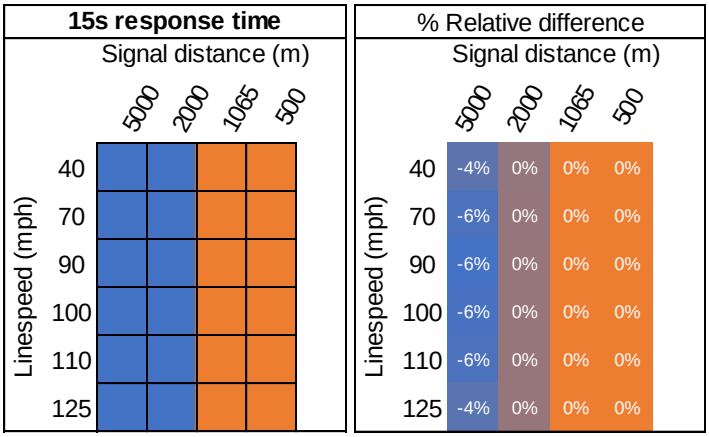
Effects of headways on the effectiveness of a competent person (10s response time)



Benefits for short signal distances remain very limited except when response time is very low. Even at low speed, the train would quickly come in sight of a signal being set at danger. The model assumes drivers can see signals from a distance exceeding 1000 metres (default assumption in the modelling from the original assessment), which further reduces the potential benefit of receiving a REC.

As an additional sensitivity, results for response times of 15 and 20 seconds have been produced. The result mapping for 20 second is identical to the 30 second case. 0shows the results for the 15 second response time.

Additional results for a 15s response time



Response minimising safety risk for the rest of the day:

Relying on competent person does not reduce risk
Relying on competent person reduces risk

In the context of long signal sections, where receiving a REC may be most beneficial and a driver cannot readily be stopped by signals set to danger, an average response time of up to 30 seconds may be considered as tolerable.

Indeed, it is worth noting that for a portion of the time the competent person is away from the cab, the train would be at a stand already in a station. This is particularly true when the competent person does not have to travel through the train because of short platforms.

As a general principle, the time spent away from the cab should be reduced as far as is reasonably practicable. The competent person being away would delay the ability to initiate a REC should that become necessary.

0shows in bold the cases which would meet that 30 second average response time. In practice, the mitigation would be practicable when the competent person does not have to travel through the train because of short platforms.

Highlighting conditions (in bold) corresponding to an averaged response time below 30s

		Proportion of short platforms to normal platforms										
		0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
		Average response time (s)										
Average minutes between stations	5	**21**	151	282								
	10	**15**	81	146	212	277	343	408				
	15	**14**	57	101	144	188	232	275	319	363	406	
	20	**13**	45	78	111	144	176	209	242	275	307	340
	25	**12**	38	64	91	117	143	169	195	222	248	274
	30	**12**	34	55	77	99	121	143	165	186	208	230
	35	**12**	30	49	68	86	105	124	142	161	180	199
	40	**11**	**28**	44	60	77	93	110	126	142	159	175
	45	**11**	**26**	40	55	69	84	98	113	128	142	157
	50	**11**	**24**	37	50	63	77	90	103	116	129	142
	55	**11**	**23**	35	47	59	70	82	94	106	118	130
	60	**11**	**22**	33	44	55	65	76	87	98	109	120

It is worth pointing out that the tolerable response times do not translate systematically into a proportion of occupancy. 0shows the corresponding proportion of time spent in cab for the varying modelling cases, and in bold the cases corresponding an average response time below 30 seconds.

A rule change would not be able to express the mitigation being a suitable alternative on the basis of the proportion of time that a competent person spend in a non-leading cab.

Highlighting percentage of time in cab (in bold) corresponding to an averaged response time below 30s

Average minutes between stations	Proportion of short platforms to normal platforms: 0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
	Percentage of time spent in the non-leading cab										
5	**70%**	43%	16%								
10	**85%**	72%	58%	45%	31%	18%	4%				
15	**90%**	81%	72%	63%	54%	45%	36%	27%	18%	9%	
20	**93%**	86%	79%	72%	66%	59%	52%	45%	39%	32%	25%
25	**94%**	89%	83%	78%	72%	67%	62%	56%	51%	45%	40%
30	**95%**	91%	86%	82%	77%	73%	68%	64%	59%	55%	50%
35	**96%**	92%	88%	84%	80%	76%	73%	69%	65%	61%	57%
40	**96%**	**93%**	90%	86%	83%	79%	76%	73%	69%	66%	63%
45	**97%**	**94%**	91%	88%	85%	82%	79%	76%	73%	70%	67%
50	**97%**	**94%**	92%	89%	86%	84%	81%	78%	75%	73%	70%
55	**97%**	**95%**	92%	90%	87%	85%	83%	80%	78%	75%	73%
60	**98%**	**95%**	93%	91%	89%	86%	84%	82%	80%	77%	75%

Recommendation: Any proposed change to the rule book or railway industry standards should make it clear that the presence of a competent person in a non-leading cab is beneficial from a safety perspective if either: the competent person is able to remain continuously in the cab; or, if the competent person is a guard in charge of dispatch, the person is able to return immediately to the non-leading cab when not carrying out dispatching duties.

Recommendation: Any proposed change to the rule book or railway industry standards should clarify that the immediate return would not include travelling through multiple carriages to return to the non-leading cab.

The modelling considered 15 seconds to return to the cab once dispatch duties have been carried out, which is compatible with travelling a short distance (e.g. between guard operated passenger doors and the non-leading cab).

Recommendation: Any proposed change to the rule book or railway industry standards should clarify that the immediate return is also essential to allow the competent person to quickly initiate a REC in case of an emergency.

Results when providing emergency protection

In line with the framing of the study, two possible alternatives are reviewed:

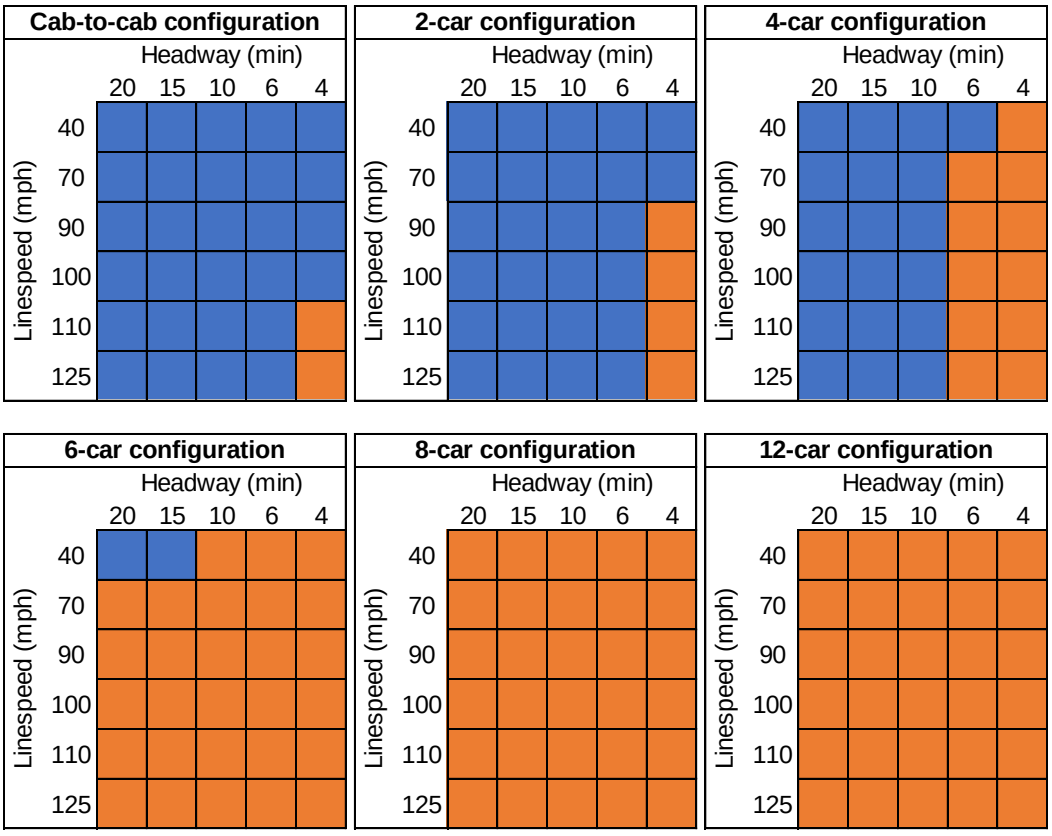
Replace the need to collect portable / transportable radio equipment for the rest of the day.

Temporarily rely on a competent person in another non-leading cab to extend the distance that can be travelled by a train before equipment has to be collected.

The effect of the distance to be travelled until equipment collection has also been investigated, as well as the effect of the competent person being brought later on the train.

Using a competent person as an alternative to collecting equipment for the rest of the day

Effects of train configurations on the effectiveness of a competent person (initiating a REC)



The results compare the effect of relying on a competent person for the rest of the day to collecting radio equipment at the maximum allowable distance of 75 miles.

Generally, only the cab-to-cab, 2-car and 4-car configurations identified a majority of operational cases where a competent person provides equivalent or better safety benefits compared to collecting equipment.

The lower response times increase the effectiveness of the measure, as illustrated by the best results found when cab-to-cab communications between driver and competent person is available.

To allow further comparison, 0shows the relative risk difference between using a competent person and collecting equipment. Negative values mean that relying on a competent person is better than collecting equipment.

Corresponding relative difference in risk between using a competent person and collecting radio equipment within 75 miles (negative: competent person is better)

% Relative difference

Linespeed (mph) \ Headway (min)	20	15	10	6	4
40	-8%	-9%	-9%	-10%	-8%
70	-8%	-9%	-11%	-8%	-3%
90	-8%	-10%	-11%	-7%	-1%
100	-8%	-10%	-11%	-6%	0%
110	-9%	-11%	-12%	-6%	0%
125	-10%	-12%	-13%	-7%	1%

Cab-to-cab configuration

% Relative difference

Linespeed (mph) \ Headway (min)	20	15	10	6	4
40	-8%	-8%	-8%	-8%	-5%
70	-7%	-8%	-10%	-7%	-2%
90	-8%	-9%	-11%	-6%	0%
100	-8%	-9%	-10%	-5%	1%
110	-9%	-10%	-11%	-6%	1%
125	-10%	-11%	-12%	-6%	2%

2-car configuration

% Relative difference

Linespeed (mph) \ Headway (min)	20	15	10	6	4
40	-6%	-5%	-4%	-2%	4%
70	-4%	-4%	-4%	2%	12%
90	-4%	-4%	-4%	5%	16%
100	-3%	-3%	-3%	6%	18%
110	-3%	-4%	-3%	7%	20%
125	-4%	-4%	-3%	8%	21%

4-car configuration

% Relative difference

Linespeed (mph) \ Headway (min)	20	15	10	6	4
40	-3%	-1%	2%	6%	14%
70	1%	2%	4%	15%	26%
90	3%	4%	6%	21%	32%
100	4%	5%	7%	23%	35%
110	5%	6%	8%	26%	38%
125	5%	6%	9%	28%	39%

6-car configuration

% Relative difference

Linespeed (mph) \ Headway (min)	20	15	10	6	4
40	1%	4%	9%	15%	14%
70	8%	10%	15%	29%	26%
90	11%	14%	19%	36%	32%
100	14%	16%	22%	39%	35%
110	16%	19%	24%	43%	38%
125	18%	20%	26%	45%	39%

8-car configuration

% Relative difference

Linespeed (mph) \ Headway (min)	20	15	10	6	4
40	9%	14%	21%	16%	14%
70	19%	25%	33%	29%	26%
90	27%	32%	40%	36%	32%
100	31%	37%	44%	39%	35%
110	36%	42%	48%	43%	38%
125	40%	46%	52%	45%	39%

12-car configuration

Response minimising safety risk for the rest of the day:

Collect portable / transportable equipment within 75 miles
Rely on competent person

When expressed relatively to the risk of collecting equipment, the cab-to-cab configuration shows very comparable or better risks regardless of operating circumstances (at worst being 1% higher than collecting equipment).

The 2-car configuration offers similar results overall, although in such a case the competent person would not be able to readily assist with dangers present on adjacent tracks, as they cannot be readily reported by the driver. Results for 4-car to 12-car configurations show a significant increase

in risk relative to collecting equipment. In those cases, it would not be reasonable to rely on a competent person for the rest of the day.

Note that the distance between signals has virtually no impact on the conclusions above.

Recommendation: In the context of a proposed change to the rule book or railway industry standards , relying on a competent person in a non-leading cab rather than collecting equipment would be acceptable if the driver and competent person have access to a direct means of communication between cabs.

Recommendation: Any proposed change to the rule book or railway industry standards should make it clear that the means of communication would need to allow instructions and / or information to be shared between parties regarding the nature of the danger. That is, relying solely on the train buzzer or bell would not constitute a suitable means of communication.

Recommendation: Any proposed change to the rule book or railway industry standards should also clarify that, when relying on cab-to-cab communications, operational procedures should be in place to allow a competent person to initiate a REC if suspecting an incident has occurred and unable to contact the driver. This would cover the cases where the driver may be incapacitated as a result of the accident.

Recommendation: It is recommended that a proposed change to the rule book or railway industry standards should not allow relying on a competent person for the rest of the day as an alternative to collecting equipment when cab-to-cab communication is not available.

It would likely be confusing to try and define allowable cases where the measure may be reasonable, either by allowing only certain separation distances, or only minimum headways between trains.

It is important to realise that where the comparison highlights a lower safety risk when relying on a competent person, this is in relation to collecting equipment at the maximum allowable distance.

This in practice means that the train would be travelling without any radio capability for some time. The level of risk for that portion of time would be greater than if relying on a competent person.

Following equipment collection, the level of risk for the rest of the day would then become lower than that when relying on a competent person (even accounting for the potential reduced performance of the equipment itself).

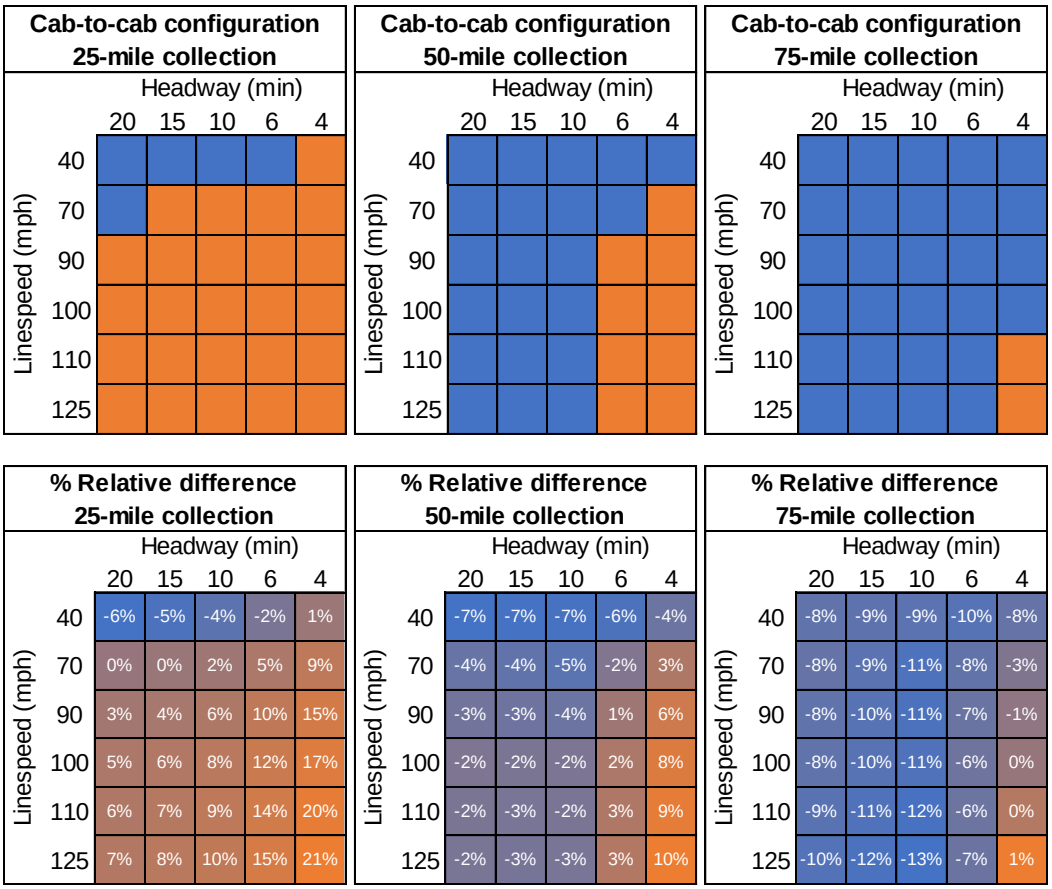
As such, the comparison in this section is made on the basis of cumulative risk exposure. The next section highlights how the cumulative risk is impacted by reducing distance to collection.

Effect of reducing distance to equipment collection

As highlighted in the previous section, the delay in collecting equipment is the key reason why the ability to rely on a competent person may be beneficial (as it may mitigate the risk more readily).

To further illustrate this, 0compares the effect of earlier equipment collection on the balance of risk when compared to relying on a competent person for the rest of the day. Results are shown for 25, 50 and the original 75-mile collection limit. The results are only included for the cab-to-cab configuration, found to be tolerable in the previous section.

Effects of reducing distance to equipment collection on competent person benefits (showing results for cab-to-cab configuration)



The results demonstrates the intuitive conclusion that the earlier the equipment can be collected the better the afforded protection. As the benefits from the competent person remain unchanged, the comparative assessment would favour equipment collection more if that can be achieved sooner.

This reflects the inherently safer option of providing the means of warning approaching trains of danger to the driver, who would be best place to assess the situation and take the decision to initiate a REC.

Recommendation: Any proposed change to the rule book or railway industry standards should mention that, when equipment can be collected readily within the existing limits (i.e. 75 miles), this should be done rather than relying on a competent person.

Effect of delaying the competent person operation of the radio

This section considers the opposite situation compared to the previous section. In this case, 0illustrates the effects of delaying the time at which a competent person starts monitoring the radio when considering equipment collection at the maximum allowable travelled distance.

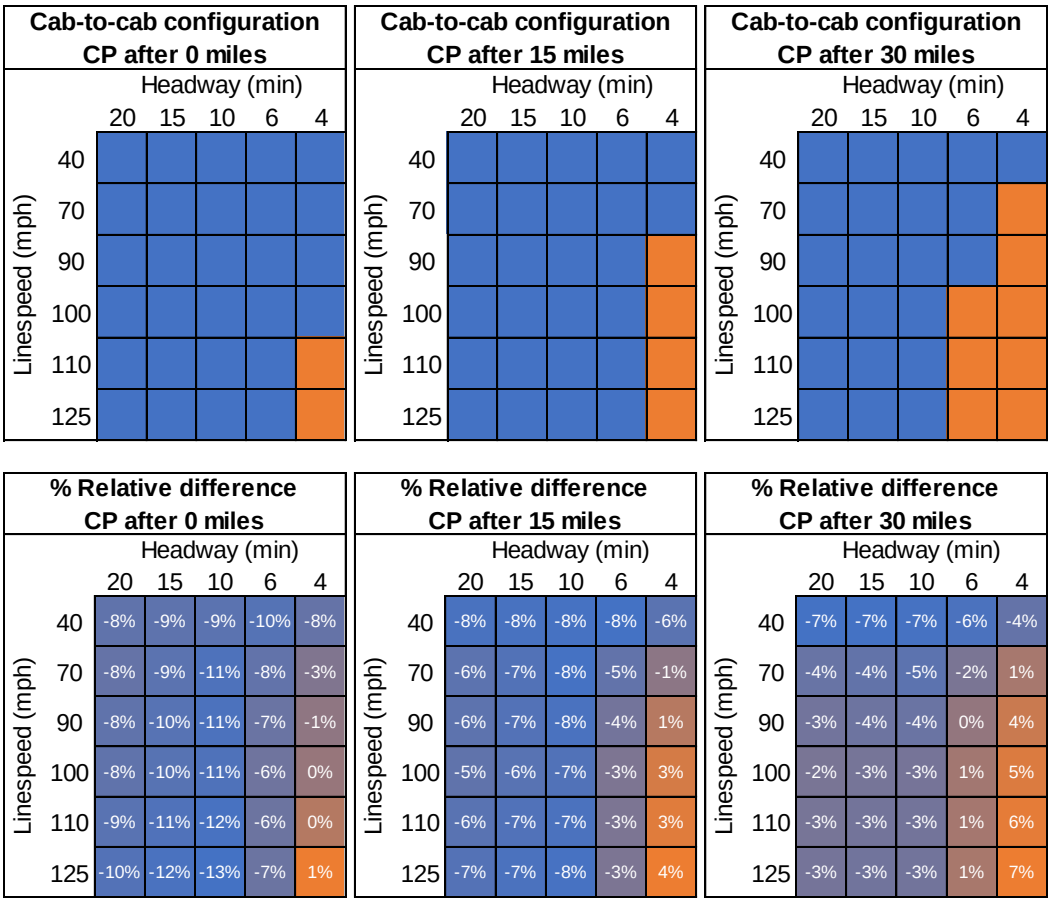
Whilst a guard may be readily available to act as a competent person, there may be cases where the train operator may wish to proceed to a nearby location to allow a suitable person to come on board. This would replicate the approach taken for equipment collection.

Cases where the competent person starts operating the radio equipment immediately (the original assumption shown in above sections), after 15 miles, and after 30 miles have been considered.

The use of a competent person provides less risk mitigation than collecting equipment. As a result, lesser travelled distances without mitigation would be expected to be tolerable.

Results show a more pronounced impact when considering higher linespeeds. Within 15 miles, the absolute worst case modelled (4 minute headway and 125 miles per hour linespeed), leads to a level of risk 4% greater than when collecting equipment after 75 miles. This is considered a reasonable limit when intending to rely on the competent person for the rest of the day.

Effects of delaying the competent person's operation of the radio (showing results for cab-to-cab configuration)



Recommendation: Any proposed change to the rule book or railway industry standards should be only considered as a potential alternative when the competent person is already on-board, or available at the next available location / within 15 miles, whichever comes first.

Effect of relying on the competent person before collecting equipment

As an alternative to being able to rely on the competent person for the rest of the day, the opportunity to delay the equipment collection by temporarily relying on the person has been reviewed.

In the context of the results shown for previous sections, this may only be relevant if considering allowing the reliance on a competent person despite not having access to cab-to-cab

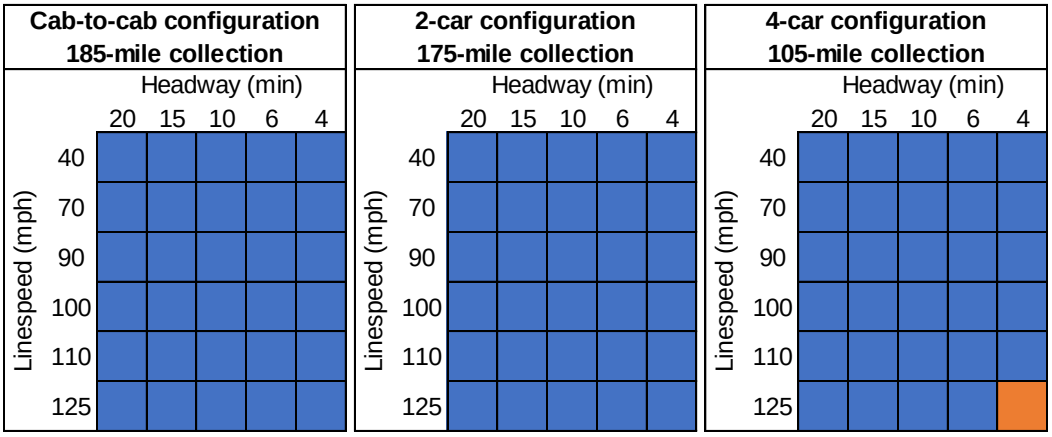
communications. However, it may remain of interest when trains are travelling for significant distances.

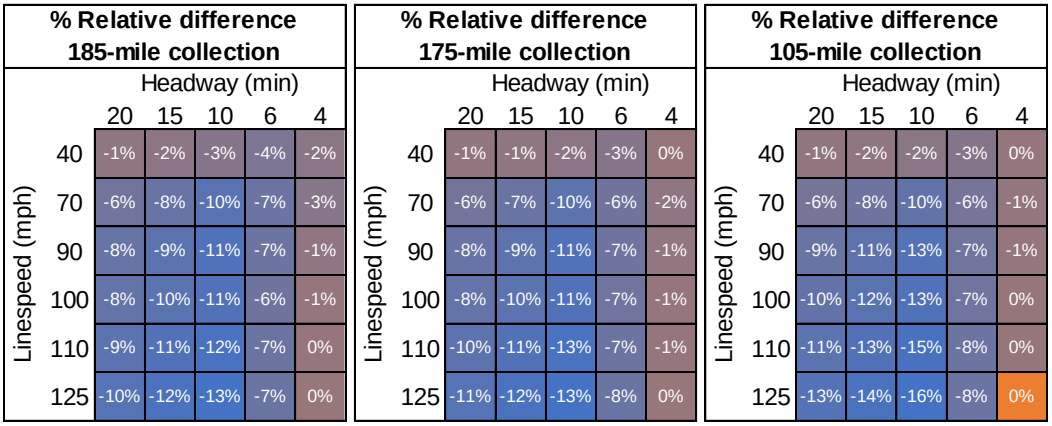
The modelling considers by default an average distance per journey of 77 miles, and a number of journeys per day of 6 (i.e. 462 miles in total). When trains are travelling long distances on a daily basis, such as high-speed services, the cumulative risk exposure may increase significantly.

The lesser benefit of relying on a competent person compared to collecting equipment may tend to favour collecting equipment on those routes.

0highlights possible tolerable collection distances for cab-to-cab, 2-car and 4-car configurations.

Allowable delayed equipment collection when relying temporarily on competent person





Response minimising safety risk for the rest of the day:

Collect portable / transportable equipment within 75 miles
Rely on competent person for **X** miles then collect radio

The distances shown in 0are rounded to the nearest 5 miles and correspond to those found to provide at worst the same level of risk mitigation as collecting equipment after 75 miles.

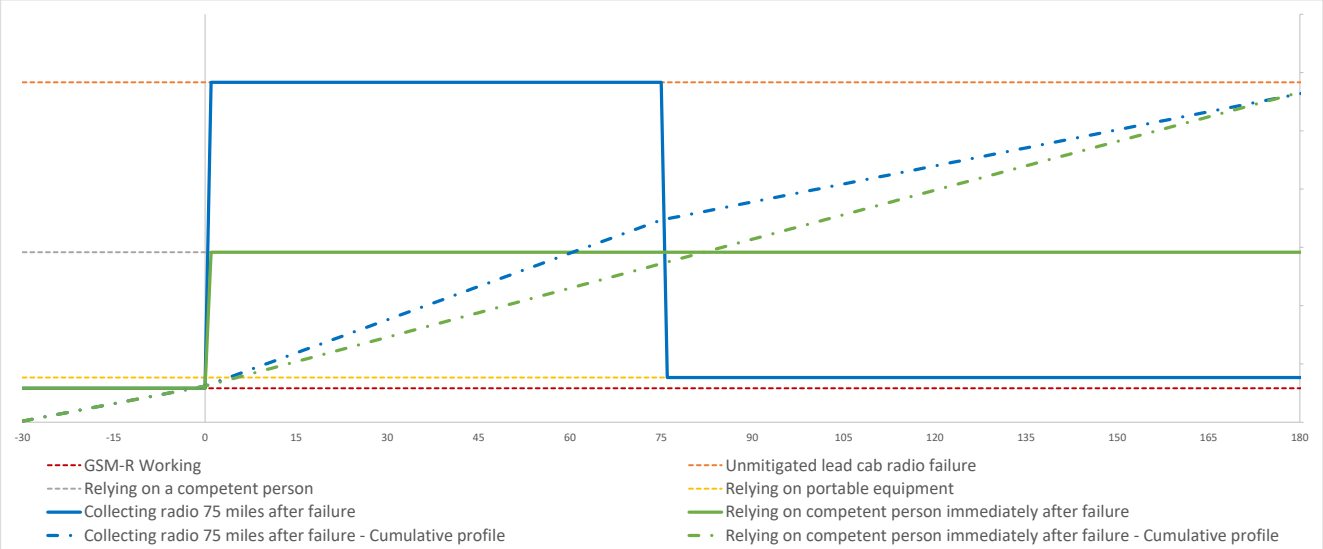
For the 6-car to 12-car configurations, no meaningful extension of the distance to collection was found (i.e. at most 5 additional miles may have been considered).

For the 2-car and 4-car configurations, the increased distances identified would still not account for the possible dangers to train on adjacent tracks, which would not be readily mitigated. Further, defining an increased allowable distance to collection would be dependent on the actual response times that may be expected, itself dependent on the separation distance between competent person and driver.

Recommendation: Relying on a competent person operating a non-leading cab radio without means to communicate with the driver would still provide some level of risk mitigation. However, there is a lot of uncertainty around the actual effectiveness in those circumstances. This should not replace collecting radio equipment within the existing limitations of the railway standards.

When the mitigation is used within a train having cab-to-cab communication, the result shows that travelling 180 miles before collecting the radio would lead to similar risk levels as collecting the radio after 75 miles. This could be considered as a limit to the maximum distance a train may be allowed to travel during the day using a competent person in a non-leading cab. 0provides an illustration of the train risk exposure following a failure (shown to occur at 0 miles in the figure).

Illustrative graph showing effect of mitigations on risk exposure (cumulatively and per unit of distance)



Horizontal dashed lines illustrate risk exposure level per unit of distance for each case. The green and blue profiles respectively reflect relying on a competent person after a failure, and collecting a radio after travelling for 75 miles. Dashed profiles represent the cumulative risk exposure as the train travels on the network.

In practice as the train reaches a terminus, the driver may move to another cab for the next journey, where the GSM-R equipment would likely be functional. The distance travelled accounted for should only consider those times where the train is driven from the cab with the failed radio.

Recommendation: Any proposed change to the rule book or railway industry standards should only allow relying on a competent person in a non-leading cab for up to 180 miles before portable or transportable equipment is collected. This would prevent trains travelling over much longer distances from relying on the less effective mitigation provided by a competent person.

Conclusions and Recommendations

A review has been carried out to consider the possibility to rely on a competent person as an alternative to having to collect portable or transportable radio equipment, in case of lead cab radio failure.

The potential change would be limited to the circumstances where equipment may be collected:

- Entering service from somewhere other than maintenance depot.
- Failure while in service.

The risk assessment comprised both a qualitative assessment of the proposed change (via stakeholder engagement and review of existing operational rules), and a quantitative assessment using the RSSB GSM-R Failure Risk Model.

The qualitative assessment specifically reviewed:

- Whether or not the proposed mitigation addresses an actual operational issue with the industry.
- The practicalities surrounding a competent person's ability to remain within a non-leading cab.
- The practicalities surrounding a competent person's ability to use the emergency brake upon receiving a REC.
- The practicalities surrounding a competent person's awareness of the need to initiate a REC following a hazardous event affecting the train.
- The practicalities surrounding safety critical communications between the train and the wayside in the context of lead cab radio failure.

The quantitative assessment modelled scenarios surrounding:

- The affected train heading towards a train accident location.
- The affected train experiencing the accident or identifying the danger to other trains and needing to provide emergency protection.

For the latter case of the train experiencing the accident or identifying the danger, the quantitative assessment specifically reviewed the possibility to:

Replace the need to collect portable / transportable radio equipment for the rest of the day. This included the specific review of:

The effect of the distance to be travelled until equipment collection; and

The effect of the competent person being brought later on the train (e.g. picked up from the next station).

Temporarily rely on a competent person in another non-leading cab to extend the distance that can be travelled by a train before equipment has to be collected.

The review makes a number of recommendations to consider if the current rules / requirements or guidance are modified.

0 summarises all the recommendations, including the appropriate section which can be consulted for further information.

List of recommendations

#	Recommendation	Report Section
1	Proposed changes to the standards should be reviewed to mitigate the risk of potential unwanted interactions or confusion between the findings of project 21-013 and 19-005.	0
2	Any proposed change to the rule book or railway industry standards should remain an alternative option to manage the risks associated to a lead cab GSM-R radio failure. It shall not replace other existing operational mitigations currently in place.	0
3	Any proposed change to the rule book or railway industry standards should specify that a competent person would only be able to undertake safety-critical tasks (as clarified by the ORR, Ref. 13) whilst operating a non-leading cab radio. For instance, if the competent person is the guard in charge of dispatch, the change should not prevent that person from carrying out that existing duty.	0
4	The same requirements as for the driver should apply to a competent person upon receiving a REC (bringing the train to a stand immediately and listening to the message).	0
5	Any proposed change to the rule book or railway industry standards should only allow a competent person to use the GSM-R radio equipment from a non-leading cab in the context of an emergency (subject to the limitations identified within the quantitative risk assessment). This includes: monitoring the radio to bring the train to a stand upon receiving a REC, and operating the radio to initiate a REC as a means to stop approaching trains in an emergency.	0
6	Any proposed change to the rule book or railway industry standards should specifically preclude the competent person from using the radio for any other purpose than an emergency (such as to pass messages between the signaller and the driver).	0

#	Recommendation	Report Section
7	A review / consultation with stakeholders should be carried out to clarify potential risks surrounding the receipt of berth-triggered broadcasts (particularly unacknowledged) using unregistered radios (collected or in non-leading cab).	0
8	Any proposed change to the rule book or railway industry standards should make it clear that the presence of a competent person in a non-leading cab is beneficial from a safety perspective if either: the competent person is able to remain continuously in the cab; or, if the competent person is a guard in charge of dispatch, the person is able to return immediately to the non-leading cab when not carrying out dispatching duties.	0
9	Any proposed change to the rule book or railway industry standards should clarify that the immediate return would not include travelling through multiple carriages to return to the non-leading cab.	0
10	Any proposed change to the rule book or railway industry standards should clarify that the immediate return is also essential to allow the competent person to quickly initiate a REC in case of an emergency.	0
11	In the context of a proposed change to the rule book or railway industry standards, relying on a competent person in a non-leading cab rather than collecting equipment would be acceptable if the driver and competent person have access to a direct means of communication between cabs.	0
12	Any proposed change to the rule book or railway industry standards should make it clear that the means of communication would need to allow instructions and / or information to be shared between parties regarding the nature of the danger. That is, relying solely on the train buzzer or bell would not constitute a suitable means of communication.	0
13	Any proposed change to the rule book or railway industry standards should also clarify that, when relying on cab-to-cab communications, operational procedures should be in place to allow a competent person to initiate a REC if suspecting an incident has occurred and unable to contact the driver. This would cover the cases where the driver may be incapacitated as a result of the accident.	0
14	It is recommended that a proposed change to the rule book or railway industry standards should not allow relying on a competent person for the rest of the day as an alternative to collecting equipment when cab-to-cab communication is not available.	0
15	Any proposed change to the rule book or railway industry standards should mention that, when equipment can be collected readily within the existing limits (i.e. 75 miles), this should be done rather than relying on a competent person.	0

#	Recommendation	Report Section
16	Any proposed change to the rule book or railway industry standards should be only considered as a potential alternative when the competent person is already on-board, or available at the next available location / within 15 miles, whichever comes first.	0
17	Relying on a competent person operating a non-leading cab radio without means to communicate with the driver would still provide some level of risk mitigation. However, there is a lot of uncertainty around the actual effectiveness in those circumstances. This should not replace collecting radio equipment within the existing limitations of the railway standards.	0
18	Any proposed change to the rule book or railway industry standards should only allow relying on a competent person in a non-leading cab for up to 180 miles before portable or transportable equipment is collected. This would prevent trains travelling over much longer distances from relying on the less effective mitigation provided by a competent person.	0

References

1. Letter from ASLEF general secretary sent on 21 October 2020 to the ORR, reference: H/GWR/60 & H/GSMR/60, regarding 'GSM-R failure in leading cab'
2. Operational requirements for GSM-R radio, RIS-3780-TOM Issue One, September 2016
3. Request for help 21-REQ-018 and supporting paper.
4. Defective On-Train Equipment, RIS-3437-TOM Issue 3, September 2022
5. Preparation and movement of trains: Defective or isolated vehicles and on-train equipment, GERT8000-TW5 Issue 11, September 2022
6. Dealing with a train accident or train evacuation,GERT8000-M1 Issue 6, September 2020
7. RSSB GSM-R failure safety risk model report, 29 July 2016, issue 2.0
8. Station duties and train dispatch, GERT8000-SS1 Issue 8, September 2022
9. Preparation and movement of trains, GERT8000-TW1, Issue 18, September 2022
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