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Rail Industry Standard on Signal Overrun Risk Evaluation and Assessment

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Issue record

Issue	Date	Comments
One	December 2014	This document has been developed under project 10/028 to replace the out of scope requirements in GI/RT7006 and the guidance in GI/GN7606. The document sets out the industry's approach to the management of signal overrun risk, which is consistent with the application of the Common Safety Method on Risk Evaluation (CSM RA).

Superseded or replaced documents

The following Railway Group Standard is superseded or replaced, either in whole or in part as indicated:

Superseded documents	Sections superseded	Date when sections are superseded
GI/RT7006 issue one Prevention and Mitigation of Overruns – Risk Assessment	All	06 December 2014
GI/GN7606 issue one Guidance Note: Prevention and Mitigation of Overruns – Risk Assessment	All	06 December 2014

GI/RT7006 issue one Prevention and Mitigation of Overruns – Risk Assessment, ceases to be in force and is withdrawn as of 06 December 2014. GI/GN7606 issue one Guidance Note: Prevention and Mitigation of Overruns – Risk Assessment is withdrawn as of 06 December 2014.

Supply

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Part 1 Introduction

1.1 Purpose of this document

1.1.1 This document is a standard on signal overrun risk management, primarily aimed at infrastructure managers (IMs), railway undertakings (RUs), contracting entities and manufacturers, who have a legal obligation to manage the risk arising from a planned change to the railway system before the change is put into use.

1.1.2 The guidance is also relevant to IMs and RUs that have a legal obligation to cooperate with the proposer in order to manage risk.

1.2 Application of this document

1.2.1 A member of RSSB may choose to adopt all or part of this document through internal procedures or contract conditions. Where this is the case the member of RSSB will specify the nature and extent of application.

1.2.2 Compliance requirements and dates have not been specified, since these will be the subject of internal procedures or contract conditions.

1.2.3 This RIS is applicable only to changes on lines fitted with a lineside signalling system. Guidance on lineside signal aspects and indications, and the information they convey is given in GK/GN0658.

1.2.4 The requirements and guidance in this document cover:

a) The signal overrun risk management process.

b) The choice of risk acceptance principle.

c) The use of explicit risk estimation as a risk acceptance principle.

1.2.5 The requirements in this document seek to reduce the potential for train-on-train collisions, and derailments on switches and crossings, arising from signal overruns.

1.2.6 The requirements in this document are based on the assumption that the lineside signalling layout is compatible with the train driving task, and that trains are operated in accordance with the relevant standards and operating procedures.

1.2.7 Compatibility requirements for lineside signalling systems are set out in Railway Group Standards (RGSs).

1.2.8 Requirements for signal overrun incident investigation are set out in GO/RT3119.

1.2.9 Recommendations relating to the risk assessment of buffer stops, arresting devices and end impact walls are set out in GC/RC5633.

1.2.10 Compatibility requirements for managing low adhesion between the wheel and rail are set out in GE/RT8040 and guidance is given in GE/GN8540. Signal overrun risk arising from low adhesion is not comprehensively addressed by signal overrun risk assessment and evaluation because:

a) It is difficult to predict whether the effects will be localised or widespread.

b) Poor adhesion is an effect which is not necessarily present at any given site throughout the service life of the track and signalling.

c) A train that unexpectedly encounters a widespread area of poor rail head conditions might travel a considerable distance before coming to a stand (possibly passing more than one signal).

1.3 Health and safety responsibilities

1.3.1 Users of documents published by RSSB are reminded of the need to consider their own responsibilities to ensure health and safety at work and their own duties under health and safety legislation. RSSB does not warrant that compliance with all or any documents published by RSSB is sufficient in itself to ensure safe systems of work or operation or to satisfy such responsibilities or duties.

1.4 The structure of this document

1.4.1 This document is set out as a series of requirements, in some cases followed by relevant guidance. The guidance is indicated by prefixing the paragraph number with the letter 'G'.

1.5 Copyright

1.6 Approval and authorisation of this document

1.6.1 The content of this document was approved by Control Command and Signalling (CCS) Standards Committee on 21 August 2014.

1.6.2 This document was authorised by RSSB on 24 October 2014.

Part 2 Application of this Document

2.1 Scope of application

2.1.1 The requirements in this RIS shall be applied to all changes with the potential to affect signal overrun risk.

G 2.1.1.1 Rationale: The application of the RIS is good practice and is scalable. It is capable of being used in a proportionate way for any change with a potential impact on signal overrun risk, irrespective of whether the change is considered to be significant in the legal sense.

G 2.1.1.2 The requirements in this RIS are consistent with the application of the Common Safety Method on Risk Evaluation and Assessment (CSM RA) to control the hazard of a train passing a stop signal without authority, where the hazard is caused by either:

a) A train driver misreading or misinterpreting lineside signalling system displays.

Or

b) A train driver misjudging the braking requirement on approach to a stop signal due to causal factors on the approach to the signal.

G 2.1.1.3 Commission Regulation (EC) No 352/2009 (‘the regulation’) requires the application of the CSM RA 'to any change of the railway system in a Member State ... which is considered to be significant within the meaning of Article 4 of this regulation. Such changes may be of a technical, operational or organisational nature'. The regulation includes a flowchart setting out the risk management and independent assessment process to be followed, in Annex I of the Appendix.

G 2.1.1.4 The CSM RA is applied before a change is taken into use, to confirm that the change will have no adverse effect on the safe operation of the railway system (safe integration).

G 2.1.1.5 Guidance on the application of the CSM RA to railway projects is given in GE/GN8640, GE/GN8641, GE/GN8642, GE/GN8643, GE/GN8644 and GE/GN8645.

G 2.1.1.6 Detailed advice on the regulation’s requirements, its scope and the significance test that triggers the requirement to apply the CSM RA in full, is set out in the Office of Rail Regulation (ORR) guidance on the application of the common safety method (CSM) on risk evaluation and assessment (December 2012).

G 2.1.1.7 The responsibilities of the proposer (see definitions) of a change to the railway system and of the other actors (see definitions) who have a legal obligation to cooperate with the proposer in order to manage shared risk are set out in detail in Annex I section 1 of the regulation.

G 2.1.1.8 At the start of the project it is important to establish:

a) Who is the proposer.

And

b) Which parties are actors.

G 2.1.1.9 For changes that affect signal overrun risk, the proposer may be either an IM or an RU.

G 2.1.1.10 The signal overrun risk evaluation and assessment process set out in this RIS is intended to address the following requirements in the regulation in Annex I:

'1.1.5 … the risk assessment process shall fall within the responsibility of the proposer. In particular the proposer shall decide, with agreement of the actors concerned, who will be in charge of fulfilling the safety requirements resulting from the risk assessment. This decision shall depend on the type of safety measures selected to control the risks to an acceptable level.

1.1.6 The first step of the risk management process shall be to identify in a document, to be drawn up by the proposer, the different actors' tasks, as well as their risk management activities. The proposer shall coordinate close collaboration between the different actors involved, according to their respective tasks, in order to manage the hazards and their associated safety measures.

1.2.1 For each interface relevant to the system under assessment and without prejudice to specifications of interfaces defined in relevant TSIs, the rail-sector actors concerned shall cooperate in order to identify and manage jointly the hazards and related safety measures that need to be handled at these interfaces. The management of shared risks at the interfaces shall be coordinated by the proposer.

1.2.2 When, in order to fulfil a safety requirement, an actor identifies the need for a safety measure that it cannot implement itself, it shall, after agreement with another actor, transfer the management of the related hazard to the latter...

1.2.5 When agreement cannot be found between two or more actors it is the responsibility of the proposer to find an adequate solution.'

Part 3 System Definition and Hazard Identification

3.1 Information requirements for system definition

3.1.1 The proposer shall consult with actors by sharing the following information, where relevant to each preferred change option, that has the potential to affect signal overrun risk, before seeking approval for the change:

a) The objective (intended purpose) of the change.

b) The railway system functions and elements affected by the change, including:

i) Lineside signalling system functions and elements.

ii) Train driving functions and elements.

iii) Train dispatch functions and elements.

iv) Train service pattern and frequency.

v) Rolling stock functions and performance.

c) The system boundary, including changes to:

i) Lineside signalling systems.

ii) Track layout.

iii) Permissible speeds.

iv) Gradients.

v) Station platforms.

vi) Level crossings.

vii) Fixed infrastructure features (for example, bridges and tunnels).

viii) Automatic train protection (ATP) systems.

ix) Train protection and warning (AWS / TPWS) systems.

x) Electrification systems.

xi) The vehicles being operated.

xii) Rolling stock systems.

xiii) Train consists.

xiv) Operational procedures.

d) Physical and functional interfaces affected by the change, where these are relevant to the train driving task, including:

i) Lineside signalling system interfaces.

ii) Train dispatch system interfaces.

iii) Train protection system interfaces.

e) Changes that affect the system environment, where these are relevant to signal overrun risk.

f) Changes to existing signal overrun risk safety measures, including:

   i) ATP systems.

   ii) AWS / TPWS systems.

   iii) Train braking systems.

   iv) Sanding arrangements.

   v) Safe overrun distances and conflict points.

   vi) Trapping protection.

   vii) In-cab control and display systems.

   viii) Working timetables.

   ix) Train driving policy and procedures.

   x) Train dispatch procedures.

g) Assumptions which shall determine the limits for the risk assessment, including:

   i) The parts of the railway that will not change.

   ii) The operational rules and procedures that will not change.

   iii) Passenger loadings.

G 3.1.1.1 Rationale: The consultation makes information about the scope of potential change available to the proposer and actors before the project takes a decision to proceed with single option development. The information includes changes to human, technical and operational features of the railway system and their interfaces within and outside of the system boundary.

G 3.1.1.2 Rationale: Proposers and actors require this information to:

a) Understand what cooperation will be required.

b) Understand their responsibilities for jointly managing the hazards and related safety measures at the interfaces.

c) Identify when a change to the lineside signalling system or the operational context has the potential to increase signal overrun risk.

G 3.1.1.3 Rationale: The proposer requires this information to:

a) Develop the system definition.

b) Determine whether or not the change is significant within the meaning of the regulation and so whether independent assessment is required.

c) Identify the circumstances in which the hazard of a train passing a stop signal without authority can occur.

d) Inform decisions about approval.

G 3.1.1.4 The criteria for creating a system definition are set out in Annex I section 2.1.2 of the regulation.

G 3.1.1.5 Operational changes that have the potential to increase signal overrun risk, include:

a) Changes to the overall concept of operation.

b) Changes proposed by the infrastructure manager (network), for example:

i) Method of signalling.

ii) Working timetable.

c) Changes proposed by the infrastructure manager (stations), for example:

i) The train dispatch system.

ii) Train stopping positions.

d) Changes proposed by railway undertakings, for example:

i) Method of train dispatch.

ii) Train driving policy.

iii) Trainborne risk mitigation measures (including a driver's reminder appliance).

G 3.1.1.6 Environmental factors that have the potential to increase signal overrun risk, include:

a) Inadequate ambient lighting conditions (readability).

b) Adverse effects from railway neighbours.

c) Poor rail head conditions.

G 3.1.1.7 Recognised industry practice is to consult, prior to approval, using the following documents:

a) Draft track and signalling layout sketches.

b) Train performance specification.

c) Company operating policy.

d) Timetable specification.

e) Concept of operation.

G 3.1.1.8 Further guidance about lineside signalling system interfaces is given in GE/GN8537, GK/GN0658 and GK/GN0645.

G 3.1.1.9 Further guidance about mechanical train stop systems (a type of ATP system) is given in GE/GN8618.

G 3.1.1.10 Further guidance about TPWS interfaces is given in GE/GN8675.

G 3.1.1.11 Further guidance about train dispatch system interfaces is given in GE/GN8560.

3.1.2 Approval shall take account of the extent to which each viable option has the potential to control the hazard of a train passing a stop signal without authority, by either:

a) Eliminating signal overrun risk.

Or

b) Reducing signal overrun risk to acceptable levels.

G 3.1.2.1 Rationale: Approval should identify a design option that is capable of being delivered economically and capable of controlling signal overrun risk.

G 3.1.2.2 The aim of the project should be to select a viable option that will be capable of being safely integrated into the railway system (a prerequisite of taking into use).

G 3.1.2.3 A range of viable options may influence signal overrun risk to a lesser or greater extent, for example:

a) An option to provide a flyover at a junction would have the potential to eliminate some of the signal overrun risk that would otherwise be retained at a flat junction.

And

b) A project to significantly increase the frequency of trains on an existing route might include timetable options that would decrease the number of potential conflicts at a junction. Account should be taken of the frequency of late and / or early running trains which could invalidate this control option.

G 3.1.2.4 Further example signal overrun risk mitigations are set out in Appendix C.

3.2 Hazard classification

3.2.1 The proposer shall identify whether the planned change alters the risk associated with the hazard of a train passing a stop signal without authority.

G 3.2.1.1 Rationale: The proposer is in charge of the risk management process and is responsible for identifying and classifying all the hazards associated with the change.

G 3.2.1.2 The criteria for hazard identification, hazard classification, the creation of a hazard record and the role of expert judgement in fulfilling this requirement are set out in Annex I section 2.2 of the regulation.

3.2.2 The hazard of a train passing a stop signal without authority shall be evaluated by application of a risk acceptance principle.

G 3.2.2.1 Rationale: The regulation uses the term ‘broadly acceptable’ to identify those hazards which need not be evaluated further. ‘Broadly acceptable’ applies to those hazards where the risk is, to all intents and purposes, insignificant or negligible. Neither of these criteria apply in the context of signal overrun risk and therefore one of the three risk acceptance principles applies.

3.2.3 The proposer shall identify the signals where the hazard of a train passing a stop signal without authority is potentially affected by the planned change.

G 3.2.3.1 Rationale: The proposer needs to understand which stop signals require signal overrun risk evaluation and assessment.

G 3.2.3.2 The planned change has the potential to alter the conditions of this hazard if any of the following apply:

a) A new signal is introduced.

b) An existing signal is modified in form or function.

c) The operational context in which an existing signal operates is changed.

d) A new hazard is introduced between the stop signal and next signal.

e) An existing hazard is changed or relocated.

G 3.2.3.3 The proposer should not discount a small change in the risk without considering whether an accumulation of small changes over time results in an increase in signal overrun risk beyond that which is acceptable.

G 3.2.3.4 Change factors include:

a) Readability, including:

i) The signal aspects and indications presented by the signal.

ii) Signal reading times and readable distances.

iii) Signal configuration.

b) Interpretability of the information conveyed by the signal aspects and indications.

c) Driveability, including:

i) Signal spacing.

ii) Cautionary aspect sequences.

d) The signalling braking distances.

e) Existing signal overrun risk controls (for example, signalling overlap length, trapping protection, AWS / TPWS functionality).

f) The safe overrun distance (SOD) / distance to point of conflict.

g) Gradients.

h) Frequency that trains approach the signal.

i) Likelihood that drivers could experience a stop aspect.

j) Changes to a station platform on the approach to the signal.

k) Dispatch operations.

l) Train driving procedures.

m) Type of rolling stock operated on the route.

3.2.4 The signal overrun risk evaluation and assessment process set out in Parts 4 and 5 shall be applied to all the signals listed in accordance with 3.2.3 above.

G 3.2.4.1 Rationale: To confirm that the hazard of a train passing a stop signal without authority is addressed at each stop signal affected by the change.

Part 4 Selection of Risk Acceptance Principle

4.1 Consultation on the selected design option

4.1.1 The proposer shall consult with actors on the selected design option before the proposer selects the risk acceptance principle to be applied to signal overrun risk.

G 4.1.1.1 Rationale: The proposer, with the support of other involved actors, is required by Annex I sections 2.3 and 2.4 of the regulation to analyse whether hazards are appropriately covered by application of relevant codes of practice or use of reference systems.

G 4.1.1.2 In order to support this, the proposer provides the actors with details that describe the proposed change.

G 4.1.1.3 The actors need this information in order to fulfil their role in the signal overrun risk evaluation and assessment process.

G 4.1.1.4 The types of information include:

a) Draft signalling scheme plans.

b) The list of signals derived by the hazard identification.

c) Signal readability (signal sighting) assessment workbooks.

d) Draft timetables, taking account of minimum and maximum train frequencies on each route.

e) Draft rolling stock working schedules.

f) Draft operating procedures.

G 4.1.1.5 It is the responsibility of the proposer to select the risk acceptance principle(s) to be used to accept the risks linked to the identified hazards associated with changes giving rise to signal overrun risk.

G 4.1.1.6 The CSM RA includes three risk acceptance principles:

a) Compliance with a code of practice (see 4.2).

b) Comparison with a reference system (see 4.3).

c) Use of explicit risk estimation (see Part 5).

G 4.1.1.7 A combination of risk acceptance principles may be applied to provide project efficiencies.

4.2 Use of codes of practice and risk evaluation

4.2.1 The proposer shall consult with actors on the use of codes of practice to control signal overrun risk.

G 4.2.1.1 Rationale: Requirements for the proposer, with support from other involved actors, to analyse whether any hazards are appropriately controlled by the application of relevant codes of practice, and the criteria for codes of practice, are set out in Annex I clause 2.3 of the regulation.

G 4.2.1.2 The objective of selecting a code of practice is to provide project efficiencies by applying standard controls to reduce the signal overrun risk to an acceptable level.

G 4.2.1.3 Further guidance on using codes of practice is given in the guidance on the application of the CSM RA, published by the ORR.

G 4.2.1.4 The application of a code of practice alone is unlikely to be sufficient to conclude that the risk at a particular signal has been managed to an acceptable level.

4.3 Use of comparison with a reference system and risk evaluation

4.3.1 The proposer shall consult with actors on the use of reference systems to control signal overrun risk.

G 4.3.1.1 Rationale: Requirements for the proposer, with support from other involved actors, to analyse whether any hazards are appropriately covered by a similar system that can be used as a reference system are set out in Annex I clause 2.4 of the regulation.

G 4.3.1.2 The objective of using comparison with a reference system is to provide project efficiencies by re-using existing signal overrun risk controls that are known to reduce the signal overrun risk to an acceptable level in similar applications elsewhere.

G 4.3.1.3 Comparison with a reference system is appropriate only if the signal overrun risk associated with the reference system is known to be acceptable and the operational context is broadly the same as the signals to which it will be applied.

G 4.3.1.4 Further guidance on using comparison with a reference system is given in the guidance on the application of the CSM RA, published by the ORR.

G 4.3.1.5 Two reference systems are set out in 4.3.2 and 4.3.3.

G 4.3.1.6 Other reference systems could be used where the proposer confirms that the application is appropriate to signal overrun risk. For example, a standard TPWS configuration could be used as a reference system if evidence is available to confirm that the configuration is sufficient to control the signal overrun risk at another signal.

4.3.2 An ATP system design is permitted to be used as a reference system where:

a) The signal and the associated preceding caution signal(s), and the associated AWS equipment, are compliant with the requirements of the RGSs in force at the time of the signal overrun risk assessment and are relevant to the control of signal overrun risk.

b) The action of the train protection system and, where applicable, the setting and interlocking of facing points ahead of the stop signal, is such that all trains overrunning the stop signal will be routed so as to avoid, or be brought to a stand short of, all areas of conflict and all infrastructure features that could either increase the likelihood of a collision or could significantly worsen the consequences of a collision or derailment.

c) The action of the train protection system is such that all trains overrunning the stop signal will be brought to a stand so as to avoid a rear end collision with a train standing at a stop signal ahead (this criterion has to be met in respect of all routes that the train might follow after overrunning the stop signal under consideration).

d) The action of the train protection system is such that all trains overrunning the stop signal will not derail on any points or crossings ahead (this criterion has to be met in respect of all routes that the train might follow after overrunning the stop signal under consideration).

G 4.3.2.1 Rationale: The ATP system should be capable of controlling signal overrun risk at the signals to which it is applied.

G 4.3.2.2 In Great Britain (GB), ATP functionality is not generally provided on routes fitted with lineside signalling systems and trains which operate on them, which means that not all signal overrun risk is controlled.

G 4.3.2.3 TPWS is not considered to be an ATP system because it does not completely control the hazard of a train passing a stop signal without authority.

4.3.3 The signal overrun risk controls for a colour light stop signal are permitted to be used as a reference system where:

a) The signal is on plain line with no switches and crossings between that signal and the next stop signal ahead.

b) The signal and the associated preceding caution signal(s), and the associated AWS equipment, are compliant with the requirements of the RGSs in force at the time of the signal overrun risk assessment and which are relevant to the control of signal overrun risk.

c) It is unlikely that a driver would misinterpret another nearby signal as being applicable to their train (this applies at both the stop signal and the preceding caution signal(s)).

d) The stop aspect is not associated with an approach control function.

e) A 180 m overlap is provided beyond the signal, with no provision made for the use of reduced or restricted overlaps.

f) There are no stations, tunnels, viaducts, controlled level crossings, automatic level crossings or other infrastructure features between the stop signal and the next stop signal ahead that could either increase the likelihood of a collision or could significantly worsen the consequences of a collision or derailment.

G 4.3.3.1 Rationale: The consequence arising from the hazard of a train passing a stop signal meeting these criteria should be limited to a rear end collision with a train occupying the section ahead. The likelihood of a train being present in the section ahead is low at such signals.

G 4.3.3.2 It should not be assumed that a signal that meets these criteria has a signal overrun risk that is acceptably low. All relevant risk factors should be considered before deciding whether to use this reference system, for example:

a) The relationship between signal spacing, train speed and signalling braking distance, which influences the amount of time available to the driver to stop the train at the signal.

b) Variation in signal spacing on the approach to the stop signal.

c) The number of signal routes approaching the stop signal.

d) Infrastructure features on each approach to and beyond the stop signal.

e) Train protection and warning system configuration.

f) Permissible speed profile.

g) Gradient profile.

h) Timetable.

i) Rolling stock types being operated (such as differences in crash worthiness, braking distance and driver visibility).

j) Operating procedures.

Part 5 Explicit Signal Overrun Risk Estimation and Evaluation

5.1 Signal overrun risk acceptance criterion

5.1.1 'So far as is reasonable practicable' (SFAIRP) shall be the risk acceptance criterion used for explicit signal overrun risk estimation and evaluation.

G 5.1.1.1 Rationale: SFAIRP is the acceptance criteria used by the GB mainline railway industry.

G 5.1.1.2 The proposer is required by Annex I section 2.5 of the regulation to demonstrate the acceptability of estimated risk using requirements contained in EU legislation or in notified national rules. SFAIRP is consistent with the risk acceptance criterion 'as low as reasonably practicable' (ALARP).

G 5.1.1.3 SFAIRP is the only relevant risk acceptance criterion applicable to explicit risk estimation and evaluation of signal overrun risk. The alternative risk acceptance criterion of a rate of failure of 10^{-9} per operating hour, set out in clause 2.5.4 of the regulation, is not relevant to signal overrun risk because it does not address human error risk.

G 5.1.1.4 A cost-benefit analysis should be completed to inform the proposer when deciding whether to give 'safety acceptance' to the change.

G 5.1.1.5 Where the signal overrun risk assessment indicates that, even after the application of risk reduction measures, the risk is not reduced to an acceptable level, then consideration should be given to the means of further reducing the risk, such as:

a) Changing the operational use.

And

b) Changing the signalling layout.

5.2 Signal overrun risk assessment process

5.2.1 The proposer shall manage signal overrun risk estimation and evaluation in two stages:

a) Stage 1: Initial signal overrun risk assessment (see 5.3).

And

b) Stage 2: Signal overrun risk assessment workshop (see 5.4).

G 5.2.1.1 Rationale: The two-stage approach provides efficiencies by limiting the signal overrun risk assessment to only the most critical signals.

G 5.2.1.2 Annex I clause 2.5 of the regulation sets out requirements for the proposer to perform an explicit risk estimation and evaluation for those hazards where use of a code of practice or use of a reference system do not apply (as set out in this RIS sections 4.2 and 4.3).

G 5.2.1.3 Explicit risk estimation and evaluation for the hazard of 'a train passing a stop signal without authority' apply a structured signal overrun risk assessment methodology to assign a quantified risk value in combination with structured engineering judgement, to decide whether the risk is reduced to an acceptable level.

G 5.2.1.4 Where the design standards being used for the change include technical compatibility assessment requirements (for example, signalling layout design assessment), it may be appropriate to combine these with the signal overrun risk assessment to provide efficiencies.

G 5.2.1.5 The signal overrun risk assessment work should be started as soon as sufficient information on the proposed change becomes available. Further guidance on consultation is given in 3.1.

G 5.2.1.6 The validity and suitability of all information and data being used to support the signal overrun risk assessment should be confirmed.

5.3 Signal overrun risk assessment: stage 1

5.3.1 The stage 1 signal overrun risk assessment shall be applied to the signals where the hazard of 'a train passing a stop signal without authority' is affected by the planned change, except for those signals for which the proposer has decided that either:

a) Use of a code of practice in accordance with 4.2 applies.

Or

b) Use of reference system in accordance with 4.3 applies.

G 5.3.1.1 Rationale: To confirm that the hazard of 'a train passing a stop signal without authority' is addressed at each signal affected by the change.

G 5.3.1.2 For each stop signal, the extent and path of the possible overrun scenarios should be identified in terms of:

a) Which points and line(s) the overrunning train might traverse.

And

b) Where the train might eventually come to a stand (whether by driver action, activation of the train protection system or by derailment).

5.3.2 The proposer shall use a verified signal overrun risk assessment tool to calculate a quantified signal overrun risk value for each affected stop signal subject to the stage 1 signal overrun risk assessment.

G 5.3.2.1 Rationale: A verified signal overrun risk assessment tool provides an industry recognised methodology for estimating and evaluating signal overrun risk.

G 5.3.2.2 The proposer is required by Annex I clause 2.5.7 of the regulation to make sure that:

a) The methods used for explicit risk estimation reflect correctly the system under assessment.

And

b) The results are sufficiently accurate to serve as a robust decision support.

G 5.3.2.3 The signal overrun assessment tool (SORAT) developed by Network Rail is verified for use as a signal overrun risk assessment tool for train-on-train collisions only. If SORAT is to be used, the proposer should contact Network Rail. Further information on SORAT is set out in Appendix A.

G 5.3.2.4 Derailment and level crossing collision risks are part of the overall signal overrun risk assessment, but are not addressed by SORAT.

G 5.3.2.5 The stage 1 signal overrun risk assessment has historically used the Network Rail signal assessment tool (SAT) to allocate a signal overrun risk value. This method is no longer preferred for new projects.

G 5.3.2.6 Use of alternative signal overrun risk assessment tools should be agreed by actors before they are used to inform project decisions about signal overrun risk. Signal overrun risk data is available from Network Rail to support the application of other tools.

G 5.3.2.7 Changes to the algorithms used within accepted tools should be verified and consulted with industry before they are introduced.

5.3.3 The proposer shall use the results from the stage 1 signal overrun risk assessment to decide whether signal overrun risk is acceptable.

G 5.3.3.1 Rationale: The stage 1 signal overrun risk assessment is a proven effective process used by the rail industry to decide whether signal overrun risk is acceptable without needing to apply the stage 2 signal overrun risk assessment to all affected stop signals.

G 5.3.3.2 The decision about the acceptability of risk should consider the basis of the quantified signal overrun risk value assigned to each signal and take account of the procedures and user guides provided with the tool.

G 5.3.3.3 Network Rail has prepared a user guide for SORAT covering data input and signal overrun risk assessment processes.

G 5.3.3.4 A cost-benefit analysis is needed to inform the proposer when deciding whether to accept a change. SORAT includes a cost-benefit capability for collision risk.

G 5.3.3.5 The output of the stage 1 signal overrun risk assessment is:

a) A list of affected stop signals where the signal overrun risk is considered by the proposer to be acceptable.

And

b) A list of signals which require the stage 2 signal overrun risk assessment.

G 5.3.3.6 If the proposer has sufficient information to carry out the stage 1 signal overrun risk assessment, it is not necessary to consult with actors at this stage.

5.4 Signal overrun risk assessment workshop: stage 2

5.4.1 The proposer shall commission a signal overrun risk assessment workshop for:

a) Those signals where the results from stage 1 do not support a decision that signal overrun risk is acceptable.

b) Existing multi-SPAD signals that are part of the system definition.

c) New signals that replace or are equivalent to existing multi-SPAD signals.

d) Any signal where a signal overrun event has led to a collision or a derailment since the last signal overrun risk assessment was completed.

e) Those signals within the system definition about which signal overrun risk concerns have been raised by actors.

G 5.4.1.1 Rationale: The signal overrun risk assessment workshop uses structured expert judgement in combination with a verified signal overrun risk assessment tool to calculate a quantified signal overrun risk value for each assessed stop signal. This risk value is used to support a decision that signal overrun risk is acceptable.

G 5.4.1.2 Rationale a): Further assessment is required to provide evidence to support a decision that the signal overrun risk is acceptable.

G 5.4.1.3 Rationale b) to e): These signals have a history of signal overrun risk. Further assessment is required to investigate the potential for mitigating the signal overrun risk at these signals.

G 5.4.1.4 Information about signal overrun events is available from the Safety Management Information System (SMIS) and information about the overall risk is available from the Safety Risk Model (SRM), both managed by RSSB on behalf of the industry.

G 5.4.1.5 The relative probabilities of each overrun scenario occurring should be evaluated, taking account of the site specific post-overrun factors that could determine the route taken by the train or affect where it might eventually come to a stand.

G 5.4.1.6 For all credible overrun scenarios, the probability of a collision or derailment occurring should be evaluated, taking account of the relevant factors that could affect the probability.

G 5.4.1.7 For each collision and derailment scenario, the credible consequences should be identified and evaluated in terms of injuries and fatalities, taking account of the relevant factors that could determine the severity of loss.

5.4.2 The signal overrun risk assessment workshop shall:

a) Consider the key factors associated with signal overrun risk, using structured questions.

And

b) Use the results in a verified signal overrun risk assessment tool.

G 5.4.2.1 Rationale: The use of structured questions and a verified tool to evaluate the answers are intended to support consistent recommendations.

G 5.4.2.2 Appendix B sets out the structured questions historically used by signal overrun risk assessment workshops to consider the key risk factors.

G 5.4.2.3 Annex I clause 2.5.7 of the regulation requires the proposer to make sure that:

a) The methods used for explicit risk estimation reflect correctly the system under assessment.

And

b) The results are sufficiently accurate to serve as a robust decision support.

G 5.4.2.4 Signal overrun risk assessment workshops have historically used SAT to calculate a signal overrun risk value. SORAT is the tool verified by Network Rail for use on all new projects for train-on-train collisions.

G 5.4.2.5 Use of alternative risk assessment methods should be agreed by actors before they are used to inform project decisions about signal overrun risk.

G 5.4.2.6 Changes to the algorithms used within existing tools should be verified and consulted with industry before they are introduced.

5.4.3 The proposer shall consult with actors to identify the resources necessary to fulfil the roles and responsibilities associated with the signal overrun risk assessment workshop.

G 5.4.3.1 Rationale: The proposer has the legal obligation to control the risk being introduced by the change, but relies on cooperation with actors to obtain the resources needed to provide the expert judgement necessary to support the workshop.

G 5.4.3.2 Particular consideration should be given to the need to include workshop participants who are skilled in signal readability assessment (signal sighting assessment). It is good practice to include the signal sighting committee members from the project introducing the change.

G 5.4.3.3 The workshop representatives from affected IMs should have combined knowledge and experience of:

a) The signal overrun risk assessment processes and procedures being applied.

b) The technical characteristics of the relevant infrastructure.

c) The relevant operational context, including timetabling, train regulation and local operations.

d) The application of controls in relation to signal overrun risk reduction.

e) The costs and benefits associated with the proposed controls.

G 5.4.3.4 The workshop representatives from affected RUs should have combined knowledge and experience of:

a) The signal overrun risk assessment processes and procedures being applied.

b) The technical characteristics of the relevant rolling stock.

c) Train driving on the affected route.

d) The relevant operational context, including timetabling, train regulation and local operations.

e) The application of controls in relation to signal overrun risk reduction.

G 5.4.3.5 Actors should only agree to share a common representative if that person has the required knowledge and experience needed to act on their behalf.

5.4.4 The proposer shall appoint a workshop facilitator.

G 5.4.4.1 Rationale: The facilitator is responsible for managing the signal overrun risk assessment.

5.4.5 The proposer shall commission a signal overrun risk assessment record that includes:

a) The identity of each signal assessed.

b) The signal overrun risk assessment results.

c) Recommended signal overrun risk controls.

d) The signal overrun risk control assumptions that underpin the signal overrun risk assessment results.

e) Referenced documentation, including plan numbers, document references and standards.

f) References to the data and sources of information used in the stage 2 signal overrun risk assessment, including attainable speed data, acceleration data, signalling braking distance calculation data and safety risk data (for example, SPAD history).

g) Records of quantitative risk assessment, including the probabilities of overrun, derailment, collision and any other relevant consequences.

h) List of workshop attendees.

G 5.4.5.1 Rationale: This is the formal record of the signal overrun risk assessment which is used to support a decision that the level of signal overrun risk is acceptable for the assessed stop signals.

G 5.4.5.2 The proposer is required by Annex I clause 2.5.3 of the regulation to register the safety measures in the hazard record.

G 5.4.5.3 Additional records that do not form part of the signal overrun risk assessment could be included at the request of the proposer or an actor.

Part 6 Consultation on Safety Requirements

6.1 Single option design approval

6.1.1 The proposer shall consult with actors on the finalised design before deciding that signal overrun risk is controlled to an acceptable level.

G 6.1.1.1 Rationale: To confirm that all of the actors are aware of their responsibility to fulfil the safety requirements arising from the signal overrun risk assessment.

G 6.1.1.2 The proposer is required by Annex I section 3 of the regulation to confirm that all actors are able to demonstrate compliance with the safety requirements resulting from the risk assessment.

G 6.1.1.3 Types of documents to support consultation include:

a) Signalling scheme plan.

b) Signal overrun risk assessment report.

c) Timetable.

d) Rolling stock working schedules.

e) Operating procedures.

G 6.1.1.4 The demonstration of compliance is necessary to support the independent assessment by an assessment body, in accordance with Annex I Article 6 of the regulation.

G 6.1.1.5 Carrying out this process supports decision taking about signal overrun risk in order to meet legal obligations. RSSB's document 'Taking Safe Decisions' gives guidance on other considerations relevant to cost-benefit analysis and decisions about signal overrun risk mitigation.

6.2 Phased implementation

6.2.1 When signal overrun risk reduction measures are not all being implemented at the same time, the proposer shall consult with the actors on the prioritisation of implementation in order to gain optimal safety benefit.

G 6.2.1.1 Rationale: The proposer may require the actors to implement additional procedures during a phased implementation, to compensate for the phased approach.

6.3 Pre-commissioning design changes

6.3.1 The proposer shall consult with the actors before implementing any pre-commissioning design changes that have the potential to increase the level of signal overrun risk.

G 6.3.1.1 Rationale: The actors may need to implement additional procedures to compensate for the design changes.

G 6.3.1.2 The need for further signal overrun risk assessment should be considered for all design changes, as the risk may be adversely affected by a number of small changes.

Appendix A Signal Overrun Risk Assessment Tool (SORAT)

G A.1 Overview

G A.1.1 The signal overrun risk assessment tool (SORAT) forms part of Network Rail's signal overrun risk assessment (SORA) process, which is the means by which Network Rail discharges its legal responsibilities to undertake a suitable and sufficient risk assessment of risk arising from signals passed at danger due to train driver error (Category A SPAD).

G A.1.2 SORAT calculates and stores signal overrun risk assessment data for train-on-train collisions. SORAT does not include assessment of derailment or level crossing collision risks.

G A.1.3 SORAT has been independently verified and calibrated against the Safety Risk Model (SRM).

G A.1.4 SORAT is capable of supporting assessments for:

a) Steady state review of existing signals.

b) Planned changes to network infrastructure and operations.

c) Planned changes to trains and train operations.

G A.1.5 SORAT supports:

a) A quantitative evaluation of signal overrun risk based on mathematical formula.

And

b) A qualitative evaluation of risk based on expert judgement.

G A.1.6 Risk calculations are based on historically derived, network-wide statistical values for the probability of a signal overrun and the distance of the signal overrun.

G A.1.7 Collision consequence is measured against train type and the Accident Consequence Model (ACM).

G A.1.8 SORAT includes data modifiers so that assessors are able to tailor assessments to address the operational context relating to each signal being assessed.

G A.1.9 SORAT applies algorithms to the input data to generate numerical outputs based on the frequency of train-on-train collisions at each assessed signal. The numerical outputs include:

a) Collision frequency score − representative of the predicted likelihood of collision occurring.

b) Consequence score − representative of the predicted likely severity of the collision event, should it occur.

c) The risk reduction, as applied by usage of TPWS, ATP systems and ERTMS.

d) Risk score, measured in units of fatalities and weighted injuries (FWI) per year.

G A.1.10 Risk scores are classified within the range A1-M4 to support easy comparison with other signals.

G A.1.11 Network Rail uses the alphanumeric code to support cost-benefit analysis and subsequent decisions about the implementation of signal overrun risk controls.

G A.2 Selection of risk acceptance principle

G A.2.1 SORAT applies a structured set of questions to support a decision about whether a signal meets the criteria for use of reference systems to control signal overrun train-on-train collision risk set out in 4.3 of this RIS.

G A.3 Explicit signal overrun risk estimation and evaluation

G A.3.1 Use of SORAT is consistent with the two-stage signal overrun risk assessment process set out in 5.2 of this RIS.

G A.3.2 SORAT includes functionality that is consistent with the signal overrun risk assessment workshop process and application of the Vari-SPAD protocol questionnaire set out in Appendix B of this RIS.

G A.3.3 SORAT includes the option to apply risk score modifiers to take account of secondary consequences covering any infrastructure feature or hazard that has the potential to increase death or injury following a train-to-train collision.

G A.3.4 SORAT includes functionality that allows the signal overrun risk assessment workshop to compare signal overrun risk mitigation options by changing parameters and recalculating the risk scores.

G A.4 Assessment records

G A.4.1 SORAT is designed to provide an auditable record of the signal overrun train-on-train collision risk at each assessed signal, including records of each application of signal overrun risk assessment.

Appendix B Risk Assessment Workshop Questions

G B.1 Vari-SPAD questions

G B.1.1 The 16 questions set out in Appendix B are intended to inform and support structured engineering judgement at the signal overrun risk assessment workshop. The questions are based on the Vari-SPAD protocol questionnaire which was developed to support the SAT-DA process.

G B.1.2 The example risk factors provided with each question are intended to inform the signal overrun risk assessment. Other factors may also be relevant.

G B.1.3 Some example risk mitigations are provided with each factor. Further example risk mitigations are set out in Appendix C. Other mitigations may also be relevant.

G B.1.4 The overall impact of risk factors and mitigations can be used to modify the quantitative risk score.

Question 1	**Example risk factors**
Relative to previous signals: is the signal in a different position, or does it have a different configuration?	a) Signal position is not consistent with the spacing between preceding signals
	b) Signal is mounted on a post and the preceding signals are on gantries
	c) Signal is mounted on a gantry and the preceding signals are on posts
	d) Signal is of a completely different design to preceding signals
	e) Signal post is on a different side of the track than the preceding signals
	f) Signal is at a significantly different height than preceding signals
	g) AWS is in a non-standard position on the approach to the signal
	h) There is a 4-aspect to 3-aspect sequence transition at the preceding signal
	i) Signal layout has been altered in the last six months
	Example risk mitigations
	i. Consistent signal spacing
	ii. Count-down markers on the signalled approach
	iii. Consistent signal design
	iv. Directional arrow sign at the signal
	v. Reposition the signal to other side of the track
	vi. Co-acting signal
	vii. Alter the signal height
	viii. Display the stop aspect uppermost in ground-mounted signal head
	ix. Fit AWS if not already fitted
	x. Reposition AWS magnet to the standard position
	xi. Driver training

Rail Industry Standard on Signal Overrun Risk Evaluation and Assessment

Question 2	Example risk factors
Could the signal be confused with other signals on an adjacent line or on the same gantry ('count across' errors)?	a) Signal is in the middle, that is, not at the end of a gantry of four or more signals facing the same way
	b) The position of the signal relative to the end of a gantry is different to preceding signals, but the route has not involved a crossover prior to the signal
	c) Signal is on a post and could be confused with a signal on an adjacent line
	d) Signal is a platform starter, and could be confused with a signal for an adjacent platform
	e) Signal has an identical profile / outline to adjacent signals
	f) Number of lines (including sidings) visible to the driver differs from the number of visible signals
	g) Signal has a curved approach and there is a possibility that a driver could misread a signal applicable to another line (opinion)
	h) When the AWS horn is activated, another signal is closer to the driver's line of sight than the relevant route signal
	Example risk mitigations
	i. Mount all signals on the gantry
	ii. Alter size / shape of backboard, so signals are perceptually distinct
	iii. Ensure signals for all lines are visible
	iv. Line identifiers
	v. Shield nearby signals from view
	vi. Appropriate signal should be clearly associable with its line at point of AWS horn
	vii. Optimise signal aspect beam alignment
	viii. Optimise lens hood position or length on signal
	ix. Interlocking of signals
	x. Driver training

Question 3	Example risk factors
Could a driver misread a signal because the train movement involves a crossover just before the signal? (If yes, record distance from crossover to signal)	a) More than 50% of trains approach the signal through a crossover.
	Example risk mitigations
	i. Line identifiers
	ii. Driver training

Question 4	Example risk factors
Is there a risk from reading through to the signal ahead? (If yes, provide supporting evidence)	a) Drivers report that there is a tendency to read through at this signal.
	Example risk mitigations
	i. Optimise lens hood position or length on signal
	ii. Optimise signal aspect beam alignment
	iii. Shield signal ahead from view
	iv. Driver training

Question 5	Example risk factors
Could the signal be obscured from the driver's view?	a) Signal reading time is inadequate
	b) Signal is positioned round a curve and the reading angle is inadequate
	c) Signal is positioned round a curve and there is an obstruction blocking the signal's line of sight
	d) Signal can be obscured by vegetation
	e) Signal can be obscured (intermittently or otherwise) by a bridge or other structure, for example station structures
	f) Signal can be obscured (intermittently or otherwise) by overhead line
	g) Signal can be obscured (intermittently or otherwise) by trains on other lines
	h) Signal is located in a visually complex area (for example, lots of gantries, OHLE, buildings, advertising billboards etc)
	i) Signal is positioned at the exit of a long tunnel, and drivers report that it takes time to readjust to outside light upon leaving the tunnel
	j) Signal is a platform starter, and the stopping position of some trains (at least 50% of all trains) is such that the signal is obscured from the driver's view
	k) If signal is on an open approach with a line speed above 20 mph, signal back plate has a light coloured or hatched border
	l) Signage adjacent to signal lenses makes aspect more difficult to perceive
	m) Edge of signal back plate is less than 100 mm from edge of aspect
	Example risk mitigations
	i. Increase backboard size (by 50%)
	ii. Reposition signage
	iii. Do not use white or blue / white borders around back plates for long viewing distances
	iv. Optimise signal aspect beam alignment
	v. Manage vegetation
	vi. Position red aspect on top of ground-mounted signal head
	vii. Adjust close viewing element to optimise close-up readability
	viii. Alterations to OHLE
	ix. Cantilever structure to position signal aspect closer to driver's line of sight
	x. Alter signal height
	xi. Remove / shield potential distractions in stations
	xii. Reposition signal on straight track
	xiii. Avoid placing signals immediately beyond converging junctions
	xiv. Countdown markers
	xv. Banner repeater
	xvi. Co-acting signal
	xvii. Car stop signs
	xviii. Re-locate signal post telephone on approach to signal (15 – 20 m)
	xix. Make signal post more conspicuous
	xx. Driver training

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Question 6	Example risk factors
Could the signal's visibility be adversely affected by sunlight?	a) Signal faces in an east-west direction (within 10 degrees), and sun can cause a problem
	b) Signal faces south (within 10 degrees) and winter sun can be a problem
	c) Drivers report that the signal is susceptible to sun glare
	Example risk mitigations
	i. Adjust lens hood position or length to optimise readability
	ii. Large backboard
	iii. Increase signal light luminance
	iv. Driver training

Question 7	Example risk factors
Could the signal be confused with or obscured by artificial lighting?	a) Signal is located near a facility with strong lighting
	b) Drivers report that the signal is susceptible to confusion with other lighting (for example, street lighting)
	c) Signal is a platform starter, and could be masked by station lighting
	Example risk mitigations
	i. Relocate / shield or otherwise mitigate extraneous lighting
	ii. Large backboard
	iii. Increase signal light luminance

Question 8	Example risk factors
Does the track on the approach to the signal suffer from adhesion problems?	a) Signal is located in an area which suffers from ice, frost, leaf fall, dampness or other adhesion problems
	Example risk mitigations
	i. Static sanders
	ii. Rail guards
	iii. Lineside fencing / netting
	iv. Fit rolling stock with wheel scrubbers and / or sanders
	v. Railhead conditioning (Sandite)
	vi. Management of lineside vegetation
	vii. Low adhesion warning signs
	viii. Driver training

Question 9	Example risk factors
Is there a reduction in permissible speed on the approach to the signal?	a) There is a reduction in permissible speed on the approach to the signal
	Example risk mitigations
	i. Redesign permissible speed profile
	ii. Driver training

Question 10	Example risk factors
Is there a falling gradient on the approach to the signal?	a) There is a falling gradient on the approach to the signal
	Example risk mitigations
	i. Countdown markers
	ii. Driver training

Question 11	Example risk factors
For a signal that is not a platform starting signal: Can the driver be distracted by something outside the cab?	a) Signal is located in the vicinity of a main station, or other busy area that contains advertising billboards, buildings, gantries, OHLE etc
	b) Driver could be distracted by trespassers
	c) There is a motorway or other busy main road in the vicinity of the signal
	d) There is excessive lineside signage which could cause distraction from signal
	e) Other, for example, OHLE, neutral section ahead of signal
	Example risk mitigations
	i. Reduce number of signs on approach to signal
	ii. Reposition signal
	iii. Relocate OHLE, neutral section or 3rd rail section gap
	iv. Signal reminder sign
	v. Position signal where driver not distracted by other duties
	vi. Driver training

Question 12	Example risk factors
For a platform starting signal: Could the driver be distracted by something outside the cab?	a) Signal is a platform starter and driver could be distracted by something outside the cab (for example, passengers, other train movements)
	Example risk mitigations
	i. TRTS / RA facilities at platforms
	ii. Position signal where driver is not distracted by other duties
	iii. Signal reminder signs
	iv. Driver training

Question 13	Example risk factors
Could the driver be distracted by other tasks at or on approach to the signal?	a) There is a change in permissible speed on the approach to the signal
	b) More than 50% of trains are accelerating on the approach to the signal (for example, following exit from a station)
	c) Driver must arm ATP on approach to the signal
	d) Driver must use / set up radio on approach to the signal
	e) Signal in rear (that is to say, caution signal) is preceded by a flashing yellow signal for more than 50% of all approaching trains
	f) More than 50% of trains involve a crossover just after the signal
	g) Operation of TASS visible indicator on the approach to the signal
	Example risk mitigations
	i. Redesign permissible speed profile
	ii. Reposition balise if operation of TASS visual indicator is a cause of SPADs
	iii. Signal reminder signs
	iv. Position signal where driver not distracted by other duties
	v. Driver training

Rail Industry Standard on Signal Overrun Risk Evaluation and Assessment

Question 14	Example risk factors
Is signal approach released from a main stop aspect?	a) Signal is approach release from red for at least 50% of trains
	Example risk mitigations
	i. Alter the signalling system to remove the requirement to apply approach release from red conditions
	ii. Driver training

Question 15	Example risk factors
Would a stop aspect be unexpected at the signal?	a) Signal is usually displaying a proceed aspect (roughly 99% of time)
	b) Signal is the first controlled signal after a series of at least four automatic signals, and is usually displaying a proceed aspect (roughly 99% of time)
	c) On the approach to the signal, the driver is used to running on cautionary aspects
	d) The previous signal is a platform starter
	Example risk mitigations
	n/a

Question 16	Example risk factors
Would a green aspect be unexpected at the signal?	a) Signal is usually (roughly 99% of time) red
	b) Signal is last one before entry into a main station
	Example risk mitigations
	n/a

Appendix C Further Risk Mitigation Examples

G C.1 Example signal overrun risk (frequency x consequence) mitigations

G C.1.1 Further potential risk mitigations to reduce signal overrun (frequency x consequence) include:

a) Grade separation.

b) Reduce the frequency that drivers experience the signal displaying a stop aspect using:

i) Timetable design.

ii) Train path design.

iii) Platform allocation design.

c) Reduce the permissible speed (at high-risk locations), taking account of any adverse effect on frequency of signal overrun.

G C.2 Example signal overrun frequency mitigations

G C.2.1 Further potential risk mitigations to reduce the frequency of signal overrun include:

a) Minimise the number of non-preferred routes within the signalling layout, to improve driveability through consistency.

b) Display an approach-controlled aspect sequence at signals in rear.

c) Implement an active train protection system.

d) Implement an active driver advisory system that reduces the likelihood that the train will approach the signal displaying a stop aspect.

G C.3 Example signal overrun consequence mitigations

G C.3.1 Further potential risk mitigations to reduce the consequence of a signal overrun include:

a) Maintain the next signal section clear (double blocking).

b) Implement a monitoring system to identify a signal overrun and take action by signal or radio.

c) Track layout design:

i) Double junction instead of a single lead junction.

ii) Fixed diamond instead of a switch diamond.

iii) Parallel crossovers instead of single ladder junction.

iv) Group lines by direction.

v) Define the dominant direction of traffic flow on bi-directional lines.

vi) Minimise the length of bi-directional lines.

d) Position platform starting signal AWS beyond the platform end.

e) Provide flank point protection:

i) Auto-normalisation of points.

ii) Set points in and beyond overlap to route trains away from conflict.

iii) Set points in and beyond overlap to maximise safe overrun distance.

f) Provide safe overrun distance:

i) Increase distance between the protecting signal and the conflict point.

ii) Move the signal to maximise safe overrun distance.

iii) Provide a longer overlap.

iv) Define and use preferred overlaps.

g) Provide trapping protection, taking account of the impact on derailment risk.

h) Optimise TPWS functionality:

i) Provide signal group replacement functionality.

Definitions and Abbreviations

Actor

Any party which is, directly or through contractual arrangements, involved in the application of the CSM RA.

ATP

Automatic Train Protection.

AWS

Automatic Warning System – see GE/RT8075.

Conflict point

The first location beyond a signal at which a collision could occur.

CSM RA (the regulation)

The Common Safety Method on Risk Evaluation and Assessment. Commission Regulation (EC) No 352/2009 of 24 April 2009 on the adoption of a common safety method on risk evaluation and assessment, as referred to in Article 6(3)(a) of Directive 2004/49/EC of the European Parliament and of the Council.

Hazard

A condition that could lead to an accident.

ORR

Office of Rail Regulation.

Multi-SPAD signal

A signal where more than one category A SPAD incident has occurred in the previous five years. Further definitions relevant to SPAD categories are set out in GO/RT3119.

Proposer

As defined in the regulation:

'proposer' means the railway undertakings or the infrastructure managers in the framework of the risk control measures they have to implement in accordance with Article 4 of Directive 2004/49/EC, the contracting entities or the manufacturers when they invite a notified body to apply the 'EC' verification procedure in accordance with Article 18(1) of Directive 2008/57/EC or the applicant of an authorisation for placing in service of vehicles. (Article 3, clause 11.)

SFAIRP

So far as is reasonably practicable. The Health and Safety at Work etc Act 1974 imposes a duty on employers to ensure the safety of people affected by their undertaking SFAIRP. The requirement to ensure safety SFAIRP also applies when explicit risk estimation is used in an application of the Common Safety Method on Risk Evaluation and Assessment. This is sometimes expressed as a requirement to reduce risk to a level that is as low as reasonably practicable (ALARP). RSSB's document 'Taking Safe Decisions', which describes how companies in the GB mainline railway industry take safety-related decisions, provides further information.

Safety acceptance

As defined in the CSM RA regulation:

A status given to the change by the proposer based on the safety assessment report provided by the assessment body. (Article 3, clause 24)

Further guidance about assessment bodies is given in GE/GN8645.

Safety measures

As defined in the CSM RA regulation:

A set of actions that either reduce the rate of occurrence of a hazard or mitigating its consequences in order to achieve and / or maintain an acceptable level of risk. (Article 3, clause 10)

Safety requirements

As used in this document: A characteristic of a system and its operation (including operational rules) necessary in order to deliver acceptable risk.

As defined in the CSM RA regulation:

'safety requirements' means the safety characteristics (qualitative or quantitative) of a system and its operation (including operational rules) necessary in order to meet legal or company safety targets. (Article 3, clause 9)

Signal overrun risk

The safety risk from accidents caused by a train passing a stop signal that is displaying a stop aspect denoting the end of its movement authority. Risk is a combination of frequency and consequence, typically measured in term of fatalities and weighted injuries per year.

SORAT

Signal Overrun Assessment Tool, developed and validated by Network Rail.

System

As defined in the CSM RA regulation:

'That part of the railway system which is subject to a change. (Article 3, clause 25)

TPWS

Train Protection and Warning System – see GE/RT8075.

Vari-SPAD

Variable SPAD Probability Model. A series of structured questions used to support the stage 2 signal overrun risk assessment workshop.

References

The Catalogue of Railway Group Standards gives the current issue number and status of documents published by RSSB. This information is also available from www.rgsonline.co.uk.

RGSC 01	Railway Group Standards Code
RGSC 02	Standards Manual

Documents referenced in the text

Railway Group Standards

GE/RT8040	Low Adhesion between the Wheel and the Rail − Managing the Risk
GE/RT8075	AWS and TPWS Interface Requirements
GO/RT3119	Accident and Incident Investigation

RSSB documents

GC/RC5633	Recommendations for the Risk Assessment of Buffer Stops, Arresting Devices and End Impact Walls
GD-0001-SKP	Taking Safe Decisions
GE/GN8537	Guidance on Gauging
GE/GN8540	Guidance on Low Adhesion between the Wheel and the Rail - Managing the Risk
GE/GN8560	Guidance on Engineering Requirements for Dispatch of Trains from Platforms
GE/GN8601	Guidance on Lineside Signalling Asset Compatibility Assessment Requirements [in preparation, will replace GE/GN8537]
GE/GN8612	Guidance on Signalling Layout Assessment Requirements [in preparation, will replace some parts of GK/GN0645]
GE/GN8618	Guidance on Mechanical Trainstop System
GE/GN8640	Guidance on Planning of an Application of the CSM on Risk Evaluation and Assessment
GE/GN8641	Guidance on System Definition
GE/GN8642	Guidance on Hazard Identification and Classification
GE/GN8643	Guidance on Risk Evaluation and Risk Acceptance
GE/GN8644	Guidance on Safety Requirements and Hazard Management
GE/GN8645	Guidance on Independent Assessment
GE/GN8675	Guidance on AWS and TPWS Interface Requirements
GK/GN0645	Guidance on Lineside Signals, Indicators and Layout of Signals
GK/GN0658	Guidance on Lineside Signal Aspect and Indication Requirements
RSSB Safety Risk Model	RSSB Safety Risk Model Risk Profile Bulletin
Safety Management Information	System (SMIS) – the rail industry's national database for recording safety-related events that occur on the UK rail network

Other references

EC No 352/2009	Commission Regulation on a Common Safety Method on risk evaluation and assessment
	The Health and Safety at Work etc Act 1974

Other relevant documents

Railway Group Standards	
GE/RT8037	Signal Positioning and Visibility
GE/RT8060	Engineering Requirements for Dispatch of Trains from Platforms
GK/RT0045	Lineside Signals, Indicators and Layout of Signals
GK/RT0058	Lineside Signal Aspect and Indication Requirements
GK/RT0070	Signalling Layout Requirements [pending publication]
RSSB documents	
GK/GN0670	Guidance on Signalling Layout Requirements [pending publication]
Other references	
(EU) No 402/2013	Commission Regulation on a Common Safety Method for risk evaluation and assessment (2013)
ORR Guidance (Dec 2012)	ORR guidance on the application of the common safety method (CSM) on risk assessment and evaluation (December 2012)
ROGS 2006	Railways and Other Guided Transport Systems (Safety) Regulations 2006