Rail Industry Standard
RIS-8040-TOM
Issue: Two **Draft:** 1W
Date: June 2022

Managing Low Adhesion

Synopsis

This standard sets out a framework to develop, implement, monitor and review the effectiveness of site-specific plans to manage low adhesion at identified high-risk sites, which helps transport operators to control risks, mitigate hazards and improve safety and performance in preparation for low adhesion conditions.

Published by RSSB

Issue record

Issue	Date	Comments
One	03/12/2016	Original document.
Two	04/06/2022 [Proposed]	Replaces issue one. This revision incorporates relevant content from RIS-8040-TOM issue one and GEGN8540 issue two. The standard is structured in a framework that is easier to follow, clarifies responsibilities, and each requirement has a corresponding rationale and, where relevant, guidance.

Revisions have not been marked by a vertical black line in this issue because the document has been revised throughout.

Superseded documents

The following Railway Group documents are superseded, either in whole or in part as indicated:

Superseded documents	Sections superseded	Date when sections are superseded
RIS-8040-TOM issue one	All	04/06/2022 [Proposed]
GEGN8540 issue two	All	04/06/2022 [Proposed]

Supply

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Contents

Part 1 Purpose and Introduction

1.1 Purpose

1.1.1 When the rail surface or the wheels are coated with contaminants, the risk of low adhesion increases.

1.1.2 Low adhesion limits the acceleration and braking capability of trains as the wheels slip or slide on the rails, which can lead to:

a) Trains running too far or too fast - potentially leading to a movement authority being exceeded (signals passed at danger, SPaD), an intended stopping place being overrun, derailment or collision;
b) Collision with another train or infrastructure due to the inability to bring the train to a stand short of conflict point due to wheelslide;
c) Collision due to the loss of train detection through the non-operation of track circuits; and
d) Damage to wheel or rails as wheels slip or slide during acceleration and braking.

1.1.3 Incidents due to low adhesion can cause injuries and fatalities, damage to the industry's reputation and have an impact on timetables and staff resources, all of which are costly.

1.1.4 RIS-8040-TOM sets out a framework to develop, implement, monitor and review the effectiveness of site-specific plans to manage low adhesion at identified high-risk sites, which helps transport operators to control risks, mitigate hazards and improve safety and performance in preparation for low adhesion conditions. The framework consists of five steps, as outlined in Figure *1*.

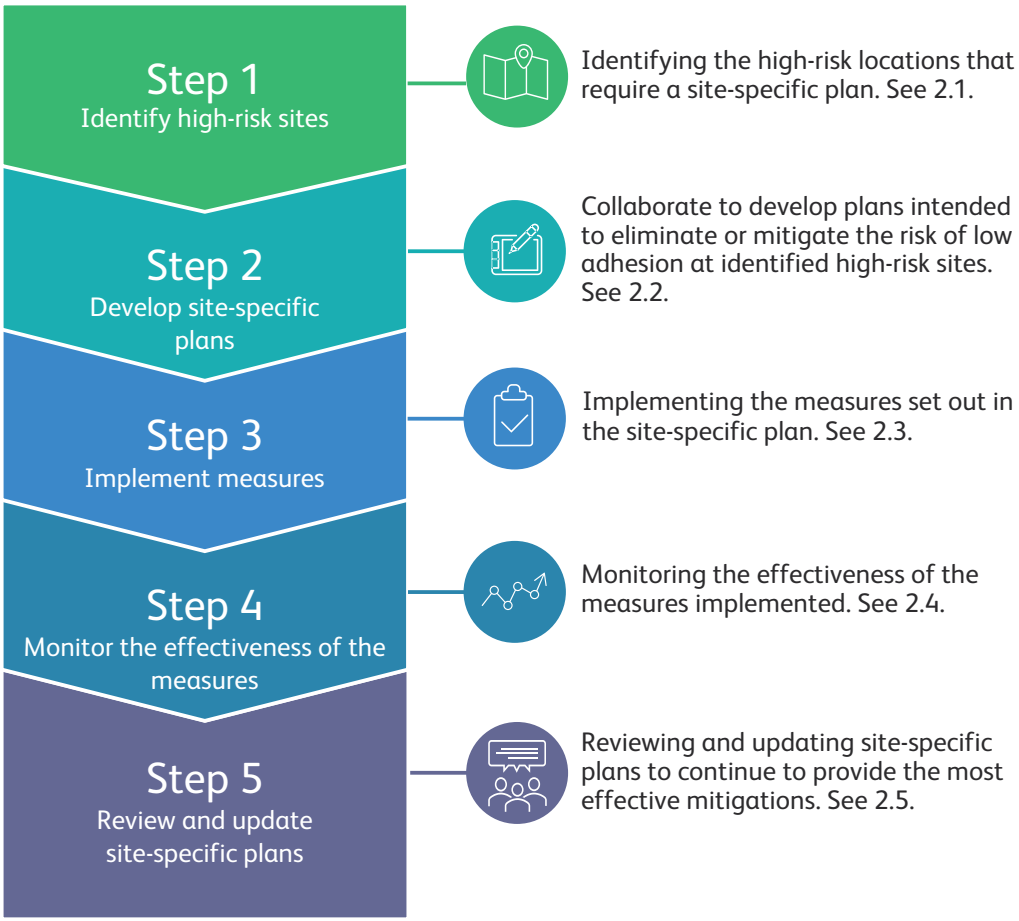

Figure 1: Framework to manage low adhesion

1.1.5 The framework builds upon the duty of cooperation that the Railway and Other Guided Transport Systems (Safety) Regulations 2006 (as amended) (ROGS) places on transport operators as they collaborate to review the plans and share good practices.

1.1.6 The Seasonal Challenge Working Group and the Vehicle/Track System Interface Committee Adhesion Research Group supported the development of this standard.

1.2 Application of this document

1.2.1 Compliance requirements and dates have not been specified because these are the subject of internal procedures or contract conditions.

1.2.2 If you plan to do something that does not comply with a requirement in this RIS, you can ask a Standards Committee to comment on your proposed alternative. If you want a Standards Committee to do this, please submit your deviation application form to RSSB. You can find advice and guidance on using alternative requirements on RSSB's website www.rssb.co.uk.

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 Structure of this document

1.4.1 This document sets out a series of requirements that are sequentially numbered. This document also sets out the rationale for the requirement, explaining why the requirement is needed and its purpose and, where relevant, guidance to support the requirement. The rationale and the guidance are prefixed by the letter 'G'.

1.4.2 Some subjects do not have specific requirements but the subject is addressed through guidance only and, where this is the case, it is distinguished under a heading of 'Guidance' and is prefixed by the letter 'G'.

1.5 Approval and authorisation of this document

1.5.1 The content of this document will be approved by the Traffic Operations and Management Standards Committee on 1 March 2022 [proposed].

1.5.2 This document will be authorised by RSSB on 4 June 2022 [proposed].

Part 2 Managing the risk of low adhesion by identifying high-risk sites

2.1 Identifying high-risk sites for low adhesion

2.1.1 Infrastructure managers shall:

a) Identify sites of high-risk where low adhesion between the wheel and rail may occur;
b) Publish the details of high-risk sites in the sectional appendix or equivalent document; and
c) Agree the list of high-risk sites with relevant parties; and
d) Warn drivers of the potential risk of low adhesion, using signage, Sign AK210 to mark the start point, and Sign AK214 to mark the end point of the high-risk site.

Rationale

G 2.1.2 This requirement helps infrastructure managers control the risk of low adhesion between the wheel and rail as part of their general duties under the Health and Safety at Work etc. Act 1974 to reduce any risk to the health, safety and welfare of their employees and the general public.

G 2.1.3 Identifying the high-risk sites where low adhesion may occur:

a) Enables the exposure to hazards associated with low adhesion at high-risk sites to be effectively managed;
b) Supports the effective use of resources; and
c) Supports the development of appropriate mitigation measures where they are needed most.

Guidance for identifying high-risk sites

G 2.1.4 A 'high-risk' site is a location that is likely to be affected by low adhesion and requires a site-specific plan.

G 2.1.5 Infrastructure managers identify high-risk sites through the analysis of train performance data, incident data and operational experience, for example:

a) Reports of Low Adhesion (ROLAs), reports that rail adhesion has deteriorated to a level that is worse than would be expected by the driver for the location and environmental conditions;
b) Historical records, including accident and incident reports;
c) Previous wrong side-track circuit failures;
d) Related research;
e) Information from technical sources, such as the analysis of data recorders; for example, On-Train Data Recorders (OTDR) or remote-condition monitoring equipment;
f) Treatment at sites in previous years;
g) Reports of trains slipping to a stand;
h) Feedback from infrastructure maintenance staff; and
i) Knowledge of local conditions.

G 2.1.6 A list of relevant parties to agree the list of high-risk sites with can be found in G2.2.9.

2.2 Development of site-specific plans to manage low adhesion at high-risk sites

2.2.1 Infrastructure managers shall:

a) Lead the development of site-specific plans that set out measures to eliminate or mitigate the risks of low adhesion at high-risk sites;
b) Involve relevant parties in the development and review of the site-specific plans; and
c) Share the site-specific plans with relevant parties.

2.2.2 Railway undertakings that run services over the high-risk site, and other relevant parties, shall review the site-specific plan in collaboration with the infrastructure manager.

Rationale

G 2.2.3 Low adhesion can cause delays and result in safety incidents. Developing site-specific plans can help reduce the occurrence and impact of low adhesion and wrong-side track circuit failures.

G 2.2.4 ROGS places a duty on transport operators to cooperate to make sure the railway is safe. A collaborative review benefits the development of site-specific plans because it:

a) Facilitates sharing of information about predicted and encountered low adhesion (for example, railway undertakings have access to feedback from drivers);
b) Enables the proactive deployment of staff;
c) Helps plan railhead treatment activities;
d) Helps plan service levels and timetable changes;
e) Allows the prompt provision of advice to drivers; and
f) It enables clear prioritisation between conflicting activities during leaf fall season (for example, a maintenance possession that prevents the operation of a railhead treatment train).

Guidance for developing site-specific plans

G 2.2.5 Infrastructure managers may carry out risk assessments of high risk-sites to inform the development of site-specific plans. *Appendix A* contains a list of information that is good practice to include in the plans.

G 2.2.6 To reduce incidents where rolling stock is not fitted with systems to improve braking performance and traction during low adhesion conditions, it is good practice to provide additional control measures, review existing measures and where necessary, implement changes to improve the effectiveness of measures.

G 2.2.7 Where measures intended to reduce the risk of low adhesion are implemented at high-risk sites, it is good practice to:

a) Evaluate their effectiveness; and
b) Determine their impact for failure or damage to the following, and what alternative measures could be put in place, if necessary:

i) Train detection systems;
ii) Ultrasonic or non-destructive testing;
iii) The railhead;
iv) Wheels; and
v) Service performance.

Guidance for collaboration

G 2.2.8 The aim of transport operators collaboratively reviewing site-specific plans is to:

a) Verify that the content of the site-specific plan is appropriate for the location;
b) Verify any assumptions the infrastructure manager made about the role railway undertakings have in mitigating the risk are correct;
c) Facilitate the exchange of information, sharing of good practice, thoughts and ideas; and
d) Reach a consensus to manage the risk of low adhesion at high-risk sites.

G 2.2.9 Effective collaboration is achieved by identifying and involving relevant parties for each high-risk site, including:

a) The infrastructure manager;
b) Railway undertakings that run services over the high-risk site;
c) Operators of railhead treatment trains;
d) Operators of on-track maintenance vehicles; and
e) Driver health and safety representatives.

G 2.2.10 Collaboration to manage the risk of low adhesion for high-risk sites requires knowledge of, or access to data in areas, such as:

a) Low adhesion sites – those sites where vehicles regularly experience problems;
b) Weather conditions – up-to-date knowledge of local conditions, such as ambient temperature, humidity, wind speed and dew point;
c) Information from the analysis of on-train data collection systems – sanding equipment activations, wheel slide protection (WSP) activations, low adhesion warning systems;
d) Vegetation surveys or management information – historical data or planned work;
e) Train delay system data – indicating potential high-risk areas from previous lost time incidents;
f) Driver knowledge, such as low adhesion driving policies, techniques and instructions;
g) Possession management or planning that could impact the operation of railhead treatment trains;
h) Adhesion-related incident data, such as trains slipping to a stand, signals passed at danger, remote condition monitoring systems and any previous wrong-side track circuit failures; and
i) Any related research.

G 2.2.11 The review of site-specific plans can benefit from individuals with knowledge or understanding of:

a) Local conditions, such as vegetation surveys, data from weather stations, forecasts and leaf fall predictions;
b) Weather management;
c) Data analysis;
d) Railway maintenance;
e) Human factors in relation to driving techniques;
f) Suitable mitigation measures for low adhesion; and
g) Railway standards and procedures.

G 2.2.12 It is good practice to maintain an ongoing collaboration to discuss and share knowledge of any initiatives to manage low adhesion, which are continually being developed. This is because it allows all parties to fully understand how the initiatives may affect existing site-specific plans.

G 2.2.13 It is good practice for the infrastructure manager to agree with relevant parties how the site-specific plans will be stored and how relevant parties will be able to access them in the future.

2.3 Implementing site-specific plans

2.3.1 Infrastructure managers shall implement the site-specific plan:

a) When the level of available adhesion has been reported as being worse than would be expected by the driver for the location and environmental conditions; and
b) Following a review and update of the site-specific plan.

2.3.2 Where an existing control measure has been identified to be ineffective or unavailable, such as the missed run(s) of a rail head treatment train, or planned vegetation work not undertaken, the infrastructure manager shall implement alternative mitigation measures without delay.

2.3.3 If rail adhesion is reported as being worse than would be expected by the driver for the location and environmental conditions, including at locations that do not have a site-specific plan, the infrastructure manager shall inform affected railway undertakings of the remedial action taken, and subsequently inform, them on its effectiveness.

Rationale

G 2.3.4 Implementing site-specific plans ensures the most effective mitigation measures can be implemented at each high-risk site to improve braking and accelerating performance during low-adhesion conditions to minimise the risk of safety incidents.

G 2.3.5 Implementing site-specific plans supports the aim to improve safety and performance by avoiding safety incidents due to trains overrunning.

G 2.3.6 Implementing alternative mitigation measures, where existing measures have been identified as ineffective or unavailable reduces the likelihood of extended braking distances with the potential for overruns, collisions, derailments or adhesion being reported as being worse than would be expected by the driver for the location and environmental conditions.

Guidance

G 2.3.7 Infrastructure managers receive predictive warnings from external suppliers which rank the risk of low railhead adhesion over a five-day period and include daily updates. This advice can be used to direct resources and for providing advice to drivers of potential low adhesion conditions. *Appendix B* contains information on sharing seasonal information with drivers.

G 2.3.8 Rule Book Module GERT8000-TW1, section 28 sets out the operating rules relating to the management of rail adhesion, including the action to be taken when rail adhesion levels deteriorate to a level that is worse than would be expected by the driver for the location and environmental conditions.

2.4 Monitoring site-specific plans

2.4.1 Infrastructure managers shall monitor the effectiveness of site-specific plans.

Rationale

G 2.4.2 Monitoring site-specific plans assists the identification of ineffective mitigations in place, that could result in increased delays and higher levels of risk, such as, signals passed at danger, station overruns or collisions.

Guidance

G 2.4.3 Monitoring performance trends can help indicate whether the measures in the site-specific plan continue to adequately address the risks of low adhesion.

G 2.4.4 It is good practice to arrange post-incident checks of the following:

a) Rolling stock, including examining wheels for contamination and analysis of train braking performance before entering service;
b) Railhead condition at and approaching the site of the incident; taking photographs of any visible railhead contamination; and
c) Operation of all railhead treatment trains over the incident site during the previous 24 hours.

G 2.4.5 It is good practice for infrastructure managers and railway undertakings to have joint guidance in place for inspecting and capturing details of the contamination observed following an adhesion or wrong-side track circuit failure incident.

G 2.4.6 RIS-3708-TOM sets out requirements for special working arrangements for any location affected by wrong-side track circuit failures caused by leaf fall contamination.

2.5 Review and update site-specific plans

2.5.1 Infrastructure managers shall lead the review of the effectiveness of site-specific plans and update them as necessary.

Rationale

G 2.5.2 Reviewing and updating site-specific plans help manage risks that may need addressing. It also helps determine whether the measures in place continue to provide the most effective mitigation at each high-risk site.

Guidance

G 2.5.3 It is good practice to review and update a site-specific plan:

a) At the end of each autumn season;
b) After receiving two reports within a twelve hour period, of rail adhesion levels deteriorating to a level that is worse than would be expected by the driver for the location and environmental conditions;
c) When the monitoring of measures implemented at high-risk sites identifies them as no longer being effective;
d) When additional risks (such as industrial pollutants) have been identified;
e) When changes have been made to the infrastructure;
f) When changes have been made to the rolling stock over a particular route;
g) When there is replacement of a rolling stock fleet;
h) When there is a change to the service frequency; or
i) When there is a change to the maximum permitted speed of trains.

G 2.5.4 The review of the site-specific plans can be supported with:

a) Data available from the most recent autumn season, such as On-Train Data Recorders (OTDR), sanding equipment activations, wheel slide protection (WSP) activations and low adhesion warning systems;
b) An assessment of the impact of any implemented measures; and
c) Driver feedback — by giving their views on the effectiveness of the measures, giving insights into how driving conditions are and where problem areas are located.

G 2.5.5 Changes or modifications of the rolling stock in use may also affect the effectiveness of the site-specific plan.

G 2.5.6 RSSB research report T1181 & COF-LAD (2020) has further information on the effectiveness of mitigations the industry has employed against low adhesion and analysed the data sources.

G 2.5.7 Adhesion Working Group's Managing Low Adhesion manual has information on understanding and managing low adhesion. The manual lists examples of best practice measures to mitigate low adhesion.

G 2.5.8 Once a site-specific plan is updated, it is good practice to remove from the site any remedial actions or measures to manage the risk of low adhesion that are no longer considered to be effective.

Appendices

Appendix A Content of site-specific plans

A.1 It is good practice to include the following information in site-specific plans.

A.1 Measures to control risks

A.1.1 The measures that may be required at each high-risk site to control the risks from low adhesion, for example:

a) Vegetation management process, including leaf fences;
b) Railhead cleaning, including, cryogenic, plasma, water jetting and rail scrubbing;
c) The operation of railhead treatment trains or multi-purpose vehicles;
d) The presence of lineside signs;
e) The provision or absence of trainborne equipment fitted to trains, for example:
    i) Optimised wheel slide protection (WSP) equipment;
    ii) Scrubber blocks;
    iii) Magnetic track brakes. RIS-2710-RST sets out the requirements for magnetic track brakes;
    iv) Automatic sanding devices, combined traction and braking sanders, variable rate sanders, sand level monitoring and low sand level warnings. GMRT2461 sets out the requirements for sanding equipment;
f) Traction gel applicators;
g) Track circuit actuators;
h) Train lengthening;
i) Driver competence required, including route knowledge, application of driving policies and site-specific instructions;
j) Take the route out of use;
k) Speed restrictions, temporary or permanent;
l) Special box instructions restricting certain moves;
m) Top-of-rail material;
n) Selected trains performing running brake tests;
o) A review or update of driving policies;
p) The control or management at level crossings, such as timings, blocking arrangements or stopping or non stopping mode;
q) Signal Passed at Danger (SPAD) prediction equipment fitted at level crossings; and
r) Existing mitigation measures already in place.

A.1.2 Information on Network Rail's approach to the management of lineside vegetation can be found in the John Varley (2019) review.

A.1.3 RSSB research report T1149 (2020) describes a model to calculate the adhesion between wheels and rails under contact conditions, emphasising the influence of water and leaf contamination on wheel and rail adhesion.

A.1.4 RSSB research report IMP-T1107 (2020) has more information on the benefits of sanding in braking in low adhesion conditions.

A.1.5 RSSB toolkit T1156 (2019) provides further guidance on the information drivers need in low adhesion conditions.

A.1.6 RSSB research report SC04-POB-15 (2019) has more information on the benefits on the process of using cryogenic (dry ice) cleaning to effectively remove oxide and leaf contamination from rail.

A.2 Existing low adhesion information

A.2.1 Information that is known about high-risk sites, for example:

a) Historical records;
b) Incidents and accidents; and
c) Feedback from drivers and infrastructure maintenance staff.

A.3 Potential hazards

A.3.1 Potential hazards at each site, such as:

a) Infrastructure, for example bridges and tunnels;
b) Position of signals;
c) Level crossings;
d) A junction with conflicting move potential;
e) Gradients; and
f) Terminal platforms or buffer stops.

A.4 External factors

A.4.1 Potential hazards at each site from external factors, such as:

a) Kerosene near airports;
b) Chemicals or other industrial pollution;
c) Contamination of the rails, such as, grease, fuel, and oil;
d) Road traffic pollution; and
e) Damp, dew, ice, frost, or other climatic conditions.

A.5 Others

A.5.1 Other relevant information that could be included in a site-specific plan:

a) Seasonal management processes in place;
b) Alternative mitigation measures if the planned measures cannot be implemented;
c) Local conditions, such as vegetation surveys, data from weather stations, forecasts and leaf fall predictions;
d) Timescales to manage the risk; and
e) Person(s) responsible for implementing the plan.

Appendix B Sharing seasonal information with drivers

B.1 Drivers play an important role in managing the risk of low adhesion between the wheel and rail. How drivers react to low adhesion conditions in autumn can be a significant factor in whether services run safely and on time. It is good practice to share seasonal information with drivers, which is:

a) Timely – for example, a GSM-R acknowledged (safety) broadcast call for poor rail conditions, which is received in time for the driver to slow and prepare to brake;
b) Accurate – so that it is perceived as correct and up-to-date; for example, a correct weather forecast for that afternoon;
c) Relevant – for example, an adhesion notice that relates specifically to the driver's route;
d) Simple – for example, a 'leaf-colour' warning is much easier to understand than numeric forecast data;
e) Available – for example, information printed and displayed in the late notice case at the booking-on point; and
f) Memorable – for example, drivers are more likely to remember a short list of low adhesion sites, especially if the location names correspond with those used for route learning.

B.2 RSSB toolkit T1156 (2019) contains more detail on the principles for making information available to drivers described in *B.1*.

B.3 RSSB research report T1159 (2019) into driving techniques confirmed that there is greater variability during low adhesion than at other times.

B.4 It is good practice for railway undertakings to:

a) Monitor new drivers in low adhesion conditions;
b) Review and amend their driving training, competence management and assessment processes to include:
    i) Principles of defensive driving, such as putting safety before punctuality;
    ii) Braking techniques for different vehicle types; and
    iii) Use of on-train equipment, such as sanders.
c) Use simulators or other methods to encourage consistency of drivers' approach in low adhesion conditions; and
d) Share information with drivers on:
    i) Low adhesion initiatives;
    ii) Incident trends to make them aware of low adhesion at high-risk sites on their routes; and
    iii) The locations where the braking curve is unlikely to take into account reduced rail adhesion levels on lines operating under European Railway Traffic Management System (ERTMS) or Automatic Train Operation (ATO).

B.5 Further guidance for briefing drivers in winter conditions is set out in GEGN8628.

Definitions

European Rail Traffic Management System (ERTMS)	Signalling and operation management system encompassing ETCS for control command, and GSM-R for voice and data. It is a system for providing real-time control and supervision of trains, consisting of trainborne, track and lineside equipment. The objective is to enable the operation on compatible signalling systems across European borders.
Global System for Mobile Communications – Railway (GSM-R)	The European Standard specific to railway applications for the transmission by radio of voice and data between train and trackside installations. Source: *GERC8517 Issue 1*
good practice	A process or method that has been shown to work well; succeeds in achieving its objective(s); is widely accepted; and therefore can be recommended as an approach.
high-risk sites	Locations likely to be affected by low adhesion, which are determined by the infrastructure manager through the analysis of train performance/incident data and operational experience in previous years.
incident	An unplanned, uncontrolled or unintended event which under different circumstances could have resulted in an accident.
infrastructure manager (IM)	Has the meaning given to it in the Railways and Other Guided Transport Systems (Safety) Regulations 2006 (as amended), but is limited to those infrastructure managers who hold a safety authorisation issued in respect of the mainline railway. Source: *ROGS*
leaf fall contamination period	The period between 01 October and 13 December inclusive, but this may be extended by the infrastructure manager.
railway undertaking (RU)	Has the meaning given to the term 'transport undertaking' in the Railways and Other Guided Transport Systems (Safety) Regulations 2006 as amended, but is limited to any private or public undertaking the principal business of which is to provide rail transport services for goods and/or passengers, with a requirement that the undertaking must ensure traction. Source*: ROGS*
Report of Low Adhesion (ROLA)	Reports that rail adhesion has deteriorated to a level that is worse than would be expected by the driver for the location and environmental conditions.
risk	The combination of the likelihood of occurrence of harm and the severity of that harm (specifically defined in CSM RA regulation as: the frequency of occurrence of accidents and incidents resulting in harm (caused by a hazard) and the degree of severity of that harm).
safety	The freedom from unacceptable risk of harm.
transport operator	An infrastructure manager or railway undertaking.

References

The Standards catalogue gives the current issue number and status of documents published by RSSB: http://www.rssb.co.uk/standards-catalogue.

RGSC 01	Railway Group Standards Code
RGSC 02	Standards Manual

Documents referenced in the text

Railway Group Standards

GEGN8628	Preparation for and Operation during Winter
GERT8000-TW1	Preparation and movement of trains
RIS-3708-TOM	Arrangements Concerning the Non-Operation of Track Circuits During the Leaf Fall Contamination Period
Sign AK210	Warnings for Train Crews
Sign AK214	Termination of adhesion condition
GMRT2461	Sanding Equipment
RIS-2710-RST	Magnetic Track Brakes

RSSB documents

IMP-T1107 (2020)	In-Service Pilot of Double Variable Rate Sanders on Class 323, Birmingham Cross-City Line
T1149 (2020)	ADHERE: Further Development of Modelling the Effects of Low Adhesion Mechanisms: WILAC Model User Guide
T1156 (2019)	Managing driver behaviours through adhesion-related information flows: technical report
2019-05-T1156-DriverInformationToolkit (2019)	Managing driver behaviours through adhesion-related information flows Supporting confident driving during leaf-fall by enhancing driver information: a toolkit
T1159 (2019)	Driver Variability in Low Adhesion Conditions Summary Report
T1181 & COF-LAD (2020)	Operational Performance: How Is Autumn Worse?
SC04-POB-15	Predictable and Optimised Braking: Using cryogenic technology to increase adhesion

Other references

	Managing Low Adhesion, Sixth Edition, Adhesion Working Group, January 2018.
	The Health and Safety at Work etc. Act 1974

John Varley Review	Valuing nature – review of progress July 2019. An independent review of Network Rail's approach to vegetation management in England and Wales.
ROGS	The Railway and Other Guided Transport Systems (Safety) Regulations 2006 (as amended).