Seasonal Challenge Steering Group

GB Rail Industry Approach to Railhead Adhesion Management

Version 2.0

Version history

Version	Notes	Issue date
1.0	Approved for issue on behalf of SCSG on 31/05/22	31/05/2022
1.1	Approved for issue on behalf of SCSG on 08/06/22	08/06/2022
2.0	Approved for issue on behalf of SCSG on 02/05/24	02/05/2024

Notes

1. *Application of this document by Users*
   The Seasonal Challenge Steering Group (SCSG) is not a regulatory body and compliance with guidance notes produced by SCSG is not mandatory; they reflect good practice and are advisory only. Users are recommended to evaluate the guidance against their own arrangements in a structured and systematic way, noting that parts of the guidance may not be appropriate to their operations. It is recommended that this process of evaluation, and any subsequent decision to adopt (or not adopt) elements of the guidance, is documented. Compliance with any or all of the contents herein, is entirely at an organisation's own discretion.

2. *RSSB Rule Book*
   Where links to Rule Book references have been added to the tables in section 4.1, these links direct the user to Rule Book modules on RSSB.co.uk. However, it was not possible to establish links to specific Rule Book sections. Access to these modules is via free registration.

3. *Network Rail standards*
   Where links to Network Rail standards have been added to the tables in section 4.1, these links direct the user to the relevant page of Network Rail's Standards Portal. These standards are readily available via free registration to Network Rail's Standards Portal.

4. *Sources of key advice*
   The key advice offered in some of the tables in section 4 is mainly derived from the more extensive advice and direction given in current source documents (usually standards and formal guidance documents). Users should bear in mind that source documents may have been re-issued since the publication date of this Approach Document.

5. *Comparison to earlier versions*
   The ordering, grouping and reference coding of some of the Control Measures in this document have changed when compared to previous versions of this document.

6. *Use of the term 'Autumn'*
   The term 'Autumn' has been used only where it forms part of a recognised title (e.g. Autumn Working Arrangements), otherwise, the term 'leaf fall period' has been used instead.

Contents

Executive Summary

0.1 The suite of documents

This document sets out the approach to the management of railhead adhesion on the GB mainline rail network. It is the latest update of the document which was first issued in June 2022 (as v1.1). This railhead adhesion document is part of a suite of documents, which includes two other documents covering hot weather and cold weather management. The suite of documents is aimed at sharing good practice within the rail industry on management of seasonal effects.

0.2 The main aim of the document

The document was requested by the industry Seasonal Challenge Steering Group (SCSG) and aims to:

1. Be a single reference source for all relevant proven and practical control measures that will help Duty Holder organisations manage risk arising from low adhesion caused either by leaf fall or by another factor
2. Set out future control measures being developed that, if successful, will give new tools for Duty Holders to improve the management of these risks.

0.3 The four groups

The control measures have been categorised into four groups (infrastructure, trainborne, operational and management processes). Each control measure has a Lead Duty Holder identified and is classified as being mandatory or advisory. All include links to information from existing standards, guidance notes, published research or custom and practice.

0.4 Document ownership

This document is owned by SCSG and will be updated when needed.

Section 1 - The Purpose of the Document

1.1 Aims of the Document

1.1.1 Lower system risk

The purpose of this document is to set out the industry approach to managing the impact of low railhead adhesion on the GB mainline rail network. It aims to improve consistency, thus leading to lower system risk, improved system performance and customer satisfaction.

1.1.2 Existing and future control measures

This document follows similar approach documents produced at the request of SCSG covering hot and cold weather management. The aim is to provide greater clarity on existing control measures and to highlight future control measures being developed by the industry. It will also assist railway management staff by sign-posting standards and guidance concerning management of railhead adhesion on the railway.

1.1.3 Mandatory or Advisory

Each of the control measures in this document is classified as being 'mandatory' or 'advisory'. This classification is the current understanding of SCSG and is based on the SCSG interpretation of advice and direction given in source documents (usually standards and formal guidance documents).

1.2 Target Audience

1.2.1 Practitioners and assurers

Within Duty Holders, the target audience for the document is:

- staff responsible for the line management of others carrying out railhead adhesion control measures (practitioners), and
- staff responsible for assuring those control measures (assurers) within Duty Holder organisations

1.2.2 Duty Holders

Duty Holders are:

- Infrastructure Operators (IOs) (i.e. Network Rail (NR), in most cases)
- Train Operators (TOs) (i.e. Train Operating Companies (TOCs) or Freight Operating Companies (FOCs), in most cases)

1.2.3 Infrastructure and Train Operators

The term Infrastructure Operator (above) has effectively the same meaning as the term Infrastructure Manager which is used in the Railways and Other Guided Transport Systems (Safety) Regulations 2006 (as amended) (ROGS). The term Train Operator has effectively the same meaning as Railway Undertaking as used in ROGS.

1.2.4. Who will use what

Within Infrastructure Operator organisations, it is likely that the 'infrastructure' and 'operations' groups of control measures will be mainly used. Within Train Operator organisations, it is likely that 'trainborne' and 'operations' groups will be mainly used. All users are likely to refer to the 'management process' group of control measures.

1.2.5 Access to current version

The current version of this document can be accessed via:

- Network Rail Weather Hub
- RDG web-site
- Rail Partners, Operator Services Member SharePoint Portal

1.3 Control of the Document

1.3.1 Document ownership

The document is owned by SCSG, on behalf of Network Performance and Planning Board (NPPB). SCSG will update it when necessary and will add any new control measures once they are assessed to be proven and practical to deliver.

1.3.2 Briefing of changes

Changes included in updated versions of this document should be briefed to the relevant practitioners and assurers within Duty Holder organisations. SCSG is accountable for making sure Duty Holders have access to each update of the document.

1.4 Control Measure Codes

1.4.1 Control measure codes

The control measures included in Section 3 of this document have all been given short reference codes to allow ease of use, for example, PN1A:

- The first letter defines the status of the measure as either P or N. P means proven and practical; N means new and emerging
- The second letter defines the group to which the measure belongs. N means infrastructure, T means trainborne, P means operational and M means management process
- The number is simply the order in which the measures are listed in the group
- The final letter in the reference in this document is always the letter A. A means Railhead Adhesion (and differentiates the control measure from those measures included in the similar documents for hot weather and cold weather management)

Section 2 - The Approach

2.1 The Application of Control Measures

2.1.1 As low as reasonably practicable

The railhead adhesion control measures are intended to reduce the risk to as low as reasonably practicable (ALARP), while allowing the network to maintain operational effectiveness.

2.1.2 Risk control

The control measures are generally aimed at:

- Preventing or reducing railhead contamination during the leaf fall season
- Removing railhead contamination
- Mitigating risk caused by railhead contamination

2.1.3 Selection of control measures

The selection of control measures and how they are used is for Duty Holders to determine.

2.1.4 When control measures fail 'on the day'

When control measures fail 'on the day', Lead Duty Holders need to carry out processes, agreed jointly with other affected Duty Holders, which:

- Quickly identify that a planned control measure has failed 'on the day'
- Consider carrying out other proportionate control measures to appropriately manage the risk and record the conclusions reached

2.1.5 Control measure categories

The control measures in Sections 3 and 4 have been categorised as belonging to one of four groups:

- Infrastructure control measures – those measures that mitigate risks associated with the fixed infrastructure
- Trainborne control measures – those measures that mitigate risks associated with rolling stock and onboard crew and passengers
- Operational control measures – those measures, not included in the above two categories, that mitigate risks associated with the operation of the railway
- Management processes – those processes or control measures not included in any of the above three categories

Note that, in a depot or station managed by a Train Operator, the TO, or contractor to the TO, can be regarded as the 'Manager of Infrastructure' and, therefore, effectively the Infrastructure Operator for that depot or station. In a depot where an Infrastructure Operator manages train movements, the IO, or contractor to the IO, can be regarded as the 'Manager of Trains' and, therefore, effectively the Train Operator for those train movements.

2.2 Railhead adhesion management plans

2.2.1 Responsibility to produce plans

Relevant Duty Holders are jointly responsible for producing a railhead adhesion management plan which sets out the mix and scope of control measures for each part of their network and the way they are used. Duty Holders should decide if the plan forms part of an all-seasons weather management plan or stands alone.

2.2.2 Contents of plans

It is expected that each railhead adhesion management plan will normally include some or all of the following details:

- The contributing Duty Holders
- The extent of the network to which the plan applies
- The range, scope and timing of the (infrastructure, trainborne, operational and management) control measures to be used
- The justification, if the Lead Duty Holder concludes after consultation with potentially affected Duty Holders, that a control measure will not be used for any reason (including a lack of funding or resources)
- Which Duty Holder is responsible for implementing which parts of each selected control measure
- The process for preparing each control measure in advance of the leaf fall period
- The process for assuring preparations and use of each control measure
- The process for assessing the adequacy of the railhead adhesion plan as conditions change and making suitable changes, as necessary
- The process for identifying other risk mitigations when a planned control measure fails 'on the day'
- The input measures and targets set for the readiness and use of each control measure

Further advice regarding the content of railhead adhesion management plans can be found in RIS-8040-TOM (Appendix A)

2.2.3 Indicative metrics

Each of the tables in section 4 include a short list of indicative metrics which could be used to measure the state of preparation, or effectiveness of delivery, of each control measure. These indicative metrics are suggestions only and are for Duty Holders to consider and conclude whether they wish to use them, or alternative metrics, to monitor progress with their seasonal management plans.

2.3 Joint Seasonal Management Groups

2.3.1 Form of JSMGs

Relevant Duty Holders are recommended by SCSG to hold local joint seasonal management groups in order to create railhead adhesion management plans. The exact form of each group (for example, its name, terms of reference, meeting arrangements, the form of the agreed plan, etc) is for relevant Duty Holders to decide. In many cases, existing joint management meetings are expected to serve as joint seasonal management groups.

2.3.2 Responsibilities of Lead Duty Holders

Each control measure used on the network should have a Lead Duty Holder. The Lead Duty Holder for each control measure is proposed in the tables in Section 4. The Lead Duty Holder is responsible for satisfying itself that the control measure is being properly applied in accordance with the railhead adhesion management plan. If the Lead Duty Holder is not satisfied, then it must escalate the matter to the joint seasonal management group.

2.3.3 Assurance processes

The Lead Duty Holder is responsible for satisfying itself that the assurance processes which apply to the control measures they lead are fit-for-purpose. Where assurance processes require joint actions with other Duty Holders, these should be agreed with the other relevant Duty Holders and documented in the railhead adhesion management plan. SCSG recognises that Duty Holders may decide that assurance processes will be based on the existing industry stage-gate process. SCSG has developed a weather-related maturity model which complements the Industry Risk Management Maturity Model for Performance (RM3P). This can be adopted by Duty Holders as part of their weather-related assurance processes.

2.4 Mandatory or Advisory Control Measures

2.4.1 Mandatory or Advisory

Where a control measure is identified as mandatory, this is because a statutory or regulatory requirement has been imposed by an authorised body (for example, RSSB, NR, DfT or ORR). The tables in Section 4 include references to the source of the mandatory requirements. These are typically:

- Legislation affecting the rail industry
- A Railway Group or Railway Industry Standard
- A designated mandatory Duty Holder company standard
- Contractual terms and conditions

2.4.2 Derogations and deviations

In some instances, Lead Duty Holders may conclude that compliance with mandatory control measures is not possible for reasons such as insufficient time, resources or funding. In these cases, the Lead Duty Holder will need to follow the derogation or deviation process specified by the relevant authorising body or contract.

2.4.3 Rejection of Advisory control measure

Where a control measure is advisory, the decision of whether and how to employ it lies with the Lead Duty Holder, in consultation with other affected Duty Holders. If the Lead Duty Holder decides not to adopt an advisory control measure, it is recommended that the Lead Duty Holder records the justification, rationale and the outcomes of any consultation with other potentially affected Duty Holders.

2.5 The Role of SCSG

2.5.1 Authority of SCSG

SCSG is an industry-wide steering group, not a formal authorising body. It is a sub-group of Network Performance and Planning Board (NPPB) and takes direction from it. SCSG cannot direct Duty Holders or authorise new control measures. This responsibility remains with the relevant industry authorising bodies. The role of SCSG is to endorse new or emerging control measures once proven and include them in this document.

2.5.2 Proven and practical control measures

In verifying control measures as ‘proven and practical’**,** SCSG will consider several factors, for example, that:

- The control measure has been successfully trialled, peer-reviewed and has received appropriate system approvals
- Where standards and guidance notes have been produced, they are fit-for-purpose
- Any parts and materials needed when employing the control measure can be procured in time and cost-effectively from approved suppliers
- The business case and industry funding arrangements are robust
- Any contractual issues between Duty Holders can be mutually agreed

2.5.3 Legacy control measures

Legacy control measures are those which have been routinely used for a number of years. SCSG will, over time, verify that these measures are proven and practical. This will usually require one of following:

- A simple statement by SCSG that a control measure can be considered proven and practical
- SCSG to commission a check on the fitness-for-purpose of any historic verification process
- SCSG to commission new research to verify that the legacy measures are proven and practical

2.5.4 New and emerging control measures

SCSG offers guidance and support to organisations developing new control measures. SCSG can help with the authorisation process and will verify, but cannot authorise, those which are proven and practical.

2.5.5 Developers of new control measures

Many different organisations can lead the development of new control measures. These include industry research bodies such as the Rail Safety and Standards Board (RSSB), Network Rail (NR), UK Rail Research and Innovation Network (UKRRIN) universities, private industry, small and medium enterprises (SMEs), etc. SCSG actively encourages new control measures to be developed. However, SCSG cannot assume lead responsibility for developing new control measures.

Section 3 - The List of Control Measures

3.1 Control Measures verified as being PROVEN AND PRACTICAL good practice

Notes

1. In the third column, 'M" appears where control measures are understood by SCSG to be mandatory and 'A' appears where they are understood to be advisory.
2. In the fourth column, the suggested Lead Duty Holder is shown as either IO (Infrastructure Operator), TO (Train Operator), All (All Duty Holders) or, in the case of PM1A, LDH (the relevant Lead Duty Holder).

- PROVEN AND PRACTICAL Infrastructure Control Measures

PN1A	Managing Signals Passed at Danger/Red (SPAD/R)	M	IO
PN2A	Line Proving	M	IO
PN3A	Treating the railhead with high-pressure water jetting	M	IO
PN4A	Treating the railhead with sand-based substance (Adhesion Modifier)	M	IO
PN5A	Applying traction gel to the railhead (using Traction Gel Applicators)	M	IO
PN6A	Using portable railhead scrubbers	A	IO
PN7A	Hand-applying sand to the railhead	M	IO
PN8A	Hand-applying citric-based cleaners to the railhead	A	IO
PN9A	Managing lineside vegetation	M	IO
PN10A	Designing buffer stops	M	IO
PN11A	Responding to low adhesion Signalling Hazard and Risk Ratings on ETCS	M	IO
PN12A	Responding to low adhesion on braking of on track plant	M	IO

- PROVEN AND PRACTICAL Trainborne Control Measures

PT1A	Upgrading wheel slide protection (WSP) systems	A	TO
PT2A	Fitting wheel slide protection (WSP) systems to tread-braked multiple units	A	TO
PT3A	Maintaining sander systems to maximise sand laying rate	A	TO
PT4A	Increasing the sand delivery rate from an existing sander system	A	TO
PT5A	Expanding sand laying criteria	A	TO
PT6A	Enabling of sanders on non-leading units	A	TO
PT7A	Optimising software-controlled sander systems	A	TO
PT8A	Automating sandbox level measurement and reporting	A	TO
PT9A	Automating identification of low adhesion sites	A	TO
PT10A	Fitting Magnetic Track Brakes (MTB) to new-build rolling stock	A	TO
PT11A	Removing leaves from engines, cooling systems and filters	A	TO

- PROVEN AND PRACTICAL Operational Control Measures

PP1A	Improving driver rolling stock knowledge	A	TO
PP2A	Maintaining route knowledge to ensure adhesion high-risk sites known	M	TO
PP3A	Reporting sites of low adhesion from the driving cab	M	TO
PP4A	Understanding optimal braking conditions	M	TO
PP5A	Ensuring the safe operation of On-Track Machines	M	TO
PP6A	Maintaining distance for SPAD prevention in low adhesion conditions	A	TO
PP7A	Arranging a controlled test stop	M	IO
PP8A	Raising awareness of rolling stock formation and the impact on adhesion	A	TO
PP9A	Implementing operating restrictions when needed	M	TO

- PROVEN AND PRACTICAL Management Processes

PM1A	Responding to non-delivery of control measures ‘on the day’	M	LDH
PM2A	Creation of a joint adhesion management plan	M	IO
PM3A	Amending the end dates of Adhesion Working Arrangements	M	IO
PM4A	Responding to adhesion forecasts	M	IO
PM5A	Reporting sites of low adhesion from other than the driving cab	A	All
PM6A	Recording high-risk sites of low adhesion	M	IO
PM7A	Recording high-risk sites for non-operation of track circuits	M	IO
PM8A	Inspecting high-risk sites	M	IO
PM9A	Prioritising railhead treatment train paths	M	IO
PM10A	Auditing railhead treatment train effectiveness	M	IO
PM11A	Establishing an Adhesion Control	M	IO
PM12A	Creating a fit-for-purpose leaf fall period timetable	M	IO
PM13A	Managing wheel lathe availability before and during the leaf fall period	A	TO
PM14A	Supporting further development of unproven systems	A	All

3.2 NEW AND EMERGING Control Measures not yet verified as being PROVEN AND PRACTICAL good practice

- NEW AND EMERGING Infrastructure Control Measures

NN1A	Using high pressure water with abrasive suspension (e.g. Trackjet)
NN2A	Using new railhead cleaning products (e.g. Interflon LeafGuard - Clean OTR)
NN3A	Using thermo-optical Remote Condition Monitoring (RCM) system

- NEW AND EMERGING Trainborne Control Measures

NT1A	Fitting Single or Double Variable Rate Sanders (SVRS/DVRS)
NT2A	Applying Sand alternatives to improve wet rail adhesion (e.g. Rail-Traction)
NT3A	Applying low pressure water treatments to improve adhesion (e.g. Water-Trak)
NT4A	Applying laser technology to improve adhesion (e.g. LaserTrain)
NT5A	Applying plasma technology to improve adhesion (e.g. PlasmaTrack)
NT6A	Using dry ice pellet blasting to clean railhead (e.g. Cryogrip)
NT7A	Applying sand alternatives to reduce risk of wrong side track circuit failures
NT8A	Fitting a wheel flat protection system to freight wagons (e.g. iwagon)

- NEW AND EMERGING Operational Control Measures

NP1A	Using new portable tribometer to quantify friction conditions (e.g. Rivelin Rail)

- NEW AND EMERGING Management Processes

NM1A	Using ARG recommendations for good practice in low adhesion testing

Section 4 - The Control Measures in Practice

4.1 Control Measures verified as being PROVEN AND PRACTICAL good practice

PROVEN AND PRACTICAL Infrastructure Control Measures

PN1A – Managing Signals Passed at Danger/Red (SPAD/R)

Purpose	To respond to alleged Signal Passed At Danger (SPAD) events
Lead Duty Holder	• Infrastructure Operators
References and guidance	• National Operating Procedures Procedure: 3.36, Incident response to alleged Signal Passed at Danger (SPAD) events • National Operating Procedures Procedure: 4.07, Taking Samples of Railhead Contamination • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition. Section 4.1.2
Indicative metrics	• Number of operational staff at start of leaf fall to carry out swab testing • Railhead swab testing samples taken as required
Key tasks	• Operations Managers to arrange for: ○ sufficient supplies of kits to be available to response staff; and ○ out-of-date kits to be withdrawn and disposed of
Key advice offered	• Arrange for railhead swab testing samples to be taken if any allegation has been made regarding loss of adhesion as a contributory factor to the incident. These samples shall be taken as soon as it is safe to do so and sent for analysis. • The TOC/FOC concerned shall also be asked to carry out similar tests on the wheels of the train involved
Mandatory or Advisory	• Mandatory

PN2A – Line proving

Purpose	To check, if necessary, the operation of signalling equipment and indications
Lead Duty Holder	• Infrastructure Operators
References and guidance	• National Operating Procedures Procedure: 3.41, Route and Line Proving • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition. Section 3.6.3
Indicative metrics	• As part of the assessment, consider the last time the line was treated for low adhesion
Key tasks	• Re-brief signallers and control staff as necessary
Key advice offered	• Where a line has been closed in excess of 48 hours, the Route Control shall decide whether line proving is required. • Where a route is closed over 60 hours line proving shall always be carried out. • When making the decision to line prove, the Route Control shall consider: ○ a) the weather conditions during the time no trains were running over the line ○ b) the period since the last service traversed the line ○ c) whether sweep trains have been used during the closure ○ d) the last time the line was treated for low adhesion ○ e) the season and, therefore, likelihood of contamination that could affect the normal operation of the signalling equipment ○ f) the risk of trespass, vandalism or theft ○ g) continuity of the traction power system
Mandatory or Advisory	• Mandatory

PN3A – Treating the railhead with high-pressure water jetting

Purpose	To remove railhead contamination by action of high-pressure water jetting
Lead Duty Holder	• Infrastructure Operators
References and guidance	• NR/L3/OPS/021/01 Autumn Management, clause 9 • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 4.3.1
Indicative metrics	• Number of miles planned for treatment per day • Number of miles successfully treated per day • Audit of the railhead treatment trains performance undertaken weekly • Base plan sites not treated identified and treated by alternative methods • Variation plan sites not treated identified and treated by alternative methods
Key tasks	• Receive train plan for treatment trains and align with required railhead treatment schedule • Seasons Delivery Specialist distribute the treatment train plans for the forthcoming season • Identify conflicts, revise timetable received and aligned with treatment schedule • Advise Supply Chain Operations (SCO) control office of missed sites • Undertake weekly audit of the effectiveness of railhead treatment trains at sites defined as high-risk for: ○ a) low adhesion; or ○ b) wrong side track circuit failure • Prepare plans for sites not treated by the base plan and arrange treatment by alternative methods
Key advice offered	• Routes shall determine whether water jetting through points is allowed
Mandatory or Advisory	Mandatory

PN4A - Treating the railhead with sand-based substance (Adhesion Modifier)

Purpose	To remove railhead contamination and improve friction through the application of adhesion modifier. RHTTs utilise a combination of water-jets to remove contamination from the railhead and apply an adhesion modifier. An adhesion modifier is a viscous water-based gel containing sand to improve rail adhesion and a metal additive to aid track circuit activation
Lead Duty Holder	• Infrastructure Operators
References and guidance	• NR/L3/OPS/021/01 Autumn Management • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 4.3.1 • GERT8000 Module TW5 Train Operation Staff Manual, Sanding equipment to assist train braking, Section 19.1 and 19.2
Indicative metrics	• Number of miles planned for treatment per day • Number of miles successfully treated per day • Base plan sites not treated identified and treated by alternative methods • Variation plan sites not treated identified and treated by alternative methods
Key tasks	• Receive train plan for treatment trains and align with required railhead treatment schedule • Seasons Delivery Specialist distribute the treatment train plans for the forthcoming season • Identify conflicts, revise timetable received and aligned with treatment schedule • Advise SCO control office of missed sites: ○ Prepare plans for sites missed or not treatable by the base plan and arrange treatment by alternative methods
Mandatory or Advisory	• Mandatory

PN5A - Applying traction gel to the railhead (using Traction Gel Applicators) (TGAs)

Purpose	To apply locally traction gel (sand-based gel) by fixed equipment at sites of known low adhesion
Lead Duty Holder	• Infrastructure Operators
References and guidance	• NR/L3/OPS/021/01 Autumn Management • NR/L3/TRK/3510/C01 Use of Traction Gel Applicators • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section A1.2.7
Indicative metrics	• Number of TGAs agreed as required and published in Autumn Working Arrangements • Number operational at start of leaf fall
Key tasks	• Commission TGAs by the second week in September • Agree resourced inspection and maintenance plan/schedule • New or recommissioned TGA installations shall be inspected one week after activation: ○ Subsequent inspection shall be conducted at a minimum frequency of every 2 weeks during operation • Decommission TGAs by the end of January. Note that, some TGAs are left on all year round to help reduce heavy freight trains dispensing sand in points when attempting to gain traction • Review TGA locations at the end of each Autumn season in collaboration with internal and external stakeholders • Redundant equipment should be removed or relocated
Mandatory or Advisory	• Mandatory

PN6A - Using portable railhead scrubbers

Purpose	To spot treat the railhead where heavy contamination is identified using a motorised railhead descaling machine with a metal wire brush
Lead Duty Holder	• Infrastructure Operators
References and guidance	• NR/L3/OPS/021/01 Autumn Management (inc. key competencies PTMP 00 Safe Use of Portable and Transportable Plant, and PTMP 15.01 Railhead Cleaning Unit Equipment) • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section A1.2.9
Indicative metrics	• Number of sites requiring manual treatment by railhead scrubber per day
Key tasks	• Complete necessary training to nominated staff prior to leaf fall period commencement • Produce written Work Activity Risk Assessments in support of railhead scrubbing and the associated work activities of railhead treatment • Put in place a plan for access arrangements at high-risk sites • Service railhead scrubbers prior to the commencement of leaf fall period • Order spares and materials
Mandatory or Advisory	• Advisory

PN7A - Hand-applying sand to the railhead

Purpose	To apply sand manually to the railhead to help to provide traction in response to reports of slippage or reportable low adhesion
Lead Duty Holder	• Infrastructure Operators
References and guidance	• NR/L3/OPS/021/01 Autumn Management • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition. Section A1.2.8
Indicative metrics	• Number of sites requiring treatment with sand per day
Key tasks	• Complete necessary training to nominated staff prior to leaf fall period commencement • Maintain sand prams prior to the commencement of leaf fall period • Order sand bombs and bagged sand
Key advice offered	• Sand shall be spread at staggered intervals on the railhead at no more than 20 metre strips on any one railhead • Alternate rails should be treated to reduce the risk of trains losing track circuit detection
Mandatory or Advisory	• Mandatory

PN8A - Hand-applying citric-based cleaners to the railhead

Purpose	To manually apply a citric cleaner to soften railhead contamination at sites where heavy contamination is identified, for use in conjunction with an appropriate infrastructure control measure
Lead Duty Holder	• Infrastructure Operators
References and guidance	• NR/L3/OPS/021/01 Autumn Management • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition. Section A1.2.10
Indicative metrics	• Number of sites requiring treatment with a citric cleaner per day
Key tasks	• Complete necessary training to nominated staff prior to leaf fall period commencement • Maintain backpack sprayers prior to the commencement of leaf fall period • Order citric cleaners
Mandatory or Advisory	• Advisory

PN9A - Managing lineside vegetation

Purpose	To manage lineside vegetation sustainably and for the safe operation of the infrastructure
Lead Duty Holder	• Infrastructure Operators
References and guidance	• NR/L2/OTK/5201 Issue 5, Lineside Vegetation Management Manual • NR/L2/OTK/5201 Module 01 Lineside vegetation inspection and risk assessment • NR/L2/OTK/5201/3076 Leaf Fall Risk Assessment • NR/L2/OPS/095 High-risk sites for wrong side track circuit failures in leaf fall areas and for low adhesion • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition. Section 4.2.1
Indicative metrics	• Leaf fall risk assessments undertaken and recorded on NR/L2/OTK/5201/F3076 • The vegetation asset condition records within Ellipse have been updated following inspection or any activity that results in a change to the asset within 28 days of the inspection • Number of vegetation remediation locations identified to address high-risk leaf fall sites • Deliver work arising to plan to reduce the risk score for high-risk leaf fall sites
Key tasks	• Review vegetation locations for high risks to include in seasonal management plans • Prepare to undertake all inspections at the minimum frequencies shown in Table 1 NR/L2/OTK/5201/01 • Review the plan and associated frequencies of inspection annually to assess if the frequency of inspection is sufficient to control tree risk • Carry out inspections to assess the severity of leaf fall expected during the leaf fall period on operational lines for each eighth of a mile section • Record the results of the leaf fall risk assessment on NR/L2/OTK/5201/F3076 • Complete a WAIF if the leaf fall risk score is 3, 4 or 5, stating the work required to reduce the risk score • Provide Seasons Delivery Specialists with Leaf Fall Risk Assessment scores to allow high-risk sites to be built into treatment plans
Mandatory or Advisory	• Mandatory

PN10A – Designing buffer stops

Purpose	To ensure that the design of buffer stops on passenger lines includes the impact of known low adhesion sites that would impact braking on the approach
Lead Duty Holder	• Infrastructure Operators
References and guidance	• NR/L2/TRK/2102 Specification Design and Construction of Track • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition. Section 4.4.2
Indicative metrics	• Buffer stops on passenger lines have been designed to include the impact of known low adhesion sites
Key tasks	• Assess the design of buffer stops on passenger lines to include the impact of known low adhesion sites
Mandatory or Advisory	• Mandatory

PN11A – Responding to low adhesion Signalling Hazard and Risk Ratings on ETCS

Purpose	To assess the risk of a train under ETCS supervision passing the Supervised Location (SvL) or conflict point under TPWS due to low adhesion
Lead Duty Holder	• Infrastructure Operators
References and guidance	• NR/L2/SIG/10047 Module 03, Signalling Hazard and Risk Rating • NR/L2/SIG/14201 Manual, Signalling Risk Assessment Handbook • NR/L2/SIG/30009 Module A450, Fundamentals of Overlaps • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition. Section 6.3
Indicative metrics	• Safety-related signalling failures are correctly assessed and managed when affected by low adhesion • Signalling principals are developed considering the impact of low adhesion
Key tasks	• Assess safety-related failures where TPWS correctly initiates brake application, but train does not stop before conflict point due to poor railhead adhesion even though train is travelling within design speed of TPWS • Assess safety-related failures where a train under ETCS supervision passes the Supervised Location (SvL) due to poor railhead adhesion
Key advice offered	• Following a SPAD, identify if the track on the approach to the signal suffers from adhesion problems
Mandatory or Advisory	• Mandatory

PN12A – Responding to low adhesion on braking of on-track plant

Purpose	To assess the effects that low adhesion has on breaking performance where plant is used on gradients and cants
Lead Duty Holder	• Infrastructure Operators
References and guidance	• NR/L2/RMVP/0200/MANUAL - Infrastructure Plant Manual • NR/L2/RMVP/0200/P501 - Systems of work • NR/L3/MTC/RCS0216 - Risk control manual, OTP • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition. Section 4.3.1
Indicative metrics	• Impact of low adhesion assessed where plant is used on gradients
Key tasks	• Undertake a site briefing to include the risk of low adhesion sites as part of the Task Risk Control for the use and control of OTP
Key advice offered	• Where on-track plant is used on gradients and cants, the system of work shall include measures to prevent the occurrence of a runaway, failure to stop or overturning event. This shall be planned in accordance with NR/L2/OHS/019. This includes the effects that poor/low adhesion will have on the braking performance of a machine
Mandatory or Advisory	• Mandatory

PROVEN AND PRACTICAL Trainborne Control Measures

PT1A - Upgrading wheel slide protection (WSP) systems

Purpose	To improve wheel slide control, braking performance and sander control by upgrading old or obsolete WSP systems (for example, BR Mk2 WSP variants) with modern replacement microprocessor systems
Lead Duty Holder	• Train Operators
References and guidance	• GMGN2695 Guidance on Testing of Wheel Slide Protection Systems Fitted on Rail Vehicles • GMRT2045 Compatibility Requirements for Braking Systems of Rail Vehicles • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 5.2.1
Indicative metrics	• Quantity or proportion of fleet modified with modern replacement WSP systems • Note: The quantity or proportion of units modified will be dependent on the number fitted with an older WSP system
Key advice and tasks	• Implement active plan to source funding and to fit where currently not fitted
Mandatory or Advisory	• Advisory

PT2A - Fitting wheel slide protection (WSP) systems to tread-braked multiple units

Purpose	To prevent wheel slide in low adhesion conditions and provide automatic control of sanding by fitting WSP systems to those tread-braked vehicles that are currently unfitted and which are also proposed for extended continued operation
Lead Duty Holder	• Train Operators
References and guidance	• GMGN2695 Guidance on Testing of Wheel Slide Protection Systems Fitted on Rail Vehicles • GMRT2045 Compatibility Requirements for Braking Systems of Rail Vehicles • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 5.2.1
Indicative metrics	• Quantity or proportion of tread-braked fleet fitted with WSP systems
Key advice and tasks	• Implement active plan to source funding and to fit where currently not fitted
Mandatory or Advisory	• Advisory

PT3A - Maintaining sander systems to maximise sand-laying rate

Purpose	To maximise the adhesion improvement provided by sanders by ensuring sand is discharged at the upper design limit
Lead Duty Holder	• Train Operators
References and guidance	• GMRT2461 Issue 3.1 Sanding Equipment • T1210 ADHERE: Good Practice for Sander Maintainability • Key Train Requirements Version 7, chapter 1.6.1 • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 5.2.2
Indicative metrics	• Maintenance records showing quantities of sand discharged on test
Key advice and tasks	• Confirm presence of relevant task in maintenance Vehicle Maintenance Instructions (VMIs) and overhaul Component Overhaul Instructions (COIs) and add or revise to include recommendations of RSSB research project T1210
Mandatory or Advisory	• Advisory

PT4A - Increasing the sand delivery rate from an existing sander system

Purpose	To maximise the adhesion improvement provided by sanders by modifying the sanding system, including, where necessary, sandbox capacity, to deliver up to 2kg/min (fixed rate), where the existing sander system was originally designed to discharge sand at a rate less than this
Lead Duty Holder	• Train Operators
References and guidance	• GMRT2461 Issue 3.1 Sanding Equipment • T1046 Optimising the ability of industry to deal with low wheel-rail adhesion and the use of sanders on train • T1210 Sanding Systems: Vehicle Integration Good Practice Guide, section 2 Sand Rates • Key Train Requirements Version 7 chapter 1.6.1 • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 5.2.2
Indicative metrics	• Quantity or proportion of systems modified to lay sand at 2kg/min (fixed rate) or greater (if variable rate)
Key advice and tasks	• Obtain funding and modify sander systems
Mandatory or Advisory	• Advisory

PT5A - Expanding sand-laying criteria

Purpose	To maximise the adhesion improvement provided by sanders by modifying the sander systems to discharge sand at lower brake step demands, when low adhesion is detected (for example: Step 1 brake or equivalent) and not to switch-off until speed equivalent to 7.5g sand deposited per metre of track covered limit is approached.
Lead Duty Holder	• Train Operators
References and guidance	• GMRT2461 Issue 3.1 Sanding Equipment • T1046 Optimising the ability of industry to deal with low wheel-rail adhesion and the use of sanders on train • T1210 Sanding Systems: Vehicle Integration Good Practice Guide, section 5 • Key Train Requirements Version 7, chapter 1.6.1 • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 5.2.2
Indicative metrics	• Quantity or proportion of systems modified to lay sand safely down to low speeds in Step 1 (or equivalent) braking
Key advice and tasks	• Implement active plan to source funding and to modify, where appropriate
Mandatory or Advisory	• Advisory

PT6A – Enabling of sanders on non-leading units

Purpose	To maximise the adhesion improvement provided by sanders by modifying the sanding systems to enable forward direction sanding on all intermediate and trailing units in multiple unit formations, when low adhesion is detected, such as by WSP
Lead Duty Holder	• Train Operators
References and guidance	• GMRT2461 Issue 3.1 Sanding Equipment • T1046 Optimising the ability of industry to deal with low wheel-rail adhesion and the use of sanders on train • T1210 Sanding Systems: Vehicle Integration Good Practice Guide, section 5 • Key Train Requirements Version 7, chapter 1.6.1 • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 5.2.2
Indicative metrics	• Quantity of systems modified to operate on all units when running in multiple formation
Key advice and tasks	• Implement active plan to source funding and to fit where currently not fitted
Mandatory or Advisory	• Advisory

PT7A - Optimising software-controlled sander systems

Purpose	To optimise WSP and sander performance on trains fitted with software-controlled WSP and sander systems. The rules controlling the operation of such WSP and sanders can be complex. The purpose of this control measure is to ensure these rules are understood by Train Operators and owners and are optimised where there are opportunities to do so (for example, the rules for sand initiation and continuance)
Lead Duty Holder	• Train Operators
References and guidance	• GMRT2461 Issue 3.1 Sanding Equipment • T1046 Optimising the ability of industry to deal with low wheel-rail adhesion and the use of sanders on train • T1210 Sanding Systems: Vehicle Integration Good Practice Guide, section 5 • Key Train Requirements Version 7, chapter 1.6.1 • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 5.2.2
Indicative metrics	• Quantity of systems optimised
Key advice and tasks	• Brief relevant staff to confirm full understanding of current software-driven WSP and sander rules (where deployed) • Source funding for fitment and optimisation, where appropriate
Mandatory or Advisory	• Advisory

PT8A - Automating sandbox level measurement and reporting

Purpose	To minimise the risk of sander systems running out of sand by installing automatic sandbox sand level monitoring and reporting systems. These provide information to the train operator or maintainer allowing sand refilling and associated resources to be more effectively planned. This is more relevant to those trains at higher risk of running out of sand. Consideration should be given to installing such systems if not already fitted to fleets
Lead Duty Holder	• Train Operators
References and guidance	• T1210 Sanding Systems: Vehicle Integration Good Practice Guide, section 5 • Key Train Requirements Version 7, chapter 1.6.1 • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section A1.3.2
Indicative metrics	• Quantity of systems fitted
Key advice and tasks	• Implement Active plan to source funding and to fit where currently not fitted
Mandatory or Advisory	• Advisory

PT9A - Automating identification of low adhesion sites

Purpose	To provide accurate and timely information on areas of low adhesion
Lead Duty Holder	• Train Operators
References and guidance	• Key Train Requirements Version 7 • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 5.5.3
Indicative metrics	• Quantity of units where data is reported
Key advice and tasks	• For trains which provide real time, or near real-time reporting of WSP activity and location, arrangements should be put in place to make effective use of this information for seasonal planning or implementing short-term counter-measures • Where trains are planned to be fitted with remote condition monitoring systems, consideration should be given to ensuring these systems provide WSP activity and location recording and reporting • Implement active plan to source funding and to adopt where not already in place
Mandatory or Advisory	• Advisory

PT10A - Fitting Magnetic Track Brakes (MTB) to new-build rolling stock

Purpose	To provide effective retardation rates that do not rely on wheel-to-rail friction in emergency braking situations. This can be achieved by fitting bogie or underframe mounted metal shoes that press down directly onto the railhead when activated. These systems are provided on GB light rail and some European mainline operations
Lead Duty Holder	• Train Operators
References and guidance	• RSSB Research Brief T1099 Enabling Magnetic Track Brakes on GB mainline railway • BS EN 16207:2014+A1:2019 Functional and performance criteria of Magnetic Track Brake systems for use in railway rolling stock • RIS-2710-RST Iss 1 Magnetic Track Brakes • Key Train Requirements Version 7, chapter 1.4.1 • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 5.1.3
Indicative metrics	• Numbers of new fleets and units or vehicles specified with MTBs to be fitted
Key advice and tasks	• Train Specifiers consider whether MTB fitment to future new-build fleets is appropriate for the circumstances of each individual new fleet's proposed operation
Mandatory or Advisory	• Advisory

PT11A – Removing leaves from engines, cooling systems and filters

Purpose	To prevent fires or smoke, overheating of traction or auxiliary equipment and poor performance of trains
Lead Duty Holder	• Train Operators
References and guidance	• RDG 20 Point Plan
Indicative metrics	• All maintenance schedules and records up-to-date • Performance measures of the diesel engine, cooling, traction, electrical, electronic and auxiliary systems
Key advice and tasks	• Clean underframe, engine and cooling system • Regularly clean or change filters • Address oil leaks and wash off residue to prevent leaves sticking • Remove leaves from engine flywheel housings
Mandatory or Advisory	• Advisory

PROVEN AND PRACTICAL Operational Control Measures

PP1A - Improving driver rolling stock knowledge

Purpose	To ensure train drivers understand drive and operate rolling stock with awareness of the variabilities and braking characteristics
Lead Duty Holder	• Train Operators
References and guidance	• RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 3.3.1 • Training material
Indicative metrics	• Driver manager competence assessments of drivers results (local rules)
Key tasks	• Share and re-brief seasonal information, as necessary • Re-brief rolling stock module knowledge • Provide drivers with an understanding of the capabilities of the rolling stock during initial training • Include assessment of driver knowledge of the capabilities of the rolling stock during the leaf fall period via the use of OTDR and other remote methods in competence assessment
Mandatory or Advisory	• Advisory

PP2A - Maintaining route knowledge to ensure adhesion high-risk sites known

Purpose	To ensure that train drivers understand the high-risk sites for low adhesion and drive appropriate to the conditions and rolling stock limitations
Lead Duty Holder	• Train Operators
References and guidance	• RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 3.3.1 • GERT8000 Module TW1 Preparation and movement of trains, Section 28 Rail Adhesion and Section 29 Route and Traction Knowledge requirement • WON/PON • RIS-3702-TOM Management of Route Knowledge
Indicative metrics	• Recurring incidents at known high-risk sites
Key tasks	• Share and re-brief seasonal information as necessary • Use GSM-R broadcasts where relevant • Assess Driver Competence regarding their knowledge of high-risk sites during practical assessment and monitoring
Mandatory or Advisory	• Mandatory

PP3A – Reporting sites of low adhesion from the driving cab

Purpose	To advise, via a Report of Low Adhesion (ROLA), on sites where adhesion is worse than expected, allowing Route Operations Control to arrange necessary corrective action
Lead Duty Holder	• Train Operators
References and guidance	• GERT8000 Module TW1 Preparation and movement of trains, Section 28 Rail Adhesion • RIS-8040-TOM Managing Low Adhesion • NR/L3/OPS/021/01 Autumn Management • NR/L3/OPS/021/01/Route Adhesion Working Arrangements • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition. Section 3.3.1
Indicative metrics	• Number of ROLA reports • Subsequent incidents at sites previously reported
Key tasks	• Rebrief reporting process • Rebrief ROLA form
Mandatory or Advisory	• Mandatory

PP4A - Understanding optimal braking conditions

Purpose	To understand rolling stock type, length and weight, to ensure that braking is undertaken correctly in adverse weather conditions or areas of low adhesion
Lead Duty Holder	• Train Operators
References and guidance	• RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 3.3.1 • Training material • Professional driving policy
Indicative metrics	• Summative assessment result data
Key tasks	• Provide drivers with an understanding of the types of rolling stock during initial training • Include assessment of driver knowledge of braking capabilities of different types of rolling stock in competence assessment
Mandatory or Advisory	• Mandatory

PP5A – Ensuring the safe operation of On-Track Machines

Purpose	To enable SCO to deliver the safe operation of On-Track Machines
Lead Duty Holder	• Train Operators (normally NR or a contractor to NR)
References and guidance	• NR/L3/SCO/313, On-Track Machines (OTMs) Driver and Operations Standards manual • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 4.3.1
Indicative metrics	• OTM drivers are briefed on particular adhesion risks during leaf fall periods • OTM drivers are briefed on the Low Adhesion Forecast • OTM assessors check OTM driver's braking techniques are appropriate for low adhesion conditions
Key tasks	• OTM drivers shall increase stopping distances on wet or greasy rails when compared with braking under normal dry conditions • OTM drivers shall increase braking distances by braking earlier and lighter where low adhesion conditions exist • OTM drivers shall adjust their braking technique according to the prevailing conditions • Increases in stopping distances particularly occur when working: o short train formation such as OTMs, or o the first train of the day, or o if the route is lightly used, or o if a Rail Head Treatment Train is known to be operating in the area • During the leaf fall period, OTM assessors shall pay particular attention to checking that drivers' braking techniques are appropriate to the prevailing conditions in accordance with the relevant adhesion related elements and performance criteria, see NR/L3/SCO/313/SP-1.08
Mandatory or Advisory	• Mandatory

PP6A - Maintaining distance for SPAD prevention in low adhesion conditions

Purpose	To ensure when driving rolling stock, appropriate distances are maintained in conditions of low adhesion or on the approach to restrictive aspects. This will mitigate against the risk of wheel slide and SPADs
Lead Duty Holder	• Train Operators
References and guidance	• RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 3.3.1 • Train operator's Professional Driving Policy
Indicative metrics	• Assessment via OTDR /accompanied journey • Summative assessment result data
Key tasks	• Train and re-brief modules on rolling stock • Provide drivers with an understanding of the capabilities of the rolling stock during practical assessment. • Includes SPAD prevention in low adhesion conditions in competence assessment. This could be achieved by ongoing monitoring during leaf fall period via the use of OTDR and other remote methods
Mandatory or Advisory	• Advisory

PP7A - Arranging a controlled test stop

Purpose	To prove the route after treatment or inspection to prevent trains pulling away on low adhesion and lower the risk of SPADs
Lead Duty Holder	• Infrastructure Operators
References and guidance	• RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 3.6.1 • GERT8000 Module RS523 GSMR Handbook, Section 8 Broadcast Calls • Rule Book Module TW1 Preparation and movement of trains
Indicative metrics	• Number of SPADs
Key tasks	• Deliver Rule Book refresher training • Ensure knowledge of GSM-R use is kept up-to-date
Mandatory or Advisory	• Mandatory

PP8A – Raising awareness of rolling stock formation and the impact on adhesion

Purpose	To ensure, where possible, rolling stock is formed to best mitigate against the impacts of low adhesion. Short and light trains and light engines perform worse in low adhesion when compared to longer and heavier ones
Lead Duty Holder	• Train Operators
References and guidance	• RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 3.3.1 • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 3.4.1
Indicative metrics	• Review performance data showing 'no events' • Autumn review data
Key tasks	• Planners introduce TOC/FOC specific instructions and local guidance for formation requirements • Controllers, depot staff and shunters implement instructions and guidance regarding train formations
Mandatory or Advisory	• Advisory

PP9A - Implementing operating restrictions when needed

Purpose	To introduce measures, as necessary, for example, operating restrictions, in accordance with a plan agreed in collaboration with Train Operators
Lead Duty Holder	• Train Operators
References and guidance	• The Railways and Other Guided Transport Systems (Safety) Regulations 2006 • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Chapter 3.4.3 • GERT8000 Module TW1 Preparation and movement of trains, Section 28 Rail Adhesion • RIS-8040-TOM Managing Low Adhesion • RIS-3708-TOM Arrangements Concerning the Non-Operation of Track Circuits During the Leaf Fall Contamination Period
Indicative metrics	• Restrictions being implemented in line with operating instructions
Key tasks	• Train and re-brief operating restrictions • Deliver TOC/FOC specific briefings
Mandatory or Advisory	• Mandatory

PROVEN AND PRACTICAL Management Processes

PM1A - Responding to non-delivery of control measures 'on the day'

Purpose	To make corrective action when a control measure, which is an element of the plan described in PM2, is not or cannot be applied. Such corrective action will continue to reduce low adhesion risk for train operations to acceptable levels, as required by ROGS regulations
Lead Duty Holder	• Whichever Duty Holder is the Lead Duty Holder for the control measure not delivered
References and guidance	• The Railways and Other Guided Transport Systems (Safety) Regulations 2006 • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 3.6.4
Indicative metrics	• Command structure implemented • Route-proving completed • No. of occurrences of control measure not delivered 'on the day'
Key tasks	• Implement a plan, as described in PM2 • Consider, for expected extreme conditions, additional resources required • Ensure command structure considers adhesion risks • Review and re-brief, as necessary, adhesion management plan, including route utilisation and route-proving policy
Mandatory or Advisory	• Mandatory

PM2A - Creation of a joint adhesion management plan

Purpose	To ensure the creation of a joint plan produced as a result of collaboration between NR and TOCs/FOCs, which will reduce low adhesion risk for train operations during leaf fall period to acceptable levels, as required by ROGS regulations
Lead Duty Holder	• Infrastructure Operators
References and guidance	• The Railways and Other Guided Transport Systems (Safety) Regulations 2006 • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 3.1
Indicative metrics	• Historic data collection of NR SPAD, station overrun and Wrong Side Track Circuit Failure (WSTCF) data • Historic data on train delay, train operations and delay reduction strategies • Number of delay reduction plans or similar improvements created • Number of delay reduction plans or similar improvements successfully implemented
Key tasks	• Review and re-brief, as necessary, existing adhesion management plans and strategies • Review and implement as appropriate recommendations from Route, Region and National Autumn Reviews
Mandatory or Advisory	• Mandatory

PM3A - Amending the end dates of Adhesion Working Arrangements

Purpose	To extend or cease the Route Adhesion Working Arrangements early, including railhead treatment trains, outside those dates previously planned, where conditions dictate
Lead Duty Holder	• Infrastructure Operators
References and guidance	• NR/L2/OPS/021 Issue 8 - Weather – Managing the Operational Risks • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 4.3.1
Indicative metrics	• The necessary information has been gathered and assessed to determine when to extend or end the leaf fall treatment programme early
Key tasks	• Gather and assess leaf fall data • NR inform SCO Seasonal Control, Route Operations Control and the relevant TOCs/FOCs of the decision if any changes to the leaf fall period are required. Extensions shall be made on a circuit-by-circuit basis
Key Advice Offered	• Gather and assess the following information to establish whether the leaf fall period railhead treatment programme should be extended or can be reduced or terminated early ○ a) actual proposed dates for when the treatment trains are planned to be extended or cancelled ○ b) confirmation that the general weather forecast for the proposed extension dates contains extreme weather warnings or for early cessation that the proposed cancellation dates does not contain extreme weather warnings ○ c) confirmation of whether or not black or red leaf fall days are forecast for the proposed dates ○ d) confirmation that less than 90% of leaves are down (for extension), or more than 90% of leaves are down to date (for early cessation) ○ e) confirmation that more than 12 drivers' reports (for extension) or no more than 12 drivers' reports (for early cessation) of low adhesion per line of route or circuit have been reported in the time preceding week prior to the proposed extension or early cessation dates ○ f) determine if there has been a decrease or increase in safety KPIs (Overruns, SPAD, WSTCF) reported in the preceding week prior to the proposed extension dates to the 'peak' leaf fall weeks that are directly attributable to the leaf fall period ○ g) Inspections by locally identified personnel have been carried out at high-risk sites of low adhesion and deemed to be either low risk or no contamination found
Mandatory or Advisory	• Mandatory

PM4A – Responding to Adhesion Forecasts

Purpose	To provide a forecast of adhesion conditions during the leaf fall period such that IOs can take appropriate action
Lead Duty Holder	• Infrastructure Operators
References and guidance	• NR/L3/OPS/045/3.17 Weather arrangements • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 3.5.4
Indicative metrics	• The weather forecast provider shall supply a forecast of adhesion conditions during the leaf fall period
Key tasks	• Review the adhesion index numbers between 0 to 10, as provided by the forecaster and described in Table 3, of NR/L3/OPS/045/3.17
Mandatory or Advisory	• Mandatory

PM5A - Reporting sites of low adhesion from other than the driving cab

Purpose	To advise on sites where contamination is present and where adhesion may be low, allowing Route Operations Control to arrange necessary corrective action
Lead Duty Holder	• All Duty Holders
References and guidance	• GERT8000 Module TW1 Preparation and movement of trains, Section 28 Rail Adhesion • RIS-8040-TOM Managing Low Adhesion • NR/L3/OPS/021/01 Autumn Management • NR/L3/OPS/021/01/Route Adhesion Working Arrangements • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 3.6.1 • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 4.1
Indicative metrics	• Number of reports of contamination • Results of rail inspections • Corrective action undertaken
Key tasks	• Rebrief on adhesion levels • Rebrief communication process for reporting contamination
Mandatory or Advisory	• Advisory

PM6A - Recording high-risk sites of low adhesion

Purpose	To maintain records of sites where there is a known risk of low adhesion such that IOs can take appropriate action
Lead Duty Holder	• Infrastructure Operators
References and guidance	• NR/L3/OPS/021/01 Autumn Management • NR/L2/OPS/095 High-risk Sites for Wrong Side Track Circuit Failures in Leaf Fall Areas and for Low Rail Adhesion • RIS-8040-TOM Low Adhesion between the Wheel and the Rail - Managing the Risk • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 3.5.6 • GERT8000 Module RS521 Signals, Handsignals, Indicators and Signs Handbook, Section 12.1 Low Adhesion Hazard Signs
Indicative metrics	• Number of high-risk sites of low adhesion published in the sectional appendix • Number of agreed removal plans • Completion of an annual identification, risk-ranking and mitigation plan review • Number of completed removal plans since previous leaf fall period
Key tasks	• Identify sites of low adhesion and publish in the sectional appendix • Risk-rank identified sites using the adhesion risk matrix • Create mitigation plans to manage the risk ALARP for identified sites • Create removal plans with identified actions and timescales and agree with TOCs
Mandatory or Advisory	• Mandatory

PM7A - Recording high-risk sites for non-operation of track circuits

Purpose	To maintain records of sites where there is a known risk of WSTCF occurring as a result of railhead contamination such that IOs and TOs can take appropriate action
Lead Duty Holder	• Infrastructure Operators
References and guidance	• NR/L3/OPS/021/01 Autumn Management • NR/L2/OPS/095 High-risk Sites for WSTCF in Leaf Fall Areas and for Low Rail Adhesion • RIS-8040-TOM Low Adhesion between the Wheel and the Rail - Managing the Risk • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 3.5.6
Indicative metrics	• Number of high-risk sites of WSTCF due to leaf fall • Number of agreed removal plans • Completion of an annual identification, risk-ranking and mitigation plan review • Number of completed removal plans since previous leaf fall period
Key tasks	• Identify sites of high-risk of WSTCF due to leaf fall, using remote conditioning monitoring where available • Risk-rank identified sites using the adhesion risk matrix • Create mitigation plans to manage the risk ALARP for identified sites • Create removal plans with identified actions and timescales and agree with TOCs
Mandatory or Advisory	• Mandatory

PM8A - Inspecting high-risk sites

Purpose	To check known problematic sites and sites which can't be easily treated (such as buffer stop locations) for the presence of contamination and, where necessary, treat it
Lead Duty Holder	• Infrastructure Operators
References and guidance	• NR/L3/OPS/021/01 Autumn Management • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 4.1 • NR/L3/OPS/021/01/Route Adhesion Working Arrangements
Indicative metrics	• Adhesion levels found • Number of sites treated following inspection
Key tasks	• Re-brief adhesion levels • Re-brief of treatment options at problematic locations
Mandatory or Advisory	• Mandatory

PM9A - Prioritising railhead treatment train paths

Purpose	To ensure that RHTTs are suitably considered and prioritised in the planning and delivery of possessions
Lead Duty Holder	• Infrastructure Operators
References and guidance	• NR Engineering Access Statement • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 4.3.1
Indicative metrics	• Possessions not surrendered for RHTT passage
Key tasks	• Work with access planning teams to accommodate possessions with minimal disruption, where reasonably possible
Mandatory or Advisory	• Mandatory

PM10A – Auditing railhead treatment train effectiveness

Purpose	To check the effectiveness of RHTT treatment at least once per week and, if necessary, treat the railhead using the adhesion toolkit
Lead Duty Holder	• Infrastructure Operators
References and guidance	• NR/L3/OPS/021/01 Autumn Management • NR/L3/OPS/021/01/Route Adhesion Working Arrangements • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 4.3.2
Indicative metrics	• Change in adhesion levels from before to after passage of treatment train • Number of occasions when additional treatments were deemed necessary following audit
Key tasks	• Re-brief adhesion levels • Prepare audit plan and ensure auditors have knowledge of RHTT circuit treatment and specification
Mandatory or Advisory	• Mandatory

PM11A - Establishing an Adhesion Control

Purpose	To establish an adhesion control for the leaf fall period, for mitigation direction, control measure application and data collection
Lead Duty Holder	• Infrastructure Operators
References and guidance	• NR/L3/OPS/021/01 Autumn Management • NR/L3/OPS/021/01/Route Adhesion Working Arrangements • Route Adhesion Control Training Plan • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 3.5.3
Indicative metrics	• Maintained lists of SPADs, stations overruns, WSTCFs and freight slip to a stand • Changes made to treatment schedules in NR Online Logistics (NROL) • Record of results from high-risk site inspections and treatment train audits • Number of escalations due to non-delivery of control measures
Key tasks	• Deliver pre-season training on NROL • Brief Route Adhesion Working Arrangements • Deliver training on necessary tasks and duties
Mandatory or Advisory	• Mandatory

PM12A - Creating a fit-for-purpose leaf fall period timetable

Purpose	To make available an operational timetable for the leaf fall period which facilitates the introduction of restricted speeds in areas needed to reduce delay likelihood from adhesion related events and may include skip-stops
Lead Duty Holder	• Infrastructure Operators
References and guidance	• RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 3.4.2 • NR/L2/OPS/03 Assessing and assuring the impact of operational risks relating to changes to the train plan
Indicative metrics	• Performance being seasonally agnostic (i.e. in accordance with the published TT) • Unnoticeable changes in performance during seasonal dips • The stations impacted by a skip-stop timetable
Key tasks	• Network Rail identify, assess, evaluate and assure operational risks associated with prospective changes to the train service, prior to the publication of the Working Timetable. The four processes are underlined by Risk Management Processes with documented roles and responsibilities for Network Rail Route representatives. ○ Identify through Train Planning Hazard Identification (TP-HAZID) ○ Assess through Train Plan Risk Assessment and Mitigation (TP-RAM) ○ Evaluate through Train Plan Risk Evaluation Panel (TP-REP) ○ Assure through Train Plan Risk Assurance Panel (TP-RAP)
Mandatory or Advisory	• Mandatory

PM13A – Managing wheel lathe availability before and during the leaf fall period

Purpose	To ensure that wheel lathes, access to these and appropriate staff are fully available during and immediately after the leaf fall period
Lead Duty Holder	• Train Operators
References and guidance	• RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 5.4
Indicative metrics	• Wheel lathe staff cover for leaf fall period, including agreed leave documented Wheel lathe access agreements for MPVs/RHTTs documented • Discussions and agreements with neighbouring TOCs/third party maintainers regarding any significant wheel lathe maintenance or overhaul contingency documented
Key tasks	• Understand and plan well in advance, any significant wheel lathe maintenance and overhaul necessary, such that ideally it does not occur during the leaf fall period. Manage and agree wheel lathe staff leave requests well in advance, especially for leaf fall period, such that wheel lathes are not left under-staffed during critical periods of high demand. Liaise well in advance with geographically neighbouring TOCs/third party maintainers, such that a mutual understanding is reached and joint plans put in place to cover periods of significant wheel lathe maintenance or overhaul
Mandatory or Advisory	• Advisory

PM14A - Supporting further development of unproven systems

Purpose	To encourage all Duty Holders to provide reasonable support, appropriate to its organisation, with the trialling of unproven adhesion control measures
Lead Duty Holder	• No Lead Duty Holder – an expectation on all Duty Holders
References and guidance	• Key Train Requirements Version 6 • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section A1.5
Indicative metrics	• Quantity of trials undertaken • Number of material offers of support from the TOC/NR Routes each leaf fall period
Key tasks	• Report planned trials and documented offers of support to AWG/SCSG/SCG
Mandatory or Advisory	• Advisory

4.2 NEW AND EMERGING Control Measures not yet verified as being PROVEN AND PRACTICAL good practice

Note that further information regarding current research into the management of adhesion can be found on the RSSB web-site on the 'RSSB.co.uk - Research & Innovation – Key Research Areas – Adhesion - ADHERE' page. See link below.
RSSB ADHERE Research

NEW AND EMERGING Infrastructure Control Measures

NN1A - Using high pressure water with abrasive suspension (e.g. Trackjet)

Purpose	To clean the railhead using high pressure water with abrasive suspension with significantly reduced water consumption. The use of abrasive particles enables the technology to utilize no more than 1/10th of the water required for conventional railhead treatment fleets. The device is based on existing technology used by safety-critical industries (gas, etc.)
Organisation responsible for development	• LNT Solutions, ANT Applied New Technologies AG, Angel Trains
Research Body currently commissioning research	• PIF
Trials and Pilots Underway	• Class 153 testing at East Lancashire Railway (up to 60mph) from 27 November 2023 to 1 December 2023. Friction measurements independently undertaken by Rivelin Rail • Additional testing planned for East Lancashire Railway from 26 February 2024 to 1 March 2024
References and Reports on File	• 'High Pressure Water using Abrasive Suspension' slides (presentation at Adhesion Research Group's 6 February 2024 meeting) • Minutes of Adhesion Research Group's 6 February 2024 meeting • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section A1.5.4
Target Timescales for Gaining PROVEN AND VIABLE Status	• 2026
Envisaged sources of further funding	• IPIF funding application anticipated to be submitted in early 2024
Current Technical Readiness Level (TRL) attained	• 5

NN2A – Using new railhead cleaning products (e.g. Interflon LeafGuard - Clean OTR)

Purpose	To improve the effectiveness of railhead treatment by applying a substance which breaks down organic compounds in contaminants. Interflon LeafGuard - Clean OTR is *'a phosphoric acidic cleaner combined with surface active compounds...', able to '…break down organic compounds by producing smaller particles which are captured by the surface and active compounds providing a fast removal of contaminants from the rail.'* The product is seeking full NR product approval (for hand application) in 2024, with a desire to be deployed by railhead treatment fleet by 2025/6 (on condition of having a purpose-built dispenser module and appropriate certification, building upon lessons learnt from the Wessex Route in October 2022)
Organisation responsible for development	• Interflon
Research body currently commissioning research	• Interflon
Trials and pilots underway	• Numerous trials undertaken on the GB mainline. Most recently, in autumn 2023, a hand application trial was undertaken with NR's East Midlands, North East, North West, Wessex and Western routes (restricted to plain line). Within Wessex route, sites treated with Interflon LeafGuard - Clean OTR (and wire scrubbing) had a 20% reduction in safety KPIs and a 40% reduction in WSP activity, compared to autumn 2022 • Friction measurement testing at East Lancashire Railway in Oct 2022 • MPV testing on heritage Swanage Railway in Sep 2022 • Planned lab testing with Alstom to ensure no risk of stress corrosion cracking
References and Reports on File	• https://interflon.com/gb/products/interflon-leafguard • Presentation at 21 February 2024 National Adhesion Review • 'Interflon LeafGuard - Clean OTR' slides (presentation at Adhesion Research Group's 11 December 2023 meeting) • Minutes of Adhesion Research Group's 11 December 2023 meeting • Minutes of Adhesion Research Group's 25 October 2022 meeting • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section A1.5.6

Target Timescales for Gaining PROVEN AND VIABLE Status	• 2027
Envisaged sources of further funding	• Interflon, NR, IPIF (Innovation and Performance Improvement Fund)
Current Technical Readiness Level (TRL) attained	• 5

NN3A – Using thermo-optical Remote Condition Monitoring (RCM) system

Purpose	To allow more reliable identification from the trackside of passing trains with brake-related faults. This initiative incorporates trackside thermal and optical cameras to monitor passing trains for thermal anomalies (indicating potential dragging brakes, partially braked or unbraked wheels and handbrakes left on), and Status indicators (handbrakes on/off). The system is expected to be particularly beneficial for freight vehicles. The system has been certificated for NR Product Acceptance
Organisation responsible for development	• Rail Innovations, NR
Research body currently commissioning research	• NR
Trials and pilots underway	• The first phase involved an Artificial Intelligence (AI) feasibility trial on the Midland Main Line (Barrow-upon-Soar) in 2023. The trial successfully measured wheel temperatures, identified the status of wagon brake and door indicators and recorded vehicle 'painted numbers' • A second phase is proposed to cover Real-time AI processing of thermal and optical video streams, Edge AI processing in local equipment cabinet, provision of IR illuminators for 24/7 optical monitoring and Real-time RAG status monitoring.
References and Reports on File	• Presentation at 23 November 2023, 'RSSB & Rail Wagon Association Innovation Day'
Target Timescales for Gaining PROVEN AND VIABLE Status	• 2027
Envisaged sources of further funding	• NR - A proposal has been submitted to undertake the second phase in Control Period 7 (CP7)
Current Technical Readiness Level (TRL) attained	• 5

NEW AND EMERGING Trainborne Control Measures

NT1A - Fitting Single or Double Variable Rate Sanders (SVRS/DVRS)

Purpose	To provide consistent braking performance regardless of the railhead conditions. SVRS or DVRS can be retrofitted to existing trains or installed to new trains. This involves installing or modifying the sanders to discharge sand at variable rates depending on speed
Organisation responsible for development	• AB Hoses, KBRS, Wabtec Faiveley, Siemens, AtkinsRéalis, Unipart Rail (SmartSander SVRS)
Research body currently commissioning research	• Porterbrook, Northern Trains, SWR, ScotRail
Trials and pilots underway	• Trial on Birmingham Cross City Line Class 323s since 2019 • Class 323 testing by Northern Trains at Hattersley station in November 2022, additional testing at Hattersley and on the Macclesfield line in November 2023 • Siemens SVRS testing on a SWR Class 158 at RIDC Tuxford March 2024 • Pilot fits on Northern Trains Class 323, ScotRail Class 170 and SWR Class 158/159 in 2024
References and Reports on File	• Key Train Requirements Version 7 • RSSB R&D IMP-T1107 and COF-BRP In-Service Pilot of Double Variable Rate Sanders • RAIB Report 12/2023: Collision between passenger trains at Salisbury Tunnel Junction • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section A1.5.7
Target Timescales for Gaining PROVEN AND PRACTICAL Status	• 2025 – following pilot fit operation in autumn 2024
Envisaged sources of further funding	• NR IPIF (Innovation and Performance Improvement Fund), ROSCOs, Train builders
Current Technology Readiness Level (TRL) attained	• 7

NT2A - Applying sand alternatives to improve adhesion in wet rail conditions (e.g. Rail-Traction)

Purpose	To introduce alternative materials for increasing adhesion in wet rail conditions
Organisation responsible for development	• Goodwin PLC, Hoben International Limited
Research body currently commissioning research	• SWR, NR
Trials and pilots underway	• Most recent trial on NR Anglia and Scotland routes (material deployed by hand, not by train) • Anglia autumn 2023 trial not yet conclusive, further testing planned in Anglia for autumn 2024
References and Reports on File	• Rail-Traction Advanced Adhesion Improver • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section A1.5.9
Target Timescales for Gaining PROVEN AND PRACTICAL Status	• 2026
Envisaged sources of further funding	• NR IPIF, Innovate UK, SWR
Current Technology Readiness Level (TRL) attained	• 5

NT3A - Applying low pressure water treatments to improve adhesion (e.g. Water-Trak)

Purpose	To improve braking and traction under low adhesion conditions by applying low pressure water to the railhead. Adhesion drops when small quantities of water are present but then increases again when fully wet
Organisation responsible for development	• Northern Trains, NR, Porterbrook, Water-Trak, SWR
Research Body currently commissioning research	• Water-Trak, NR PIF, Innovate UK, RSSB
Trials and Pilots Underway	• Autumn 2023 trial undertaken with Northern Trains on 3 x Class 170s and 2 x Class 319s. Builds upon previous trials undertaken by Northern Trains in autumn 2022 and autumn 2021. In full service braking, a Water-Trak fitted Class 319 (Water-Trak combined with single variable rate sanders) demonstrated a 40% reduction in stopping distance compared to the control group (Class 319 fitted with single variable rate sanders) • Fitment of Water-Trak to the remaining Northern Trains Class 170 fleet is proceeding, with completion expected by autumn 2024 (16 units in total)
References and Reports on File	• Water-Trak • Water-Trak NTL fleet fitment interim report • How RSSB's adhesion research projects lead to practical benefits for rail • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section A1.5.8
Target Timescales for Gaining PROVEN AND PRACTICAL Status	• 2025
Envisaged sources of further funding	• NR IPIF, Innovate UK
Current Technology Readiness Level (TRL) attained	• 7

NT4A - Applying laser technology to improve adhesion (e.g. LaserTrain)

Purpose	To remove contamination from the railhead using laser ablation without the requirement for consumables
Organisation responsible for development	• Laser Precision Solutions, Metropolitan Transportation Authority Long Island Railroad (New York)
Research body currently commissioning research	• Laser Precision Solutions
Trials and Pilots Underway	• Continued use on the Long Island Railroad (Over 12,000 miles of track cleaned since autumn 2022. In 2023, MTA Metro-North was selected by the American Public Transportation Association (APTA) as a 'Gold Award winner' for 'Rail Safety' for its use of the LaserTrain). 2 x three-kilowatt lasers are mounted on each side of the train to deploy a 3cm cleaning band up to 60mph • Available in passenger car, freight container and 'subway' configurations
References and Reports on File	• Metro-North to Expand Use of Lasers to Combat Fallen Leaves on Rails • MTA Metro-North Railroad Receives Top Awards in Safety and Emergency Management From American Public Transportation Association • East Coast Transit Agencies Perfecting Method of Dealing with Pectin on the Rails • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section A1.5.3
Target Timescales for Gaining PROVEN AND PRACTICAL Status	• Unknown for GB
Envisaged sources of further funding	• NR IPIF, Innovate UK
Current Technology Readiness Level (TRL) attained	• 6

NT5A - Applying plasma technology to improve adhesion (e.g. PlasmaTrack)

Purpose	• To clean residue from the railhead using electrically-generated plasma, returning the surface to a dry, clean and uncontaminated state with no detriment to the rail steel, without the requirement for consumables
Organisation responsible for development	• NR, PlasmaTrack, Balfour Beatty
Research body currently commissioning research	• RSSB, Innovate UK, NR
Trials and Pilots Underway	• 2023 East Lancashire Railway trial • Previous trial on NR Wales Route
References and Reports on File	• Cleaning up: how PlasmaTrack is removing leaves from the line • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section A1.5.2
Target Timescales for Gaining PROVEN AND PRACTICAL Status	• 2026
Envisaged Availability of further funding	• NR IPIF, Innovate UK
Current Technology Readiness Level (TRL) attained	• 6

NT6A - Using dry ice pellet blasting to clean railhead (e.g. Cryogrip)

Purpose	To remove contaminant layers from the railhead by blasting dry ice (cryogenic) pellets which cause the contaminant to crack and de-bond. The dry ice evaporates, leaving no residue on the railhead and is also non-conductive
Organisation responsible for development	• University of Sheffield, Ice Tech Technologies, Northern Trains, Porterbrook
Research body currently commissioning research	• Northern Trains, RSSB, NR PIF, University of Sheffield
Trials and pilots currently underway	• Trials with Northern Trains throughout the autumn and winter of 2021 and 2022 to test the cleaning system onboard passenger trains • Further passenger train trials planned with Northern Trains in autumn 2024
References and reports on file	• Leaf-busting tech could end rail delays caused by leaves on the line • Track cleaning tech could prevent rail delays • High Speed Cryogenic Blasting for Rail Cleaning to Alleviate Low Adhesion • How RSSB's adhesion research projects lead to practical benefits for rail • The 'gamechanger' solution to the age-old railway problem of leaves on the line • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section A1.5.1
Target timescales for Gaining PROVEN AND PRACTICAL and viable' Status	• 2025-2026 – subject to funding, procurement and supply chain mobilisation
Envisaged sources of further funding	• NR IPIF, Innovate UK
Current Technology Readiness Level (TRL) attained	• 6

NT7A - Applying sand alternatives to reduce risk of wrong side track circuit failures

Purpose	To introduce alternative adhesion enhancing materials to sand, to reduce the risk of wrong side track circuit failures
Organisation responsible for development	• LB Foster, LNT Solutions (testing by University of Sheffield and Newcastle University)
Research body currently commissioning research	• RSSB
Trials and pilots underway	• Class 142 testing at Wensleydale Heritage Railway • Potential high-speed braking tests on a SWR Class 158 at RIDC Tuxford in March 2024. Separately, braking tests planned with Northern Trains on the Monk Bretton branch • Based on the outcomes of the braking tests, a deviation to Railway Group Standard GMRT2461 Sanding Equipment could be submitted, to enable a trial to be undertaken on the GB mainline in autumn 2024
References and Reports on File	• COF-UOS22-03 Sand consist testing for improved track circuit performance • COF-UOS-03 Sand consist changes for improved track circuit performance • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section A1.5.10
Target Timescales for Gaining PROVEN AND VIABLE Status	• 2026
Envisaged sources of further funding	• RSSB, NR IPIF
Current Technology Readiness Level (TRL) attained	• 5

NT8A – Fitting a wheel-flat protection system to freight wagons (e.g. iwagon)

Purpose	To prevent locked wheels and consequent wheel flats on freight wagons, which can result in derailment and broken rails, the iwagon is being developed by VTG and Knorr-Bremse'. 'Active' wagons are fitted with a self-powered Wheel Flat Prevention system. This continually monitors the brake system to 'detect any deterioration of performance', 'immediately identifies' axle lock detection', monitors the wagon's ambient temperature and checks 'hand brake status
Organisation responsible for development	• VTG, Knorr-Bremse
Research Body currently commissioning research	• VTG, Knorr-Bremse
Trials and Pilots Underway	• October 2023 trial (3 wagons operating within the Tarmac flow based out of Dunbar, travelling to Aberdeen and Leeds, as well as Inverness) • Additional data collected from October 2023 onwards • As of February 2024, nine iwagons are operating on the GB mainline. Initial results have shown the effectiveness of the Wheel Flat Prevention system which have prevented wheelset damage from occurring during autumn 2023. Mass production lines for the iwagon are being built and are planned to go live from mid-2024
References and Reports on File	• iwagon - The UK's First Digital Freight Wagon • Presentation RSSB & Rail Wagon Association Innovation Day held on 23 November 2023 (available from RSSB on request) • Report 01/2022: Derailment and fire at Llangennech • RAIB Report 03/2023: Track damage between Pencoed and Llanharan • RAIB Report 10/2023: Freight train derailment at Petteril Bridge Junction • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section A1.5.11
Target Timescales for Gaining PROVEN AND PRACTICAL Status	• 2025
Envisaged sources of further funding	• VTG, Knorr-Bremse
Current Technology Readiness Level (TRL) attained	• 7

NEW AND EMERGING Operational Control Measures

NP1A – Using new portable tribometer to quantify friction conditions (e.g. Rivelin rail tribometer)

Purpose	To improve the quality of local assessments of railhead adhesion conditions. Rivelin Rail developed its portable tribometer to quantify friction conditions and to help make more informed decisions on friction management strategies. The tribometer is magnetically clamped to the railhead and saves raw data onto a SD card. The wheel is manufactured from ER8 steel, provides up to c. 1 GPa contact pressure and a range of 1-8% creep. In February 2024, the Adhesion Research Group endorsed the Rivelin Rail tribometer as an example of a tool to enable tests, proposed by the 'ARG Recommendations for Good Practice in Low Adhesion Testing' document, to be carried out. Further enhancements are planned for the tribometer, including the incorporation of a sim card to transmit data measurements to centralised databases. The Feb 2024 ARG endorsement was based on the tribometer used for comparative purposes until further calibration evidence is submitted and agreed
Organisation responsible for development	• Rivelin Rail
Research body currently commissioning research	• Rivelin Rail, Connected Places Catapult (previously), Innovate UK (previously)
Trials and Pilots Underway	• Used for various trials, including LNT Solutions' water/abrasive railhead cleaning system (East Lancashire Railway, November 2023 to December 2023)
References and Reports on File	• https://rivelinrail.com/tribometer • Minutes of Adhesion Research Group's 6 February 2024 meeting • Minutes of Adhesion Research Group's 7 August 2023 meeting • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section 4.1.3
Target Timescales for Gaining PROVEN AND VIABLE Status	• 2025
Envisaged Availability of Funding	• IPIF, Innovate UK
Current Technical Readiness Level (TRL) attained	• 5

NEW AND EMERGING Management Control Measures

NM1A - Using ARG recommendations for good practice in low adhesion testing

Purpose	To improve the quality and consistency of railhead testing processes. The paper, 'ARG Recommendations for Good Practice in Low Adhesion Testing' sets out ARG's recommendations for third parties to adopt when testing processes that will improve wheel/rail adhesion. It is important to note ARG's view that clean rails do not necessarily provide good adhesion and that processes which are able to clean rails should not, without the testing and reporting identified in the document, be assumed to improve adhesion. The document was endorsed by ARG in June 2023. A 'one year review' discussion is to take place at ARG's June 2024 meeting
Organisation responsible for development	• Adhesion Research Group
Research body currently commissioning research	• Adhesion Research Group
Trials and Pilots Underway	• N/A
References and Reports on File	• https://www.rssb.co.uk/-/media/Project/RSSB/RssbWebsite/Documents/Public/Public-content/Learn-and-Connect/Groups-and-Committees/arg-recommendations-for-good-practice-in-low-adhesion-testing.pdf • Minutes of ARG's 5th June 2023 meeting • RDG/SCSG Managing Low Adhesion Manual, Seventh Edition, Section A2
Target Timescales for Gaining PROVEN AND PRACTICAL Status	• 2025
Envisaged Availability of Funding	• N/A
Current Technical Readiness Level (TRL) attained	• N/A

Definitions

ALARP	ALARP is short for "as low as reasonably practicable". Reasonably practicable involves weighing a risk against the effort, time and money needed to control it. Thus, ALARP describes the level to which we expect to see workplace risks controlled
Assurer	A person within a Duty Holder organisation that is involved in an assurance process to make sure control measures have been implemented properly
Compliance	The act of obeying an order, rule or request
Control measures	Protective precautions put into place to reduce performance and safety risks and hazards
Duty Holders	The main railway Duty Holder organisations are: • Infrastructure Managers, referred to in this document as 'Infrastructure Operators' (e.g. Network Rail) – companies responsible for infrastructure such as track, stations, signalling and electrification • Railway Undertakings, referred to in this document as 'Train Operators' (e.g. Train Operating Companies and Freight Operating Companies) – the companies that provide passenger and freight train services Each Duty Holder is responsible for its own part of the railway
GB mainline rail network	The GB mainline rail network: • Incudes running lines as shown in Table A of the Network Rail Sectional Appendix, as a passenger line or as a non-passenger line, plus connected depots and freight yards • Excludes metros and other light rail systems; networks that are functionally separate from the mainline; heritage, museum or tourist railways and privately-owned infrastructure, as defined in the ROGS regulations
Good practice	A process or method that has been shown to work well, succeeds in achieving its objectives, is widely accepted and therefore, can be recommended as a reasonable approach
Infrastructure Operator	Is any person or organisation that: • Is responsible for developing and maintaining infrastructure (not including a station) or for managing and operating a station • Manages and uses that infrastructure or station, or allows it to be used, for operating a vehicle Note that, the term Infrastructure Operator, as used in this document, has effectively the same meaning as the term Infrastructure Manager as used in the ROGS regulations
Lead Duty Holder	The Duty Holder which is responsible for satisfying itself that the control measure is being properly applied and that the assurance processes which apply to the control measures are fit-for-purpose
Low (or poor) adhesion	Low (or poor) adhesion is commonly known as adhesion which is less than that necessary for trains to achieve a level of braking and acceleration which allows them to perform to the standards required by the normal timetable (i.e. not a special timetable introduced as a mitigation against the effects of low adhesion). However, for drivers and signallers, the definition of low (or poor) adhesion is defined by the Rule Book as adhesion which has deteriorated to a level that is worse than would be expected by the driver for the location and environmental conditions and is sometimes known as reportable adhesion
New and emerging	A control measure which is under development, but which has not yet been approved by SCSG as being proven and practical
Practitioner	Someone involved in a job or activity to implement control measures
Proven and practical	A control measure which has been approved by SCSG as being effective in the reduction of performance and safety risk
RM3P	Risk Management Maturity Model for Performance developed by a group of industry stakeholders to encourage organisations to achieve excellence in performance and safety management

Train Operator	Is any person or organisation that operates a vehicle in relation to any infrastructure. Note that, the term Train Operator, as used in this document, has effectively the same meaning as the term Transport Undertaking (also known as Railway Undertaking) as used in the ROGS regulations
Transport Operator	Transport Operator is a term used in the ROGS regulations, but not used in this document. The term means an Infrastructure Manager or Transport Undertaking