SUPPLIER DAY

COF-DART: Quantifying the effects of Railhead Treatments on adhesion

22 October 2018

Agenda

- RSSB Research & Development Programme
- *The ADHEsion REsearch challenge (ADHERE)*
- Background to COF-DART and other research projects on Cross-city line
  - ADHERE: Evaluating variability in train driving under different adhesion conditions
  - ADHERE: Piloting Enhanced Sanders on the GB mainline
  - ADHERE: Autumnsense - Wet rail monitoring using a network of sensors to improve autumn resilience
  - **ADHERE: COF-DART Quantifying the effects of Railhead Treatments on adhesion**
- Questions

RSSB Research & Development Programme

Knowledge Search

Aim

To collate existing knowledge and research in a scientific or engineering field; To identify opportunities for knowledge transfer; To assess emerging and disruptive technologies.

Process

RSSB members or cross-industry groups can submit a request.

Timeframe

Submission of request to delivery of report / presentation is usually possible in one month.

It works best when...

The information sought is in the public domain, of a scientific or technological nature, outside GB rail's traditional knowledge base and not commercially sensitive.

Grant Scheme

Aim

Where an RSSB member wishes to lead the delivery of R&D which will bring short term benefit to their organisation, but which has potential benefits more widely in the industry, R&D grant funding is available to provide additional resource.

Process

RSSB fund up to 50% of the project cost, consortium members contribute at least 20% in cash and the remainder in-kind, industry partners manage the project, all parties share the intellectual property rights.

Timeframe

RSSB typically makes a funding decision within four weeks of receiving an application.

It works best when...

An industry player identifies a specific opportunity to improve an existing technology or solution that benefits its business, and is prepared to share the findings in return for a funding contribution.

Strategic Research Pipeline

Aim

To help industry deliver long-term innovative developments via significant change in railway operations or engineering (normally over two or more Control Periods in the future).

Process

Through the guidance of strategic industry groups, RSSB helps to scope the low technology readiness level research, define clear outputs and facilitate measurable progression towards strategic goals.

Timeframe

Projects typically take 1-4 months to develop and 3-12 months to deliver outputs.

It works best when...

An engaged industry group is striving to fundamentally improve an aspect of the rail industry aligned with a cross-industry strategy, which, if researched, could materially benefit the whole industry and wider society.

Tactical Research Pipeline

Aim

To help industry make incremental improvements to business or operations within the current or subsequent Control Period.

Process

RSSB member(s), supported by a cross-industry group, can submit an idea form. RSSB helps to scope the research, define clear outputs and determine and agree a path to implementation.

Timeframe

Projects typically take 1-4 months to develop and 3-12 months to deliver outputs.

It works best when...

An engaged member, or small group of member organisations, is concerned with a specific, short-term problem that, if researched, could benefit themselves and other industry organisations.

Academic research

Aim

To help RSSB members find novel solutions to industry challenges that require early stage R&D.

Process

The academic community are encouraged to form consortia with industry representatives and suppliers. RSSB monitor projects and industry advisory boards are setup to ensure that the results meet industry needs.

Timeframe

RSSB takes 6-8 weeks to initiate a call for research and funded projects typically last 9-12 months.

It works best when

There is clear industry challenge with no evident off-the-shelf solution and novel, blue-sky thinking unconstrained by the railway of today is necessary.

The programme also co-funds projects with Research Councils, PhDs and larger research calls.

Other RSSB activities

If your challenge falls outside of the scope of the R&D programme, there may be other ways that RSSB can support you.

Please get in touch via the relevant RSSB Engagement Manager or the enquiries desk:

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RSSB | ADHERE

The ADHEsion REsearch challenge (ADHERE)

Achieve 'adhesion conditions that are unaffected by and independent of the weather and climate.

Driver behaviours
Improving driver confidence and performance in low adhesion conditions

Fundamental science and modelling
Advancing the ability to model low-adhesion contaminants and braking; and enhancing knowledge on low adhesion caused delay

Changes to train design
Exploiting train-borne technologies, including sanders and magnetic track brakes

Rail cleaning and re-contamination
Enhancing knowledge on the effect of rail cleaning activities and treatments

Forecasting adhesion
Achieving better adhesion forecasting and observation capabilities to improve decision making

Current Planned Research on this route

- IMP-T1107

Piloting enhanced sanders on the GB Mainline

- COF-AUT

Autumnsense: Wet rail monitoring using a network of sensors to improve autumn resilience

- T1159

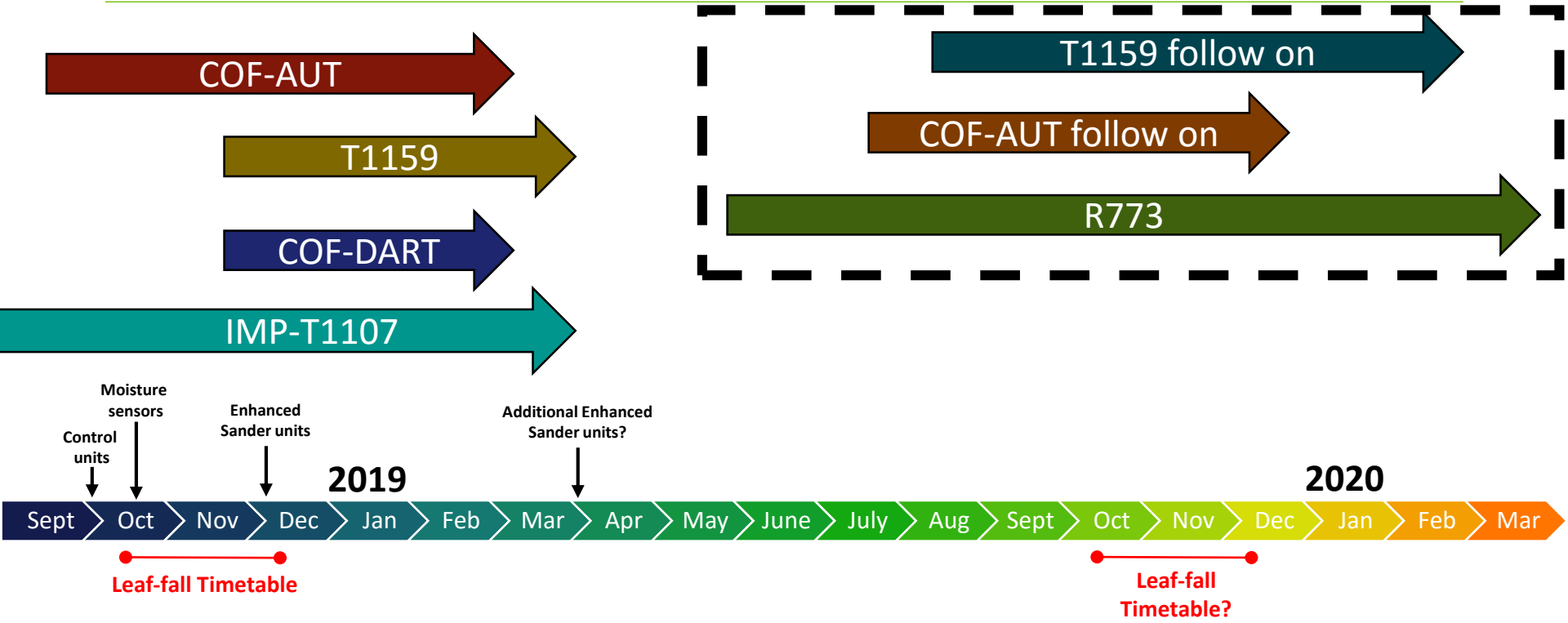
Evaluating variability in train driving under different adhesion conditions

- COF-DART

Quantifying the effects of Railhead Treatments on adhesion

Project timelines

Currently ideas – timeframes TBC pending endorsement



Why the Cross-City line

The Route

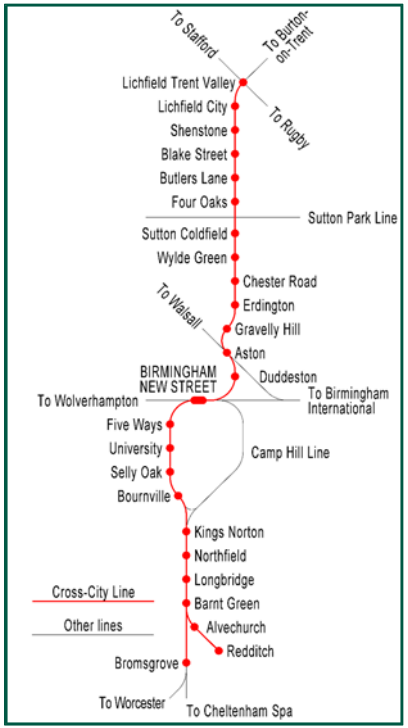
- 32 miles long (>20 stops)
- Intense metro-type service (core 6 tph ↔)
- Operated by class 323 EMUs

Problem

- leafy nature - suffers from low adhesion

Current Mitigation

- ‘Skip-stop’ leaf-fall timetable
- TGAs
- ATUSTs
- RHTTs/MPVs



Current Planned Research

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T1159
Evaluating variability in train driving under different adhesion conditions

Aim: Use on-board train data (& supporting material) to understand changes to driver behaviour variability under different adhesion conditions.

Compare:

I. Traction,
II. Speed &
III. Braking

Current Planned Research

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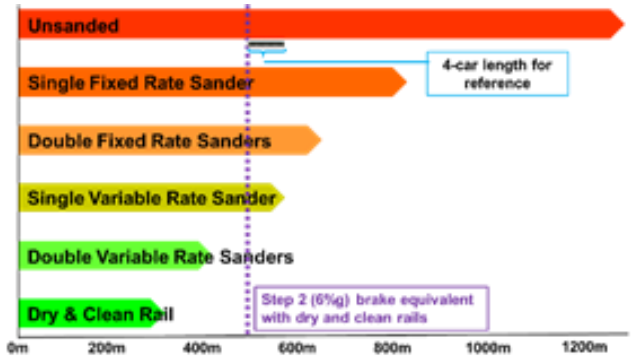
IMP-T1107
Piloting enhanced sanders on the GB Mainline

Background

T1107 delivered conclusive findings of the relative performance of different sander configurations in low adhesion conditions.



As a result, RSSB is co-funding an implementation project with WMT that seeks pilot these variable sanding configurations in a real railway environment.

IMP-T1107
Piloting enhanced sanders on the GB Mainline

Objectives

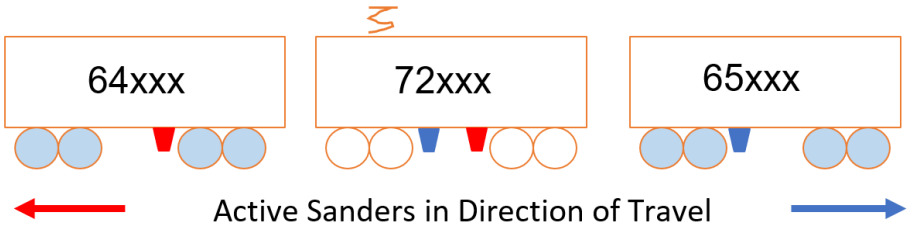
I. Accelerate the roll out of double variable rate sanders by supporting early adopters

II. Demonstrate in-service benefits to the wider industry

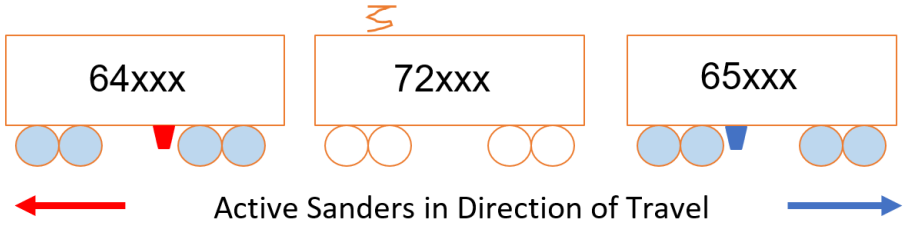
III. Capture in-service data to unlock longer term capacity gains achievable via improved and reliable braking performance

IMP-T1107
Piloting enhanced sanders on the GB Mainline

2 x Modified Enhanced Sander units (+2 units in 2019)



6 (or 4) x Unmodified units



Equipped with Data loggers to monitor braking performance

IMP-T1107
Piloting enhanced sanders on the GB Mainline

Success criteria	Data required
A. Anecdotal evidence from driver and DSM	Collect driver / DSM feedback
B. Reduction / removal station overruns	WMT station overrun data Local low speed test
C. Reduction of reported adhesion issues	reported adhesion issues data
D. Improvement in PPM (or CaSL)	PPM (or CaSL) data
E. Achieved decelerations closer to the demanded brake levels	• Unit deceleration rate (accelerometer & data logger) • Brake demand (Real-time) • Axle 1 & 2 BCP • Sander activity • WSP activity GPS speed and location data
F. Demonstrate 6%g deceleration (if practicable, >6%g demand needed)?	

IMP-T1107
Enhanced sanders on the Cross-City line

Comparing braking performance of
enhanced sander units vs unmodified units

However…..

…..Railhead treatments (TGAs/ATUSTs/RHTTs) may muddle results if “treated” vs “non-treated” rail is are not identified….

…..analysis will need to control for these variables….

….more data required!

IMP-T1107
Enhanced sanders on the Cross-City line

Comparing braking performance of enhanced sander units vs unmodified units

Treatment	Information required
TGAs	Locations, Activity/Operation/Maintenance, 323 fleet unit diagrams
ATUST	treatment sites, Unit number, Operation/Maintenance, 323 fleet unit diagrams,
RHTT/MPVs	Operation, friction modifier treatment sites, 323 fleet unit diagrams

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COF-DART
Quantifying the effects of Railhead Treatments on adhesion

History of COF-DART

- Anecdotal evidence railhead treatments work - little empirical evidence to corroborate on GB mainline.
  - RHTT - work by ARUP and by Data Alchemist
  - TGAs – work by Liverpool John Moores University
  - ATUST - inconclusive
- Opportunity to utilise IMP-T1107 data to evaluate these treatments in more detail
- Requested and endorsed by Network Rail

COF-DART
Quantifying the effects of Railhead Treatments on adhesion

Key Questions

I. What level of braking improvement is generated by the different treatments immediately after their deployment?

II. How resilient is the improvement over time?

III. What is the variability observed in the improvement and what are the key influencing factors?

COF-DART
Quantifying the effects of Railhead Treatments on adhesion

Objectives

I. Produce a database cross-referencing data sources from IMP-T1107 and others which will be used in the downstream analysis of this project.

II. Measure/determine the available adhesion on the route (when braking)

III. Determine effects and latency of TGA treatment on adhesion conditions

IV. Determine effects and latency of ATUST treatment on adhesion conditions

V. Determine effects and latency of RHTT/MPV operations on adhesion conditions

VI. Correlate varying levels of moisture on the railhead against low adhesion hotspots

VII. Compare the effects of different low adhesion mitigation strategies at different sites and climatic conditions, to determine level of variability and factors that could explain it

Current Planned Research

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COF-AUT
Autumnsense: Wet rail monitoring using a network of sensors

Aim

Produce a real time environmental monitoring system to help improve autumn resilience on the railway network by:

I. Focusing on sensing the key element of moisture, the project will translate an existing sensor prototype developed on pilot project COF- TAR- 01;

II. Collecting data over Autumn 2018 so that it can contribute to the RSSB Adhesion Forecasting data sandbox and be considered in the context of the WILAC model and other data analysis driven work that RSSB will carry out or commission as result of joint data collection effort with WMT.

COF-AUT

Autumnsense: Wet rail monitoring using a network of sensors

Objectives

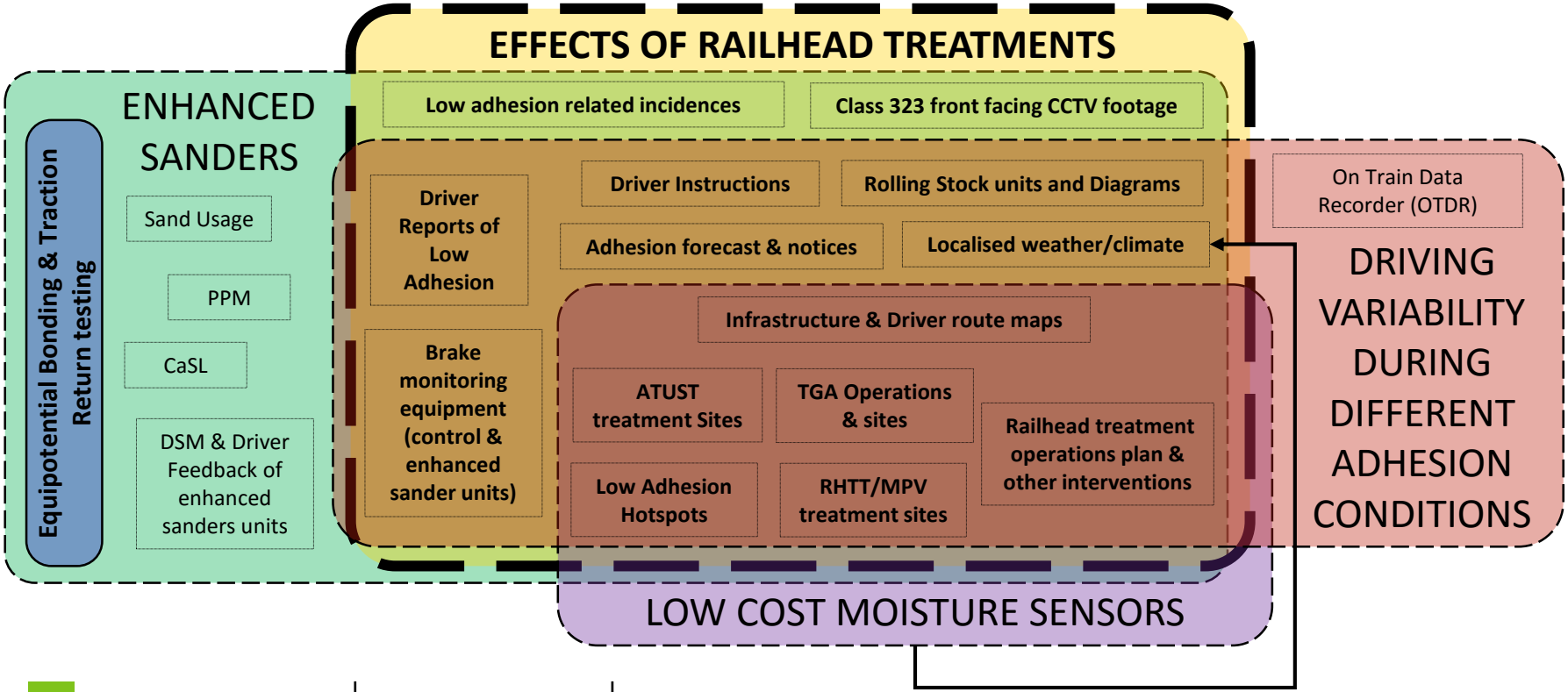
I. Modify the prototype moisture sensor so it is suitable for translation into an operational environment (i.e. adjacent to the rail on dummy rail) and equipped with a battery life to last for the entirety of the IMP-T1107 trials providing data for Autumn 2018;

II. Fitment (by Network Rail) of an agreed number of moisture sensors to a number of agreed sites.

III. Collection of moisture data to demonstrate the feasibility of the low cost moisture sensors applicability to carry out remote monitoring on the GB mainline;

COF-DART and Data

Projects and relevant data sources



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Database

Data to be provided to supplier	Expected data to be included within database
WMT Class 323 OTDR data (6 control units)	**Monitoring system data (control units)**
WMT Class 323 OTDR channels list	**Cross-City Line infrastructure**
Class 323 brake train wire coding sequence chart	**Moisture sensor locations and data (Cross-City Line)**
OTDR download guidance document	**Driver reports of low adhesion**
Monitoring system data (6 control units)	**WMT Adhesion notices**
Cross-City Line driver route maps and sectional appendix	**TGA sites (Cross-City Line)**
WMT rolling stock and train crew diagrams	**TGA data recorded along the Cross-City Line**
WMT rolling stock and train crew diagram allocation changes	**Railhead treatment operations (Cross-City Line)**
WMT professional driving policy documentation	**Identified low adhesion hotspots (Cross-City Line)**
WMT seasonal briefing documentation	**ATUST TG60 gel application sites (Cross-City Line)**
WMT Adhesion notices	**Actual rolling stock operated (Control units only)**
ATUST TG60 gel application sites (Cross-City Line)	**All actual traffic on the line**
ATUST data recorded onboard WMT Class 323 units (Cross-City Line)	
Identified low adhesion hotspots (Cross-City Line)	
TGA sites (Cross-City Line)	
TGA data recorded along the Cross-City Line	
Railhead treatment operations plans (Cross-City Line)	
Driver reports of low adhesion (Cross-City Line)	
Moisture sensor locations and data (Cross-City Line)	

Questions