Vehicle / Track

UKRRIN
UK RAIL RESEARCH AND INNOVATION NETWORK

1. ***Design of guard rail arrangements to improve efficacy at higher speed***

Proposing and assessing design enhancements to improve efficacy at higher speed, while non affecting or improving resilience, maintenance, manufacturing costs.

2. ***Inform deployment of wheel/rail friction management (FM) systems***

Developing the hard evidence needed to specify and test performance requirements and inform fitment of suitable and effective FM systems.

3. ***Ride comfort standards for primary and secondary suspension***

Developing and validating a methodology to assess the impact of different suspension characteristics on ride comfort.

4. ***Technology for detection and analytics to identify flaws in rail***

Developing methods and technology that can reliably detect tell tail signs of fatigue and ways to identify rails at risk of failure due to squat type defects.

5. ***Methods to extend crossing surface life***

Developing methods and technology that can reliably be used to repair or reprofile crossing surfaces to extend crossing life.

6. ***Tools, guidance and approaches to optimise rail profile treatment and efficient deployment of rail grinding and milling systems***

Exploring how data can be collected and combined to inform rail profile treatment and efficient deployment of resources.

7. ***Systems and technology that can non-destructively evaluate stress-free temperature (SFT) in rails***

Establishing an efficient non-destructive method of measuring rail SFTs to have more accurate and up today data to inform risk management.

8. ***Mechanics and root causes of ballast settlement leading to track quality degradation***

Developing models to predict the root causes of ballast settlement and efficient practical ways to manage the phenomenon.

Design of guard rail arrangements to efficacy at higher speed

Workstream: *Vehicle / Track*

What is the challenge / opportunity?

- *RSSB and NR funded research quantified the effect of guard rail in mitigating the consequences of train derailment.*
- *Guard rail are effective across all curve radii tested for speeds up to 60 mph (dependent on curvature).*
- *Is there potential to extend the efficacy to higher speeds and hence increase their useful application?*
- *There may be a need to understand the wider mechanical chain and failure mechanisms.*
- *Understand what level of validation exists?*
- *Understand and use existing modelling capabilities?*

What output(s) are expected?

- *Based on international guard rail design and novel thinking, propose potential design enhancements to improve efficacy at higher speed, while non affecting or improving:*
  - *Resilience and maintenance*
  - *Manufacturing implications and costs*
- *Assess the structural performance under derailment conditions*

What is needed from a good proposal?

Involvement and contributions in-kind from relevant industrial partners will enhance the attractiveness of proposals.
Strong capability in understanding and modelling track systems.

Useful links and background info

[1] Assessing the case for rolling stock and infrastructure design features that can provide guidance to trains when derailed (T1316)
[2] The introduction of the sleeper exchange system improving the productivity of the installation of the rolling stock deviation preventive guard rail as a countermeasure against earthquakes at Sanyo Shinkansen
[3] NR/L2/TRK/2102 Issue 13 – Level 2 specification: Design and Construction of Track
[4] Loading requirement for tracks systems - lateral loading (COF-UOH-59)
[5] On going work on Mitig4Derail
[6] Past relevant RAIB reports (Watford Tunnel, Carmont)

Funding size

Up to £150k for one proposal

Funding source

*Opportunity set and funded by **RSSB** jointly with contributions from **NR***

Inform deployment of wheel/rail friction management systems

Workstream: Vehicle / Track

What is the challenge / opportunity?

- *Friction management (FM) is typically uncoordinated between train operators and infrastructure managers, which can result in inefficiencies and costs.*
- *The V/T SIC wheel/rail interface strategy (2024) noted that it was common practice for the GB rail industry to use trackside FM equipment, but that this was '…far from optimum'*
- *In recent years, there have been significant advances in FM technologies including trainborne systems. However there remain key gaps in knowledge on how FM systems compare with each other.*
- *Addressing these knowledge gaps will help inform take up of the most appropriate and effective FM systems, to reduce wheel/rail wear, noise issues and to minimise costs.*

What output(s) are expected?

1. *Assessment of the performance, benefits and costs of stick and spray trainborne lubrication systems, supported by lab testing and track testing as needed.*

2. *Improved understanding of product carry down to enhance trackside and trainborne friction management system efficiency. Supported by lab testing and track testing.*

The hard evidence above is needed to specify and test performance requirements and inform fitment of the most suitable and effective FM systems. So, the findings need to presented in a way that can be used to inform (i) new train requirements; and (ii) a system approach to track vs trainborne fitment.

What is needed from a good proposal?

- *Proposals are expected to focus on one of the two aspects, with funding allocated to get answers to both.*
- *Ability to run lab testing in addition to modelling capability is a requirement.*
- *The budget allows for some track testing. The specific needs and added value for it will need to be addressed in proposals. RSSB and NR are exploring opportunity to get access to test track in-kind or at reduced rates.*
- *Involvement and contribution in-kind from friction management suppliers is expected.*

Funding size

Up to £500k for one proposal in each area

Funding source

*Opportunity set and funded by **RSSB** jointly with contributions from **NR** and **ROSCOs***

Useful links and background info

S391 Friction Management Systems

Ride comfort standards for primary and secondary suspension

Workstream: *Vehicle / Track*

What is the challenge / opportunity?

- *Ride comfort measures have been clarified in EN 12299:2024.*
- *Key Train Requirements specify measurement of Mean Comfort Index but there is scope to use additional measures, e.g. passenger response to discrete event.*
- *The relationship between suspension characteristics and ride comfort measures is not well understood.*
- *Do modern optimisation techniques allow improvement in ride comfort without sacrificing other suspension requirements?*
- *Can we embed ride comfort improvements into vehicle design and assessment to achieve better ride comfort through informed procurement specification.*

What output(s) are expected?

- *Development and validation of a methodology to assess the impact of different suspension characteristics on ride comfort, while controlling for track geometry.*
- *Develop and understanding for the level of improvement that could be made to ride comfort through optimisation.*
- *Determine the suitability/feasibility of using measurements beyond the Mean Comfort*
- *Clear proposal and ways for the methodology to be used to inform train procurement.*

What is needed from a good proposal?

- *Experience in vehicle dynamics, suspension modelling and experience of passenger comfort measurement/human factors considerations.*
- *Involvement and contribution in-kind from OEM, ROSCOs and other relevant parties will enhance the attractiveness of proposals.*
- *Consider how we take input from track*
- *Consider how we represent passenger experience*

Useful links and background info

[1] Enhancing Railway Passenger Ride Comfort with EN 12299:2024 - CEN-CENELEC

[2] key-train-requirements.pdf section 3.6

Funding size

Up to 150k for one proposal

Funding source

*Opportunity set and funded by **RSSB***

Technology for detection and analytics to identify flaws rail

Workstream: *Vehicle / Track*

What is the challenge / opportunity?

Rail head squats are fatigue related surface defects that drive high maintenance costs and can lead to rail breaks, speed restrictions, and customer disruption.

Thousands are detected and managed annually, but their causes are not fully understood, making prevention essential to reduce risk and cost.

What output(s) are expected?

Modelling of vehicle dynamics to assess vertical rail damage, will help improve our understanding of the principal factors contributing to the initiation and development of squats on the gauge corner and running surface of rails within curved and tangent track.
Identify track sections with the highest likelihood and history risk of squats developing.

Develop preventative maintenance that addresses root cause of squat initiation in high-risk locations.

Develop more effective and efficient corrective maintenance (minimum actions for grinding, weld repair).

What is needed from a good proposal?

Propose and develop methods and technology that can reliably detect tell tail signs of fatigue and ways to identify rails at risk of failure due to squat type defects.

Involvement and contribution in-kind relevant industrial partners will enhance the attractiveness of proposals.

Consider the Infrastructure Monitoring Fleet Replacement programme (NR) as a route to implementation.

Useful links and background info

Previous research and development paper available.

Funding size

Between £50k to 150k

Funding source

*Opportunity set and funded by **NR***

Methods to extend crossing surface life

Workstream: *Vehicle / Track*

What is the challenge / opportunity?

Lack of understanding of crossing profile requirements means that our existing maintenance strategy does not maximise asset life.

The challenge is to improve understanding of degradation mechanisms to reduce and prevent defects in crossings.

Research should also explore how data can be collected and combined to allow for prioritised intervention to take place before failure occurs and manage the wheel impact to a level before the forces create damage / excessive fatigue.

What output(s) are expected?

This R&D will establish scope for optimisation, whether it's possible to deliver, considering both machine profile from initial manufacturer and manual profiling during maintenance.

Once complete, the project will deliver methods for scoping sites and undertaking work based on profile degradation. This will enable staff to assess crossing condition during planning maintenance, determine what repair is suitable, expand viable repair or replacement opportunities, reducing wasted resources.

What is needed from a good proposal?

Propose and develop methods and technology that can reliably be used to repair or reprofile crossing surfaces to extend crossing life.

Involvement and contribution in-kind from relevant industrial partners, such as crossing repair system suppliers, will enhance the attractiveness of proposals.

Useful links and background info

Funding size

Between £50k to 150k

Funding source

*Opportunity set and funded by **NR***

Tools, guidance and approaches to optimise rail profile treatment and efficient deployment of rail grinding and milling systems

Workstream: *Vehicle / Track*

What is the challenge / opportunity?

Lack of understanding of rail profile requirements means that our "one size fits all" strategy does not maximise rail life.

The challenge is to explore how data can be collected and combined so prioritised intervention can take place before failure occurs and manage the conicity to a level before the forces create damage.

What output(s) are expected?

This R&D will establish scope for optimisation, whether it's possible to deliver and what the benefits could be, considering both machine and manual profiling.

Once complete, the project will deliver a fully approved wear measurement gauge for use when scoping milling sites. This will enable staff to assess wear condition during planning, determine whether milling is suitable, expand viable milling opportunities, and avoid unsuitable sites—reducing wasted resources caused by selecting inappropriate remediation during milling.

What is needed from a good proposal?

Propose and develop methods and technology that can reliably be used to optimise rail profile treatment and efficient deployment of resources.

Involvement and contribution in kind from relevant industrial partners, such as milling system suppliers, will enhance the attractiveness of proposals.

Useful links and background info

Funding size

Between £50k to 150k

Funding source

*Opportunity set and funded by **NR***

Systems and technology that can non-destructively evaluate stress-free temperature in rails

Workstream: *Vehicle / Track*

What is the challenge / opportunity?

One of the main risks of track buckles on the network is that of low stress-free temperature (SFT) of continuously welded rail (CWR). NR maintain a rail stress register which holds details of rail SFT across the network, but the average age of these records is 18 years old. Rail stress migrates along the track for several reasons, meaning that the records we hold are inaccurate. We assess our buckle risks for disturbed or deficient CWR track using these SFT records to give us our critical rail temperatures (CRTs). These dictate our safety critical mitigations that we impose to protect trains. We are currently unable to manage our buckle risk effectively due to the lack of accurate SFT information. To get accurate SFT information, we currently either must cut the rail and restress it, which is extremely labour intensive and impractical, or we must carry out verse testing which is also labour intensive due to the requirement to unclip lengths of track and jack the rail up numerous times for the calculations to be performed.

What output(s) are expected?

If we can establish an efficient non-destructive method of measuring rail SFTs, we will be able to update our SFT records with accurate information.

Doing this will allow us to manage and mitigate our track buckle risk across the network effectively which will enable a safer railway during hot weather. We will be able to accurately prioritise work required to mitigate the risk of track buckles, and in doing so, reduce safety and performance risk for our customers.

The project will deliver an unobtrusive efficient method of measuring SFT without the requirement to cut or unclip the rail.

What is needed from a good proposal?

Propose new areas of technology research and development that can be used to non-destructively test stress in rails.

Involvement and contribution in kind from relevant industrial partners will enhance the attractiveness of proposals.

Useful links and background info

Previous calls for technology and solutions

Technical specification drafted

Funding size

Between £50k to 150k

Funding source

*Opportunity set and funded by **NR***

Mechanics and root causes of ballast settlement leading to track quality degradation

Workstream: *Vehicle / Track*

What is the challenge / opportunity?

Ballasted track is by nature only partially homogeneous even when completely compacted. It has gaps between its surfaces that allow water to disperse.

The problem that this causes, under repeated loading cycles, is that these designed gaps can become voids leading to settlement, the angularity that interlocks them is worn away, leading to rounding and lack of resistance to movement, and fines that are produced by this movement, along with those created by maintenance activities, such as tamping and manual compaction methods, contaminate the ballast and permeate into the formation which eventually leads to the pooling of water and the emergence of wetbeds.

What output(s) are expected?

Appropriate, early life maintenance interventions could retain the angularity, size, interlocking capabilities and cleanliness of the ballast so that it retains its original resistance to settlement for longer periods of time, leading to fewer interventions, longer asset life, better track quality, less condition of track speed restrictions, such as cyclic top and reduce the whole life cost and carbon footprint of the asset. The project will define all the mechanisms of ballast settlement and the emergence of voiding. It will identify early indications and precursors to future settlement, voiding and wetbeds.

The project will identify a range of cost-effective solutions and maintenance activities to both improve track quality, prolong the life of the asset and allow less interventions, which will further drive efficiencies.

What is needed from a good proposal?

Propose and develop models to predict the root causes of ballast settlement and efficient practical ways to manage the phenomenon.

Involvement and contribution in kind from relevant industrial partners, such as OEMs specialising in ballast settlement management, will enhance the attractiveness of proposals.

Useful links and background info

Funding size

Between £50k to 150k

Funding source

*Opportunity set and funded by **NR***