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New on-board system will spot leaves on the line and other low-adhesion hazards

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Researchers are getting together to develop an on-board solution to spot low-adhesion track hazards, such as leaves on the line.

Low adhesion is caused by the contamination of railway lines by biological, chemical and physical factors, some of which cannot be easily monitored or controlled.

The new real-time system will allow trains to spot a range of slippery issues such as the rail equivalent of black ice. According to RSSB figures, the cost of low adhesion on the railways comes to about £350 million a year.

A minimum level of adhesion is essential for reliable braking and traction performance, especially for maintaining safety and limiting delays. Changes in adhesion can be very localised, unpredictable and transient, and poor adhesion experienced by one train may not affect following trains at the same location.

Now, engineers from Loughborough University, the University of Sheffield and engineering firm Perpetuum have partnered to develop a new product that will detect low adhesion hot spots in real-time and create an

up-to-date map of the UK's network which shows where any hazards might be.

The map will allow network operators to react quickly to potential risks allowing services to run more safely and smoothly.

Loughborough's Dr Chris Ward, who is leading the initiative, said: "The network is in danger of low adhesion events occurring at all times, and the industry takes the impact of these incredibly seriously.

"Network Rail and the wider rail industry invests huge amounts of money in rail head cleaning, controlling flora alongside lines and forecasting where low adhesion events may occur – but it's not an exact science and affected areas may only be discovered after an incident has taken place.

"The areas of low adhesion can often be short-lived, and various types of train can react differently to the conditions.

"This new technology, by detecting low adhesion in real-time from in-service vehicles, will allow for a much more accurate picture of where hazards lie on the UK's huge network of track, which will mean a quicker response – such as defensive driving or railhead treatment — and as a result a safer network with fewer delays."

The detection system will use established sensing methods to collect data that will then be processed using algorithms created by Dr Ward and colleagues at Loughborough.

The experimental software should pick up small changes in how the wheels of a carriage respond to different track conditions.

As a train passes over areas of low adhesion, the vehicle moves differently compared to running over tracks with high levels of adhesion.

Signals of the movements are picked up by sensors, which are then processed and turned into an assessment of adhesion level. If required, a warning could be sent to the driver or the wider network users.

Elaine Cockroft, Project Manager at Network Rail said: "The aim is to develop a first of type product addressing the issue of low adhesion on the wheel/rail interface and consider a tribometer/measurement tool capable of determining the co-efficiency of friction on the rail head.

"The medium-term aspiration is to install a device on the Network Rail Head Treatment Train (RHTT) or a Multi-Purpose Vehicle (MPV), or any other suitable vehicle to capture intelligent seasonal treatment data at a minimum speed of 60mph and to demonstrate the effectiveness of the rail head treatment.

"The future ambition is to add the technology to passenger trains or freight locomotives and so the technology would need to be developed to capture continuous data at a travelling speed of 125mph across the network. This would feed into an up-to-date adhesion map of the network."

A 22-month study this summer will see the research team conduct a major test programme at Network

Rail’s Rail Innovation and Development Centre, in Tuxford, Nottinghamshire.

Artificial low adhesion will be created for the testing programme and measured using state-of-the-art friction measurement equipment from University of Sheffield.

Professor David Fletcher from Sheffield said: “Our collaboration in the UK Rail Research Innovation Network has enabled us to develop a comprehensive suite of rail surface analysis hardware. We can now take our rail-wheel contact expertise from the lab and deploy it to site trials such as these with Loughborough.”