Research and Innovation Quarterly Update
February 2018
Welcome to our latest R&I quarterly update. As in previous quarters, you will find many exciting stories of innovative solutions being taken up, of findings ready to make a difference, and of new projects targeting ambitious outcomes.

One of these stories has given me a lot of food for thought that I would like to share with you. While ‘leaves on the line’ is a bit of a media joke, the problem is a very real one with serious implications for train performance and safety. A solution would not just help us with Autumn, it would also support reliable and predictable braking in all conditions.

Sanders have been used for decades to improve braking. A previous piece of lab-based research explored different sanding arrangements with promising results, and what was required next was to gather data from a full-scale trial. Hence the comprehensive testing of sander arrangements that RSSB led last Autumn, with its ground-breaking results presenting a compelling case for double variable rate sanders.

The first reflection I want to share is about the level of improvement which has been shown to be achievable by optimising an ‘old technology’ like sanders. This to me is a strong reminder of the need for research and innovation programmes that pursue incremental, optimisation improvements in parallel to novel technologies and radical solutions, even if the former are less glamorous!

The second reflection is on what it took to get this testing happening. It has been years in the making, with availability of track and train at the same time being the key hurdle – in the end this could only be secured by negotiating to carry out the testing on Fridays and Saturdays. And contractual arrangements were not easy either. So while this is a great cross-industry achievement led by RSSB and made possible by the generous support and good will of many organisations, there are lessons that must be learned if the vision of the Rail Technical Strategy is to be realised.

The third reflection is that, particularly with cross-industry research, all the effort and the findings are of little benefit unless industry works together to apply it. There are many challenges to start realising the benefits from Autumn 2018, including the fact that time is against us. But these challenges cannot be to the detriment of our passengers, and they must be overcome. RSSB and its research and innovation programmes are here to continue to support industry on this journey.

Please get in touch if you would like more information about any of the projects featured here and to discuss opportunities to collaborate on research and its implementation.

Luisa Moisio, R&D Programme Director
Luisa.Moisio@rssb.co.uk
The installation of this new hydraulic pump is a great milestone in the development of sustainable technology, and a rail industry first. The Artemis pump has re-imagined the traditional mechanical control of pistons... Using technology to digitally control the pistons means we are able to consume fuel much more efficiently by only using it when needed, similar to turning the lights in the house off when they’re not being used.

Tom Smith,
Project Engineer, ScotRail Alliance

Research and innovation in action

MyJrny ‘Smart-train’
Passenger Counting & Real-time Information System

A Smart-train passenger counting and real-time information system, co-funded by RSSB, has been successfully trialled on Chiltern Railways. The technology, which was developed by Enable iD and installed on 24 train carriages, provides accurate real-time automatic passenger counting and vehicle status information which can be used to transform the customer experience and deliver a range of operational and commercial benefits.

During an eight-week trial customers and industry representatives were able to access information on a website and mobile app. 90% of respondents said having real-time access to seat availability influenced where they stood on the platform and helped them get a seat on the train. The system streamlines people-flow and improves safety at the platform train interface and reduces dwell time to help keep trains running to time. It also provides information that could be used to deliver dynamic pricing and customer incentives.

The Smart-train system is now available for wider commercial adoption, alongside a range of adaptable passenger counting technologies.

Onboard digital equipment is reducing carbon emissions

Hydraulic units in modern diesel trains, which are often used to power the cooling fans in carriages and generate electricity, can use 10 to 15% of the engine’s fuel. ScotRail and Artemis Intelligent Power are testing a new digital hydraulic pump that controls the valves on the pump’s cylinders and turns them off when they are not needed.

This technology has been fitted to a standard commuter train in Scotland, and findings to date indicate it could save over 9,000 litres of diesel per carriage per year, which would exceed 1.5 million litres of fuel a year across ScotRail’s fleet of Class 170 Turbostars. This not only represents significant cost savings, but also an important reduction in carbon emissions.

Supporting a fair culture: good practice

A good practice guide for developing support plans after incidents is enabling duty holders to embrace fair culture while proactively managing operational incidents. South West Trains, working with ASLEF, used the guide as a catalyst to review its competence development plan process. Driver managers and local union representatives worked together using real-life operational incident scenarios and agreed proactive measures that would support incident prevention. In some cases, they found it was possible to predict future incidents based on an understanding of the driver’s profile.

Operational incidents, where driver error was identified as one of...
the causes, were reduced by over 21% in the twelve months that followed the introduction of this new process, which was part of a wider safety management system and supported by a programme of cultural change. Using a risk-based and more targeted and proportional approach to driver monitoring, South West Trains were able to remove 79 drivers from their driver support programme. They were also able to reduce additional monitoring for drivers, which is over and above the minimum monitoring requirement for driver competency management, by over 11,844 days.

UtterBerry remote monitoring system

This miniature ultra-low power wireless technology uses onboard artificial intelligence and machine learning capacity within the device to provide insightful and intelligent big data. Each UtterBerry device has circa 100 built-in sensors, enabling it to measure multiple changes in the environment such as movement, vibration, moisture and crowd sensing (counting people without the use of a camera).

Supported by Network Rail and RSSB, it was applied to monitoring level crossings at two locations. Utterberry succeeded in the challenge to detect (in real time) the number of vehicles, people and animals passing through a level crossing, the time at which they do so, and the speed at which vehicles pass through. Their intelligent system also provided accurate data on cyclist and pushchair numbers.

Not only is the UtterBerry 100% remote but it uses almost no power, is very robust and highly accurate and was cheaper than both the traditional alternatives and newer technologies such as fibre-optics at Crossrail’s Eleanor Street site. There’s no doubt it could be used in many different applications in the construction industry.

Nigel Marsh,
Land and Engineering Surveyor Manager, Costain
Research and innovation ready to use

This significant cross-industry endeavour led by RSSB found a credible solution for dramatically improving braking performance. The ground-breaking results from this testing, using two new GWR Class 387 trains, provide the rail industry with the evidence and clarity it needs to move forward in this challenging area.

Mark Hopwood, Managing Director, Great Western Railway

GeoDAS: advanced driver advisory system

The GeoDAS consortium of First Group, TTG, Thales and RDS has successfully developed and tested a driver advisory system (DAS) that will deliver multiple benefits in operational performance. The connection to the emerging Traffic Management System (TMS) allows the system to be optimised according to real-time service requirements.

The system gives drivers support in schedule keeping and energy saving together with in-journey timetable updates from traffic management. It also incorporates route knowledge support for drivers when driving less familiar diversionary routes. The system allows drivers to select the type of information to be displayed, such as driving and/or route advice, according to their experience and operational circumstances.

Next steps:
The project partners are planning an industry launch event to demonstrate how GeoDAS will improve current performance and give assistance to controllers during service perturbation.

GeoDAS

New sander arrangements proven to dramatically reduce the impact of low adhesion conditions

During autumn, low adhesion conditions cause an average of 350,000 delay minutes each year and result in signals passed at danger and station overruns. At the same time, industry aspires to run more trains per hour using new train control systems. However, the benefits that can be derived from these systems are severely compromised by a lack of predictable braking.

RSSB undertook a three-month programme of track testing in collaboration with industry partners, at the Rail Innovation and Development Centre at Melton Mowbray using two new Class 387 trains loaned by GWR. A robust dataset was created from over 220 test runs covering various configurations of sanders, test speed and train length. The findings provide a compelling case for moving to double variable rate sanders. In particular, using this configuration improves stopping distances on a 4-car train by around 50% compared to a single fixed rate sander, and delivers a 6%g braking performance.

Results have been disseminated in two industry briefings in early February, and recordings are available on the RSSB website for those who were unable to attend.

Next steps:
The project partners are planning an industry launch event to demonstrate how GeoDAS will improve current performance and give assistance to controllers during service perturbation.

Low adhesion tests

GeoDAS

Next steps:
We are discussing and agreeing with industry the steps that must be taken to start to realise the benefits of these ground-breaking results. For more information, contact: paul.gray@rssb.co.uk
Safety and health management for all and meeting the important needs of the disabled is a balance for duty holders to manage so far as is reasonably practical. Improving the access of mobility scooter (and wheelchair) users to the railway is an important feature of this and I welcome the publication of this research and the new guidance.

Ian Prosser, Director, Railway Safety, Office of Road and Rail

This work has helped us to identify the range of technical and commercial options available. It will inform the rail and digital industries on improving digital connectivity, mobile and broadband, across all of Britain’s rail network for the benefit of rail customers and the train operating companies, freight operating companies and rolling stock companies.

Nick Wilson Rail Delivery Group

Improving accessibility and safety for mobility scooter users

Each year up to 290,000 rail journeys are taken by people travelling with mobility scooters, and many more scooter users would choose rail if it were easier. Train operator policies for wheelchair and mobility scooter carriages are becoming more flexible and some operators have introduced ‘Try a Train’ days to encourage infrequent rail users with disabilities to experience train travel.

The industry must continue to improve the experience of wheelchair and mobility scooter users and prepare for the increase in passengers who experience mobility impairments that is expected to result from an ageing demographic.

New guidance – which covers passenger preferences, the use of ramps, and stowage protocols – has been produced for mobility aid users, station staff and their managers to improve passenger and staff awareness of good practice.

Next steps:

To find out more about how we are supporting industry efforts to improve accessibility, including an event planned for the spring, contact:
susan.cassidy@rssb.co.uk

Nick Wilson Rail Delivery Group

High-speed connectivity: a digital roadmap for rail

Ubiquitous digital connectivity on GB rail corridors is a step closer following the publication of a technology roadmap to deliver wireless broadband connectivity for the railway. The roadmap sets out options for creating a fair, open, transparent and competitive environment that will be capable of meeting growing demand for onboard connectivity.

4G and Wi-Fi can deliver the capacity that is required onboard trains, although there are some technical challenges such as handover at speed for high bandwidth signals. The real challenge is adopting innovative commercial models so that mobile and wireless operators are incentivised to deliver enhanced connectivity for rail commuters and facilitate more efficient passenger and freight train operations.

Next steps:

Find out more about the digital roadmap and industry’s response to the Government’s recent call for evidence on ‘Commercial options for delivering mobile connectivity on trains’. Contact:
piraba.navaratnam@rssb.co.uk

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Research and innovation in progress

Mitigating against the impact of cognitive underload in train drivers

Train cab environments have improved and this, along with long hours of sedentary work accompanied by periods of time which require little cognitive effort, can contribute to low driver alertness. Automation of some in-cab activities has also meant that drivers may have fewer responsibilities which has the potential to result in ‘cognitive underload’ – a lack of mental stimulation resulting in loss of concentration.

We are assessing the safety and performance risk associated with cognitive underload in drivers. Potential mitigations – including interactive secondary tasks, activity breaks, lighting, caffeine use and auditory stimulation – are being examined with a view to reducing risks. Improving the industry’s understanding of cognitive underload will also support a strategic approach to the automation of other operational tasks.

Get Involved:
Train and freight operators can explore opportunities to mitigate cognitive underload in drivers by participating in trials. For more information contact: justin.willet@rssb.co.uk

Faster, safer, better: boarding and alighting trains

Passengers take more than one billion rail journeys each year, passing through over 2,500 stations on the mainline network. Four university-led feasibility studies are collaborating with industry partners to explore innovative solutions which could help the industry reduce dwell time, cater for increasing capacity, and reduce safety risk at the platform train interface (PTI).

Two projects focus on opportunities to make better use of CCTV. One is using autonomous computer vision technology to identify potential PTI incidents and make dispatch safer. The other is applying novel computing techniques to CCTV footage to identify the combinations of platform and train features that set the flow rate of passengers. This could include proposals to retro-fit options for improving existing trains and platforms, as well as more radical options for future station and fleet designs.

Another project is investigating how sharing information about approaching trains with passengers could be used to influence behaviour on the platform. And the fourth and final project is assessing options for modifying or designing trains so that they can ‘kneel’, reducing the gap between the train and the platform.

Get Involved:
The results of these feasibility studies will be presented at a one-day PTI event in central London on 13 March. For more information contact: nailah.fraser-haynes@rssb.co.uk

Understanding track defects: models and mitigations

The strategic partnership between the University of Huddersfield and RSSB has initiated two new track damage projects. These novel projects use data from disparate sources – including track geometry, ultrasonic inspection, defect history and finite element analysis – to help track engineers predict and mitigate defects in selected locations.

Squat damage – damage to the surface of the rail – accounts for a large proportion of railhead defects and repairs cost an estimated £4m each year.

Another project is developing a model based on the factors that cause plastic flow – deformation of the rail due to loading pressure over time – which most frequently occurs on the low rail in sharp curves, to predict future plastic flow damage.

Get Involved:
For opportunities to implement findings from the strategic partnership and support the current programme of research contact: andrew.gleeson@rssb.co.uk

Station CCTV

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Station CCTV
Get involved

Horizon scanning
Our horizon scanning work looks at the wider trends and disruptors that are likely to impact transport demand and rail competitiveness, such as automation and future skills requirements. We are assessing emerging technologies – everything from drones to artificial neural networks and self-healing materials – to understand how they could support the railway of the future.

Get Involved:
To share your ideas and express an interest in becoming part of the active cross-industry horizon scanning community, contact: olivier.marteaux@rssb.co.uk

Enabling better performance
As part of our commitment to delivering research that is closely aligned with industry challenges and able to make a substantial difference, we are planning a multi-year R&D programme to optimise rail operations and reduce variability, prevent and mitigate service disruption; and improve the value derived from performance data.

Get Involved:
To share your performance challenges and contribute to research that could drive a step change across the industry, contact: hassan.khalil@rssb.co.uk

ADHERE: The Adhesion Research Challenge
We are working with the cross-industry Adhesion Research Group and Adhesion Working Group to capitalise on the existing body of adhesion research and identify priorities for a multi-year programme looking into rail cleaning and re-contamination, train design, driver behaviours, and forecasting adhesion.

Get Involved:
To find out more about how ADHERE is working towards “adhesion conditions that are agnostic to weather and climate” and how you can support it, contact: ben.altman@rssb.co.uk

Research and Innovation Showcase events
Our showcase events – which will cover both operations and engineering related research and innovation – will provide an overview of our programmes, give you examples of tangible solutions and explore how barriers to implementation can be overcome. Importantly, it will be an opportunity to meet face-to-face, in some cases for the first time, to discuss the challenges and opportunities faced by your business and how the R&I that RSSB run on behalf of industry can help.

Get Involved:
To secure a place at the showcase in York (8 March) or Birmingham (5 April), contact: sophie.hind@rssb.co.uk
SPARK is a knowledge hub with over 20,000 records where you can discover who is doing what in rail related research and innovation. In SPARK you can find the Research and Solutions Catalogues providing information on research and innovation projects and programmes managed by RSSB on behalf of the GB railway industry.

Access SPARK to find out more about the Solutions Catalogue and Research Catalogue.

Suggest research
The research programme is driven by the rail industry’s needs. We receive and review hundreds of ideas each year. New research ideas are always welcome. Drop us an email and we will be in touch to discuss your research needs and ideas further.

enquirydesk@rssb.co.uk

Request a knowledge search
Do you want to know if research has been done, or knowledge already exists? Our Knowledge Services include horizon scanning activities, support the R&D programme, and carry out knowledge searches for RSSB members.

knowledgesearch@rssb.co.uk