Key to icons indicating which strategic goals for the railway each project addresses:

- Increased capacity
- Reduced carbon
- Lower costs
- Improved customer satisfaction
- Safety
Welcome to the August 2019 Research and Innovation Quarterly Update.

As autumn approaches and lots of preparation is underway to ensure that we deliver the best possible service to our customers even with ‘leaves on the line’, our quarterly summary touches upon two novel tools that will start to be used.

The first, developed by the University of Birmingham with funding from RSSB, uses Internet of Things (IOT) sensors, which are proving to be a low cost and effective solution to moisture monitoring on the Birmingham Cross-City line.

The other is the Adhesion Digital Solution (ADS). This system collects ‘crowd-sourced’ driver reported data and combines it with data from the Met Office Low Adhesion model to generate granular up-to-the-minute route relevant adhesion forecasts. Funded through RSSB’s TOC 17 competition, ADS was developed by 3Squared, in collaboration with the Met Office, and it is now being trailed with two TOCs ready for the coming autumn.

In the meantime, preparations are well underway to run the first in service pilot of double variable rate sanders on the Birmingham Cross-City line. My thanks go to the West Midlands Trains and Network Rail Central Route teams for all the effort and enthusiasm that they have put into making this possible. This is not only an important step towards enhanced sanders being used, but also a unique opportunity to answer key questions around driving styles, head cleaning treatments, and train performance both during braking and while taking power.

From next autumn to the year 2050, the final report of the Rail Industry Decarbonisation Taskforce sets out the key building blocks for GB rail to be a major contributor to the government’s target of net zero carbon by 2050. The outputs of our research have underpinned the work of the taskforce, providing essential evidence on the range of potential pathways toward reducing carbon and informing the economic and commercial case. Read on for more insight into the work we have done so far and get in touch if you want to engage with the emerging research programme to support the decarbonisation strategy.

Luisa Moisio, R&D Programme Director
luisa.moisio@rssb.co.uk
Reducing freight derailment risk

Following the Camden Road container freight train derailment in October 2013, recommendations were made by the RAIB to better understand the nature of risk due to offset loaded container wagons travelling over twisted track. The Cross Industry Freight Train Derailment Working Group was established to address these recommendations, and RSSB in partnership with the University of Huddersfield’s Institute of Railway Research carried out a simulation of the dynamic response of four types of container carrying wagons with a combination of longitudinal and lateral imbalances that are foreseeable in service. The dataset that informed the load cases was previously assembled by an RSSB study using information gained from two major ports over three years.

The research produced a methodology to assess the likelihood of derailment under a range of offset container loading scenarios. The completion of the research has informed the latest release of GMRT2141 ‘Permissible Track Forces and Resistance to Derailment and Roll-Over of Railway Vehicles’ which now includes a new section with clear requirements, rationale and guidance on this issue. This will help freight operators procuring new wagons and designers of new wagons to assess resistance to derailment and improve their ability to deal with twisted track.

The freight industry is actively working on new bogie and wagon designs to meet these requirements.

For more information, contact Paul Gray:

paul.gray@rssb.co.uk
The whole industry works hard to manage low adhesion. ADS will provide operators and drivers with detailed route adhesion insight to help them make more informed decisions on train regulation that will ultimately reduce the likelihood of incidents and help reduce risk.

James Fox  
Commercial Director, 3squared

Better adhesion information

A consortium of 3Squared and the Met Office has launched a new product to aid the identification and communication of low adhesion areas along routes. Development of the Adhesion Digital Solution (ADS) was funded through RSSB’s TOC 17 competition to identify innovative projects that will improve operational performance.

ADS will complement a number of solutions for tackling low adhesion that exist today. The system collects ‘crowd-sourced’ driver reported data and combines it with data from the Met Office Low Adhesion model. Together these data sets give operators detailed up-to-the-minute route relevant adhesion forecasts in the cab, and through an operators’ portal. The core benefit comes from providing drivers with detailed information on the likely adhesion conditions they will experience along a route, in real-time. Allowing them to amend and optimise their driving style to ensure safe control and minimise impact on performance.

Trialled in Scotland with Colas Rail, the system is now being trialled further with two TOCs ready for the leaf fall season.

If you are interested in the product or for further information email: hello@3Squared.com
Rail is already a green way to travel… but we want to go further – Mark Gaynor, RDG

The challenge for rail to decarbonise is now widely understood across the industry. What hasn’t been clear is how this might be done, or whether it might even be possible, in the absence of any consensus on further significant electrification.

We have been able to answer these questions through recent research on decarbonisation options for traction energy (ref. T1145). This explored a wide range of technical possibilities and determined which are likely to be sufficiently mature by 2040 to allow the removal of diesel-only trains from the railway. Our work established that hydrogen and battery power options should be capable of making a significant contribution within this timeframe and removing all diesel-only passenger trains. A detailed economic model showed that it would be possible to use a combination of electrification, hydrogen and battery traction options, within a reasonable economic cost, to make substantial contributions to the new national target to reach net zero carbon across the UK by 2050.

The outputs of this research have informed the work of the Rail Industry Decarbonisation Taskforce. It’s recently published report has been welcomed by the Minister as providing a clear route map to decarbonisation. The outputs of the project’s economic model are now informing the work of Network Rail’s System Operator as they develop a Traction Decarbonisation Network Strategy.

The research also showed that forthcoming traction technologies will not be able to offer a viable alternative to electrification and diesel for rail freight. A further research project (ref. T1160), is
Rail is already a green way to travel, cutting up to 7.7 million tonnes of carbon emissions every year but we want to go further and… deliver a zero-carbon railway for Britain.

Mark Gaynor
Head of Railway Planning, Rail Delivery Group

now underway to investigate other ways to reduce the carbon impact of rail freight.

For more information, contact Andrew Kluth, Lead Carbon Specialist:
andrew.kluth@rssb.co.uk
Research and innovation ready to use

Environmental Reporting Tool

In April 2019, the Rail Industry Environmental Reporting Tool, managed by RSSB and operated by Action Sustainability, went live. The tool provides a single online platform for TOCs to report their environmental franchise data to the DfT and will result in more consistent reporting and analysis.

The tool was developed in response to concerns that the industry wasn’t getting maximum value from this important data. The tool will now allow industry to understand trends, benchmark and compare performance. In turn, this will create better informed long-term plans aligned with the Rail Industry Sustainable Development Principles of reducing environmental impacts and being carbon smart. All TOCs have now registered onto the tool and are beginning to input data on metrics such as water consumption and waste, amongst others.

Next steps:

The aim is that all TOCs will be utilising the Industry Environmental Reporting Tool to submit data to DfT for the 2019/20 reporting period. RSSB is in discussion with interested parties to populate the tool with historical environmental data in order to calculate industry trends from the offset, rather than waiting years to accumulate enough data.

For further details and more information, contact Lauren Brown (ref. Environmental Data Tool):

lauren.brown@rssb.co.uk
Red Aspect Approaches to Signals (RAATS) Tool now running on near-live data

The RAATS tool enables the identification of how many times trains approach signals when they are displaying a red aspect and informs the analysis of SPAD risk. It was developed under partnership with the University of Huddersfield and uses big data analytics of train describer data from Network Rail open data feeds. A beta version of the tool, using a limited sample of data has been available since 2015. Starting in 2018/19, the tool has been subject to a peer review and has been subsequently improved and updated to run on near-live data.

This will enable the industry to look at trends in red aspect approaches on an ongoing basis. In addition, the RAATS software has been moved over to an RSSB support environment, to create a sustainable platform for its future use and potential development.

Next steps:

Following the launch of the updated tool in September 2019, there will be a roadshow and period of consultation with users, to inform the requirements for ongoing support and development.

For further details and more information, please contact Liz Davies (ref. RAATS):
liz.davies@rssb.co.uk
AutumnSense for reliable moisture monitoring

The IoT sensor developed by the University of Birmingham is a reliable moisture monitoring sensor that is able to provide alerts on dew point formation and light rain. Existing sensors that are deployed at a few locations across the network do not provide a cost-effective solution, making use of expensive datalogging and comms equipment. The IoT approach significantly reduces this cost by providing a low-power sensor embedded in an existing communications mesh. Using these moisture measurements would cost less than £200 per site, enabling the measurement of moisture levels at a higher level of granularity.

Being able to monitor low levels of moisture is important for the validation of forecasts and to understand the current condition of the network to support real-time decision making. The data being gathered on the Birmingham Cross-City line is currently supporting several adhesion related projects, and has demonstrated the value that having more granular coverage of sensors across the network provides.
Next steps:

Following the deployment of a total of 30 Internet of Things (IoT) moisture sensors built by the University of Birmingham and fitted on the cross-city line in Birmingham, there has been ongoing discussion with Network Rail to fit additional sensors on LNW South Route and with TfL.

For more information, contact Aaron Barrett, Senior R&D Analyst:

aaron.barrett@rssb.co.uk
Audibility of detonators - can you really hear them?

Detonators have been used in the rail industry for over 180 years as a safety protection mechanism. For those that have never seen or used them, detonators are small yellow metal devices containing a small quantity of explosives. These detonators are placed on the track and are intended to provide a warning of potential hazards on the line ahead. The placing and removing of detonators requires staff to access the track, exposing them to risks associated with being on or near the line, including train movements, slips, trips and falls, etc. Safety incidents and near misses have been associated with their use and there has also been misuse, including incidents of theft and vandalism.

As part of wider research activity on quantifying the risks that
detonators import versus the benefits they provide, audibility testing was undertaken. This provided evidence that detonators can be audible to train drivers, however the level of reliability of this alert is variable. This is due to a range of reasons including the speed of the train, variability in noise generated by detonators and how it travels into the driving cab on different trains, and possible confusion with other common impact noises (from bird strikes to ballast underneath the vehicle). Other noises in the cab, including the AWS bell, horn and the vigilance device, could also mask some of the detonator noise if occurring at the same time.

The audibility of detonators alerting trackworkers was also measured. This found detonators may be audible by trackworkers in some situations, but their effectiveness is highly dependent on several factors, including:

- distance and location of the trackworkers from the triggered detonators
- terrain or other objects (such as buildings) obstructing sound propagation
- operation and use of trackside equipment

Therefore, track workers may need to be in close proximity to detonators in order to hear them, especially when operating or close to trackside equipment.

These outputs provide evidence that will be used in the quantified risk assessment that is underway and which aims to measure the benefits and challenges of using detonators as a risk control measure. Alternatives to detonators are also being considered, including learning from international railways that removed detonator use over 20 years ago.
Next steps:

We are planning cross industry engagement to disseminate the findings later in the year. If you are interested in taking part, please contact Hassan Khalil (T1167):

hassan.khalil@rssb.co.uk
Acti-wheel motors demonstrator session

Innovators supported through the RSSB Innovation Programme are breaking new ground with demonstrators, closing the gap between our imagination of the future and commercially viable advancements. In September there are a couple of engagement opportunities not to be missed.

Stored Energy Technology are unlocking the benefits of independent in-wheel motors through their rolling stock innovation Acti Wheel. Reduced wheel wear and rolling contact fatigue, regenerative braking, and reduced losses in the drive train are just some of the reasons the industry is getting excited by this technology.

Get Involved:

In September 2019, it’s going to be in action in a full-size battery powered demonstrator. For further information or to attend the demonstrator session contact Richard Uttley:

richard.uttley@set-gb.com
Get Involved:
Interested parties are invited to see the Cummins QSK19R engine (as fitted to the Class 180 and many other rail vehicles) running dual fuel in a test cell in September. The on-network trials start in January 2020 which will provide definitive data on the fuel savings that can be achieved.

If you are interested in learning more about the DFMU (Dual Fuel Multiple Unit) trial get in touch with Chris Smith: chris.smith@g-volution.com

Be on the lookout for G-volution’s other work as part of the RSSB research call, Intelligent Power Solutions to Decarbonise Rail, where they are focusing their attention on freight vehicles.

G-volution

G-volution are working with Grand Central and Angel Trains to run an operational trial of a modified Class 180 train that will be retrofitted to run on a mixture of diesel and Liquified Natural Gas (LNG). This dual fuel approach has economic and environmental benefits and has been in successful operation in the automotive and marine industries. However, transferring the dual fuel technology to rail is not without its challenges. Integrating the LNG tanks onto the vehicle underframe and providing a depot refuelling solution that is both safe and convenient to use is a key objective of the trial.

DFMU fuel tank arrangement with 2 LNG tanks saddling a modified ‘T’ shaped diesel tank
Get involved

What has the Rail Technical Strategy delivered and where does it need to focus now?

Our R&D portfolio contributes to the industry’s Rail Technical Strategy, which is currently being taken through a refresh: to take stock of what R&D has achieved over the last few years and to look forward, taking into account advancing technology and the government’s industrial strategy. The refresh is steered by the Technology Leadership Group and will be published late in 2019.

Get Involved:

Why not be part of the refresh? Get in touch to share your stories on research, development and innovation and your views on what the industry’s future technology journey should look like at:

rts@rssb.co.uk

UKRRIN Annual Conference

The UK Rail Research and Innovation Network (UKRRIN), of which RSSB is a proud founding member, will hold its second Annual Conference on Thursday 21 November 2019 at the Repertory Theatre in Birmingham. This year’s theme will focus on diversity, talent and skills in the rail innovation community.

Get Involved:

For any queries please contact Nailah Fraser-Haynes:

ukrrin@rssb.co.uk
R&I showcases and RSSB engagement days

We run R&I showcases to support the industry in making the most of our Research and Innovation programmes, providing a great opportunity to get up to date on the current portfolio and latest outputs. The R&I showcases are also very much about making lasting links between industry stakeholders and our R&I team to discuss research needs and implementation challenges.

Our next showcase is scheduled to take place at The Helicon in London on Monday 9 September 2019 at 2:30pm, followed by networking opportunities.

We would also welcome the opportunity to host targeted 2-hour showcase sessions at your offices to make it easier for your staff to drop in.

Get Involved:

To attend this event or to host another, please contact our R&I Account Manager, Robert Staunton:

robert.staunton@rssb.co.uk

In addition to the R&I showcases, in November RSSB will be holding our annual regional engagement days for members:

5 November 2019 in Glasgow
12 November 2019 in Cardiff
14 November 2019 in London
19 November 2019 in York
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 include knowledge searches for RSSB members.

knowledgesearch@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 that provide information on research and innovation managed by RSSB on behalf of the GB railway industry.

www.sparkrail.org