RAILWAY INDUSTRY ASSOCIATION
Championing a dynamic rail supply sector

RIA SCOTLAND INNOVATION GROUP

Unlocking Value for Scotland's Railway, an Innovation White Paper

CONTENTS

1 - FOREWORD

The Railway Industry Association (RIA) provides policy and advocacy support on behalf of its 400+ member companies with working groups that drive the development of key industry issues.

The Innovation Workstream of RIA Scotland's Leadership Group (going forwards referred to as the RIA Scotland Innovation team), supply chain and wider stakeholders recognise innovation as a fundamental driver to deliver the step changes in performance and value required to provide better outcomes for the railway in Scotland.

Across Scotland's Railway new solutions in products and services are being identified and developed. Views were obtained from across industry on the level of innovation currently adopted and implemented. This White Paper seeks to celebrate, promote, encourage and make recommendations for the development of continuous innovative thinking and practices as early as possible.

The industry has worked to innovate the design, construction, maintenance, and operation of the United Kingdom's railway network and services. There also remains a perception, that other sectors and regulated industries can develop and implement innovation at a faster pace.

This fact has been recognised by Andrew Haines (Network Rail CEO) who recently acknowledged that engaging with the rail sector, particularly Network Rail, has traditionally been complex and risk-averse due to safety, regulatory scrutiny, and commercial structures.

As part of wider industry reform, and transition to future Great British Railways, GBRX has been established as a strategic innovation body to overcome the barriers to adoption of advanced technologies on Britain's railway.

The importance of innovation in the rail sector is reflected by the series of "Unlocking Innovation" events held jointly by Network Rail, RIA and strategic partners (Telent & UKRRIN) around the UK and which in Scotland attracted over 400 rail professionals, examining the role of innovation in improving the performance of Track and Train, taking climate action and researching means of reducing the net cost of rail operations.

The railway network is a heavily regulated and safety critical environment, the tried and tested, standardised approach has contributed significantly to a strong safety performance. The system is also continuously tested through high usage levels and continues to build resilience to the prevailing impact of climate change.

However, the delivery of successful outcomes, including continued successful operation, reliability and viability of Scotland's Railway is under threat without a commitment to deliver continuous improvements for passengers, freight customers and taxpayers.

This journey towards a stronger and recognisable culture of developing, promoting, and implementing innovation in Scotland's Railway, was summarised by Richard Cairns (former chair of Scottish Rail Holdings), in 2024.

The RIA Scotland Innovation team collected the views of people in the industry on the status of innovation in rail, with the aim of increasing awareness and adoption of proven ideas and technologies, and also presenting a future pathway to unlocking further innovation.

> ***"One of the interesting things is that net zero, the wider economy and all of these other forces are actually coming towards us. And all we've got to do is recognise that – the economic picture, the environmental picture, the fiscal picture - all favour rail.***
>
> ***All we need to do is grasp the opportunity, but we cannot do that unless we are prepared to change and do things differently."***

Richard Cairns, Former Chair, Scottish Rail Holdings Ltd (SRH)

Innovation is the cornerstone of progress, driving advancements that enhance efficiency, sustainability, and value across industries. In the context of Scotland's railway sector, innovation is not just a buzzword but a critical necessity to meet the evolving demands of passengers, stakeholders, and the environment. This white paper, produced by members of the Railway Industry Association (RIA) Scotland , delves into the current state of innovation within Scotland's railway industry, highlighting successes, identifying barriers, and proposing a strategic vision for the future.

The transition to public ownership of ScotRail and Caledonian Sleeper services marks a significant shift, presenting unique opportunities to align innovation with Scotland's broader economic and environmental goals. As the industry navigates post-pandemic challenges, including reduced passenger revenue and the imperative for rail reform, the role of innovation becomes even more pivotal.

This document aims to celebrate the strides made in innovation, particularly during Control Period 6 (CP6), while setting the stage for more strategic and impactful innovations in Control Period 7 (CP7) and beyond. By fostering a culture of continuous improvement and embracing new technologies, processes, and collaborative approaches, Scotland's railway sector can achieve its objectives of climate action, improved performance, cost reduction, and enhanced passenger value.

Through comprehensive survey analysis, industry feedback, and illustrative case studies, this white paper provides a roadmap for overcoming barriers and unlocking the full potential of innovation. It calls for a concerted effort from all stakeholders to drive forward an innovation agenda that not only addresses immediate challenges but also paves the way for a sustainable and prosperous future for Scotland's railway network.

Richard Carr
RIA Technical & Innovation Director

2 - EXECUTIVE SUMMARY

The closer integration of Infrastructure and Rolling Stock (Industry model) is generally viewed as a pre-condition and positive enabler for innovation, in many respects pioneering steps that are now being implemented elsewhere (e.g. set-up of GBR).

Examples of innovation in Scotland's rail sector have been successfully demonstrated and implemented during CP6, most notably achieving greater efficiency outcomes and closer integration of track & train, primarily through incremental improvements and a focus on technology. Whilst technology is an important enabler, it is not the sole means of bringing innovation to overcome industry challenges. Based on findings – a more planned approach to innovation within the sector would be beneficial and necessary to deliver industry outcomes in a period of increasing financial challenges.

Our vision is to accelerate an innovation culture that drives efficiency and value, by creating an environment where the development and implementation of ideas can thrive. In particular, where these ideas help to support key industry outcomes of Climate Action, improving Track & Train performance, reducing Net Cost, more people onto trains, and achieving higher value to the taxpayer.

To achieve this vision, we recommend a strategic plan for innovation. This could be viewed in a similar manner to the construction and rail industry safety journey, with a success story borne from significant cultural and behavioural change. A key driver for this change process was the acceptance that accident and incident rates were too high, and that the whole industry and key stakeholders rejected the status quo. The outcome, with significant long-term commitment and recognition of the value of investment, is a notable success in safety performance during the last 30 years.

This strategic plan for innovation on Scotland's Railway, will support the outcomes which industry must achieve, recognising that both safety and innovation is continuous and requires us all to exhibit positive behaviours, i.e., "we are better, but there is more that can be done".

In practice, customers, authorities, suppliers and other stakeholders must demonstrate the effectiveness of specific innovations, i.e., demonstrate the value that initiatives, processes, or products actually deliver value towards key industry challenges.

Industry leaders should continue to encourage and increase efforts to support creative thinking whilst recognising that there will be a level of rigour and investment (cost and time) necessary in order to demonstrate the benefits and deliver value. Whilst significant potential rests with individual engineers, technologists and project managers within their respective organisations, responsibility for innovation deployment should be acknowledged across all individuals and stakeholder organisations.

Crucial to this success, will be to apply a blend of industry knowledge and experience, with diverse perspectives from other sectors, regions, countries, or those with different skills and knowledge levels.

We encourage everyone to recognise the part we play, both individually and collectively in our innovation journey for Scotland's Railway.

We have provided a series of recommendations within this paper and now seek the support of the wider industry stakeholders to recognise the challenges ahead, embrace the findings within this report and work collaboratively to address the recommendations for the benefit of passengers, freight customers, taxpayers and the environment.

3 - SCOTLAND'S RAILWAY

Scotland's Railway services communities and business across Scotland and across the border to England, with over 2,500 daily services. Rail in Scotland supports £3.1bn in economic growth (GVA), 56,000 jobs and £1bn in tax revenue and is an essential industry in delivering the Scottish Government's economic growth and decarbonisation agendas[1].

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By fostering a culture of continuous improvement and embracing new technologies, processes, and collaborative approaches, Scotland's railway sector can achieve its objectives of climate action, improved performance, cost reduction, and enhanced passenger value.

The network is supported by an organisational structure for rail in Scotland, notably different to other parts of the UK and devolved regions, including a level of integration between ScotRail as Train Operator and Network Rail as Infrastructure Manager (though this will change with GBR), with the integration considered by industry to provide the potential to deliver priority outcomes.

3.1 Public Ownership

On 1 April 2022 ScotRail services transferred into public control and ownership, with Caledonian Sleeper following on 25 June 2023.

Rail passenger services are now provided within the public sector, by an arm's length company, Scottish Rail Holdings Limited, owned and controlled by the Scottish Government (Figure 1).

The impact of these changes, with a greater alignment to outcomes for the people, country and economy of Scotland provides an opportunity for wider change. It enables a fresh look at the role of innovation in supporting delivery and forms the foundations of this paper.

These changes are further strengthened through an alliance agreement between Network Rail and Scotrail, signed in October 2024, which commits both companies to greater integration to deliver a safe, reliable, and green railway. The new agreement updates that which was signed by Abellio ScotRail and Network Rail in 2015.

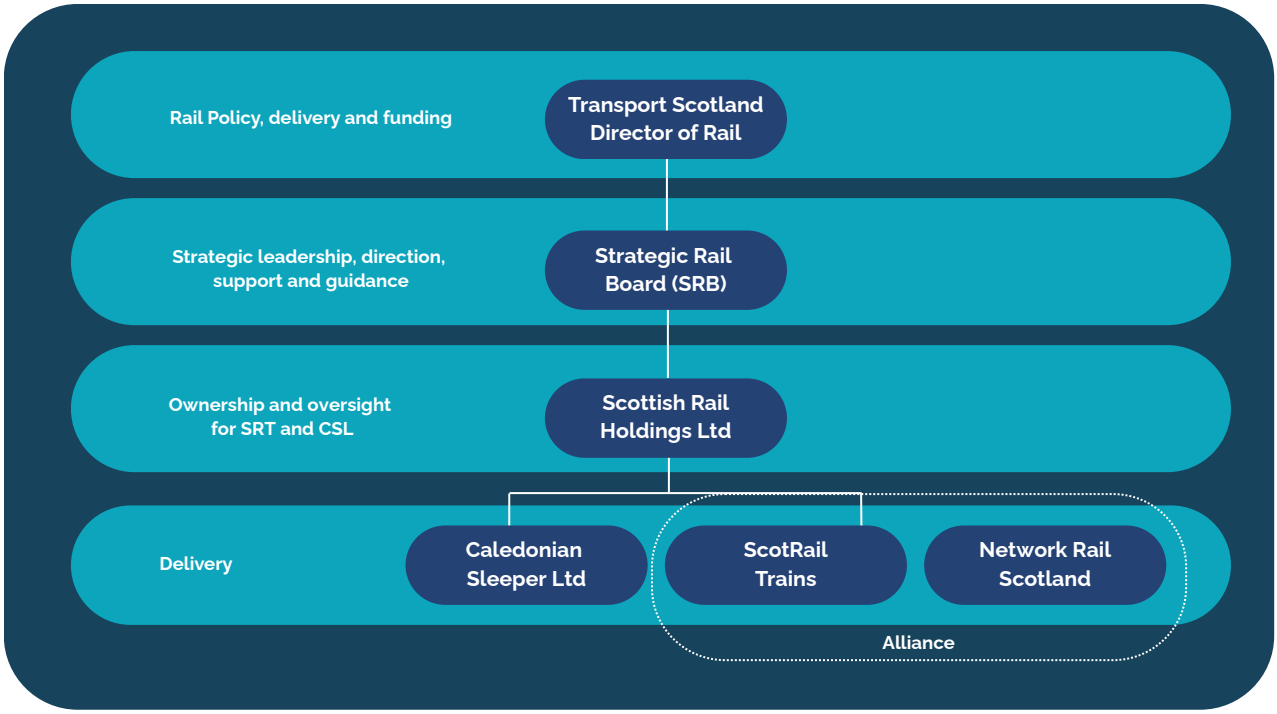

Figure 1: Organisational structure for Scotland's Railway

The changes provide clarity on arrangements, funding, responsibilities and overall policies for implementation on behalf of Scottish Ministers, identified in the Policy Compendium of the Framework Agreement between Transport Scotland and Scottish Rail Holdings Ltd, aligning with Scotland's National Transport Strategy 2[2].

The strategy clearly identifies Scotland's vision for a sustainable, inclusive, safe and accessible transport system, helping deliver a healthier, fairer and more prosperous Scotland for communities, businesses and visitors. This vision is underpinned by four interconnected priorities as illustrated in Figure 2.

The HLOS (High-Level Output Specification)[3] prepared and published by Transport Scotland on behalf of Scottish Ministers outlines what the rail industry must achieve with regard to Scottish railway activities during the review period covering 1 April 2024 to 31 March 2029.

These priorities identify outcomes and measures to be implemented and monitored, such as the measure of punctuality and reliability with associated sub-metrics which are reinforced in Network Rail's Strategic Business Plan (July 2023) for Control Period 7[3] and includes their '2024-29 plan on a page'.

Figure 2: Transport Scotland's priorities

3.2 Post-pandemic Perspective

The post-pandemic perspective is impacted by two key strategic factors; the challenge of reduced passenger revenue, and rail reform. Rail travel in Scotland and other UK nations was heavily impacted by the pandemic with 14.4m passenger journeys in the 2020-21 financial year, compared with 96.4m in 2019-2020.

There has been an encouraging steady increase in passenger numbers, with the Caledonian Sleeper now achieving pre-pandemic passenger numbers, and ScotRail services at 84.1% of their pre-pandemic numbers (Figure 3).

These figures for ScotRail compare with the UK average of 94%, and which varies considerably by operator, such as Grand Central with an increase to 128.6%, and South East trains at 71.5% of pre-pandemic figures.

In Scotland, as in other nations, revenue levels are a particular challenge with Transport Scotland carrying a £48.5m deficit from rail services in 2023-24 reflecting the ongoing reduction in rail farebox post Covid-19.

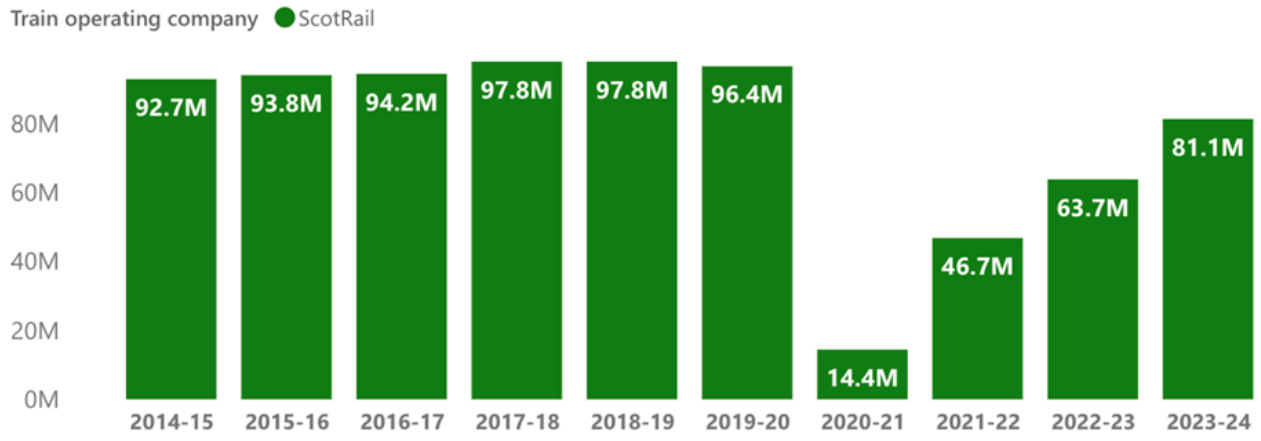

Figure 3: Passenger journeys by financial year, extracted from Office or Road and Rail transport statistics

A key objective for ScotRail is to reduce this deficit by delivering the most efficient service level by providing a passenger experience that attracts customers from other forms of transport, creating modal shift and increases in farebox revenue. This will require changes to current ways of delivering services and supporting the network, with innovation playing a leading role.

One innovative approach trialled by ScotRail to attract commuters back to train travel was the "ScotRail Peak Fares Removal Pilot", which ran from October 2023 to September 2024 and aimed to:

- Improve awareness of rail as a viable travel choice
- Improve access to rail by reducing the cost of travel at peak times, enabling more people to travel more often
- Reduce private car travel as more people choose to travel by rail.

The pilot had some success in meeting the objective of increasing awareness of rail, but it had minimal impact on overall car travel and tended to benefit those on higher incomes within the Central Belt[4].

Note: While finalising this report, the Scottish Government announced that peak fares will be abolished from 1 September 2025.

Additionally, ScotRail launched its Tap&Pay app earlier this year, with the aim of improving the travel experience and making rail travel more convenient for customers[5]. The app allows ticket-free travel using a single-use barcode that can be scanned at ticket gates and on mobile devices in the same way as the existing tickets. The resultant impact of this innovation on passenger revenue numbers is yet to be reported, but it is hoped that more customers will be attracted given the simplified and best value fare offer which is provided.

Reflecting the changes to Scotland's rail sector ownership and operating model, the launch of Shadow Great British Railways (Shadow GBR) in September 2024 set in motion an overhaul of the running of the rail network, bringing together leaders from the Department for Transport, Network Rail and publicly owned train operators. It is anticipated that Shadow GBR will pave the way for Great British Railways – a new unified arm's length body responsible for bringing track and train back together and overseeing both services and infrastructure with the passage of the Passenger Railway Services (Public Ownership) Bill through the Commons. The impact this will have on the more advanced public control and ownership currently set out within Scotland and Wales is yet to be determined.

3.3 The Role of Innovation

RIA has identified the role of innovation in rail through its Unlocking Innovation programme which calls for increased investment and research to develop a railway fit for future generations. Innovation, research, and development are all recognised as crucial to the future of the railway and to achieve positive change.

There is a perception that innovation effort to date has focused on reducing cost; future consideration may comprise adding value and attracting private investment. The success of the Edinburgh Trams highlights the opportunity available for this type of investment, where the passenger numbers in 2023 increased 90% from 2022 to 9.3m,[6] and in 2024 a record number of 12m passengers was achieved.[7]

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The Unlocking Innovation programme provides practical tools to business in identifying innovation readiness levels and providing a simple matrix of the innovation landscape with links to funding sources, cross sector initiatives, innovation programmes and a wealth of additional advice and support.

The purpose of this paper is to complement, support and align (but not replicate) the work undertaken by the RIA Unlocking Innovation programme. We have identified perceptions on the progress that is being made in Scotland, to better understand challenges and to make recommendations on future actions that have the potential to increase benefit and further build momentum for change.

4 - INDUSTRY FEEDBACK

A feedback survey of Railway Industry Association members and wider stakeholders, numbering 400+ organisations provided the primary source of information for this study.

The survey included: simple data on responding organisations, perceptions of the changes to Scotland's Railway, identifying areas and practical examples of innovation.

It sought respondents' views on opportunities for greater innovation, particularly where they felt there was the greatest opportunities for delivering greatest benefit to Scotland's economy, its taxpayers and passengers.

The responses from the survey were collated and analysed, with recommendations proposed.
The survey, issued by RIA through its Innovation distribution list, received an approximately 15% response rate. Through a blend of closed and open questions, responses were received from more than 40 individuals across industry.

The respondents were primarily suppliers and the majority whose primary interest and revenue generation was derived from rail (Figure 4), regardless of size.

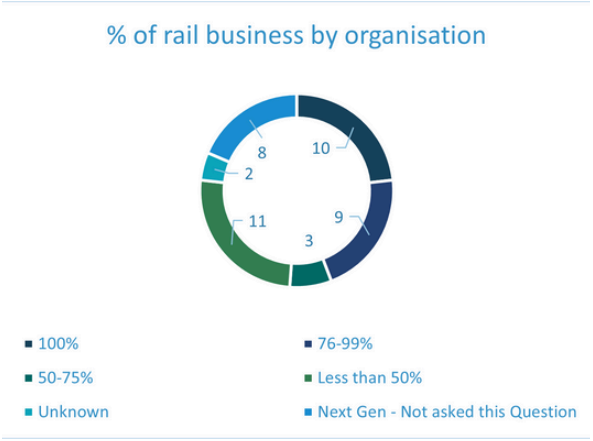

Figure 4: Proportion of revenue (by organisation) derived from the rail sector

The scale of the organisations ranged from large (turnover greater than £36m and more than 250 employees) to Small Medium Enterprises (less than £10.2m and 50 employees) including supply chain, contractors, OEMs and consultants (Figure 5).

Figure 5: Organisation size of respondents by %

4.1 Survey Key Responses

Respondents were asked their views on the changes to Scotland's Rail ownership and structures (Figure 6), with two key findings relating to innovation. A majority of individuals understand the changes to rail ownership, structure and operations in Scotland, with a minority of respondents stating that these changes have had a positive impact on innovation.

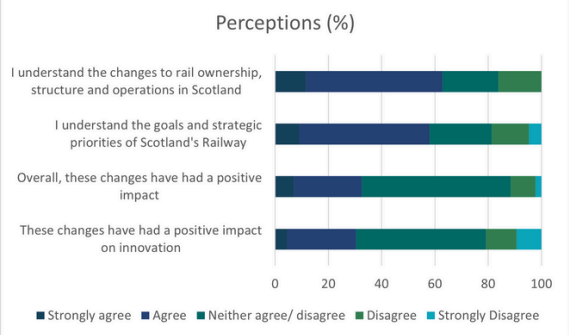

Figure 6: Perceptions on changes to Scotland's rail industry

Respondents were also asked their opinions on the most important innovation opportunities for Scotland's Rail industry. The results identified that practical elements of developing innovation are important, such as standards and product approvals, which are highlighted in some detail in RIA's Unlocking Innovation programme. The survey responses indicate that the most important areas of opportunity are in procurement teams, industry leadership and behaviours that would support innovation and change.

The findings are shown below in Figure 7.

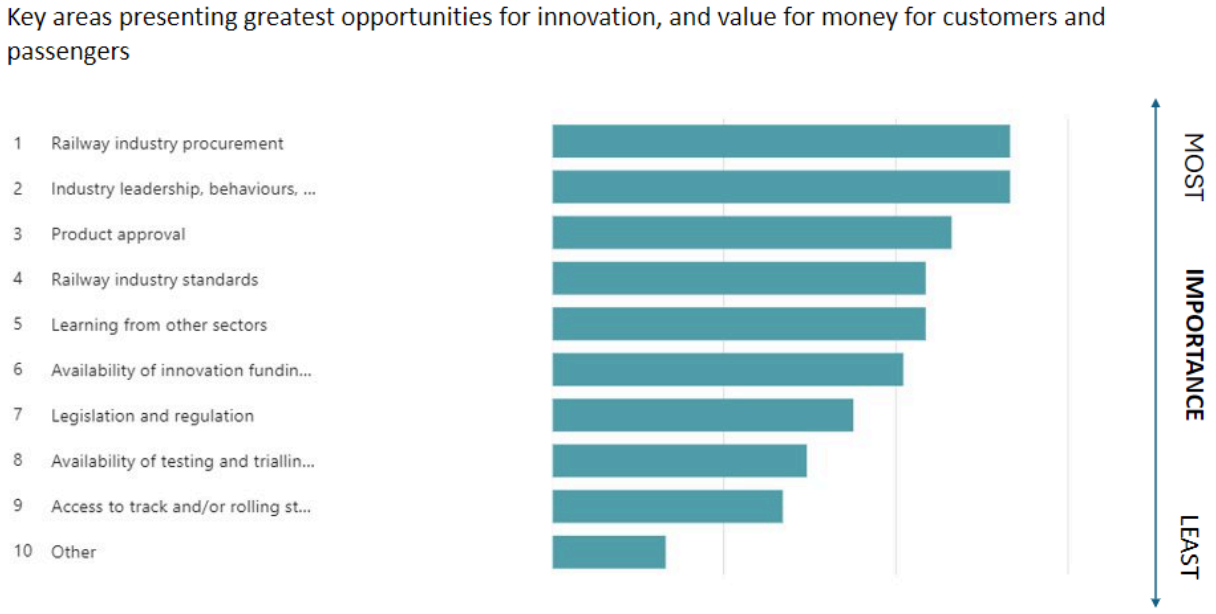

Figure 7: Areas presenting opportunities for innovation

4.2 Survey Analysis and Findings

4.2.1 Method

Respondents were also asked a variety of broader questions, with several key themes identified as a prompt. These themes were aligned broadly with the RIA Unlocking Innovation workstream, whilst applying a distinct "Scotland" lens from the team.

These themes were:

- Barriers to Innovation
- Target Areas for Innovation
- Innovation Examples
- Measuring Innovation
- Innovation opportunities
- The effects of Scotland's rail industry model on innovation

A qualitative analysis was undertaken with responses to each open question aligned to these key themes and subsequently cross-referenced against a pre-defined set of categories, these being:

- Leadership
- Behaviour
- Process
- Efficiencies
- Skills & Training
- Collaboration & Supplier Engagement
- Funding & Procurement

As the analysis was being undertaken, a further 4 categories were added to this list based on responses:

- Technology
- Customer End-User
- Other Sectors
- Sustainability

4.2.2 Findings

The cumulative totals of responses in each category, within the key themes were used as a basis for the emerging findings below:

1. Barriers to Innovation within Scotland's railway industry were identified as being related to procurement (including programme funding), leadership behaviours, collaboration and supplier engagement. Further comments were raised within the survey on the lack of time available in the project lifecycle to support innovation.

2. Respondents indicated that industry effort towards innovation on Scotland's Railway should also focus on technology and process improvements, to help drive efficiencies and added value, whilst achieving sustainability objectives. This provides some positive indication on awareness and engagement of respondents with Scotland's Railway Strategic Objectives as detailed in section 3.

3. When seeking to identify best examples of Innovation in Scotland's Railway a number of specific examples were presented (at the time of survey). These are included in Appendix A.

4. Respondents identified that industry efforts towards Innovation in Scotland's Railway should focus on driving efficiencies and create greater passenger value, with emphasis currently dominated by efficiency. They further identified that visible processes are necessary to monitor and demonstrate positive outcomes around sustainability and customer/end user are achieved. Once again, this provides positive indication on awareness and engagement of respondents with Scotland's Railway Strategic Objectives (see section 3).

5. When asked to identify the greatest opportunities for innovation a large proportion of respondents identified behaviour, followed by collaboration & supplier engagement, then funding & procurement.

6. When asked about Scotland's Rail Industry Model, respondents felt that more is needed to be done to improve collaboration and supplier engagement, funding and procurement, to drive innovation and improved outcomes.

4.2.3 Future Leaders

A separate analysis was undertaken on responses from the RIA Scotland "Next Generation Leaders" working group, in order to group to compare responses with those who have spent less time in the Rail sector (typically less than 10 years).

- When asked to identify where innovation efforts should be focused, our Next Generation Leaders placed emphasis on the customer/end-user (i.e., passenger) and value generation.
- When asked to flag best examples of innovation, our Next Generation Leaders referenced schemes that delivered Customer/end-user (i.e., passenger), and sustainability benefits.
- Barriers to Innovation within industry were primarily identified as being related to funding and/or procurement, and to a slightly lesser extent behaviours.

The first conclusions drawn from the Next Generation Leaders responses indicates an awareness and engagement with Scotland's Railway Strategic Objectives.

5 - TYPES OF INNOVATION

Control Period 7 (CP7) falls within a period of significant economic challenge, ageing assets, greater impact of climate change, higher impact digital technologies, greener materials, evolving passenger needs and a growing freight demand.

The successes found and highlighted in the survey during CP6 are seen now as business as usual by the fiscally constrained funders. The ecosystem of organisations which form Scotland's Railway needs to deliver greater efficiency and effectiveness and increased passenger value.

Innovation takes many forms from optimising a method, developing a new tool, applying a technique from another industry or developing something wholly new.

We have used the survey data to understand where our collective efforts focus by assessing the types of innovation suggested against a recognised model. There are many models for innovation in industry, but we have selected the simple "4-types" model, shown in Figure 8, to assess results, which compares Problem and Domain definition [8,9,10] and considers changing customer needs and outcomes.

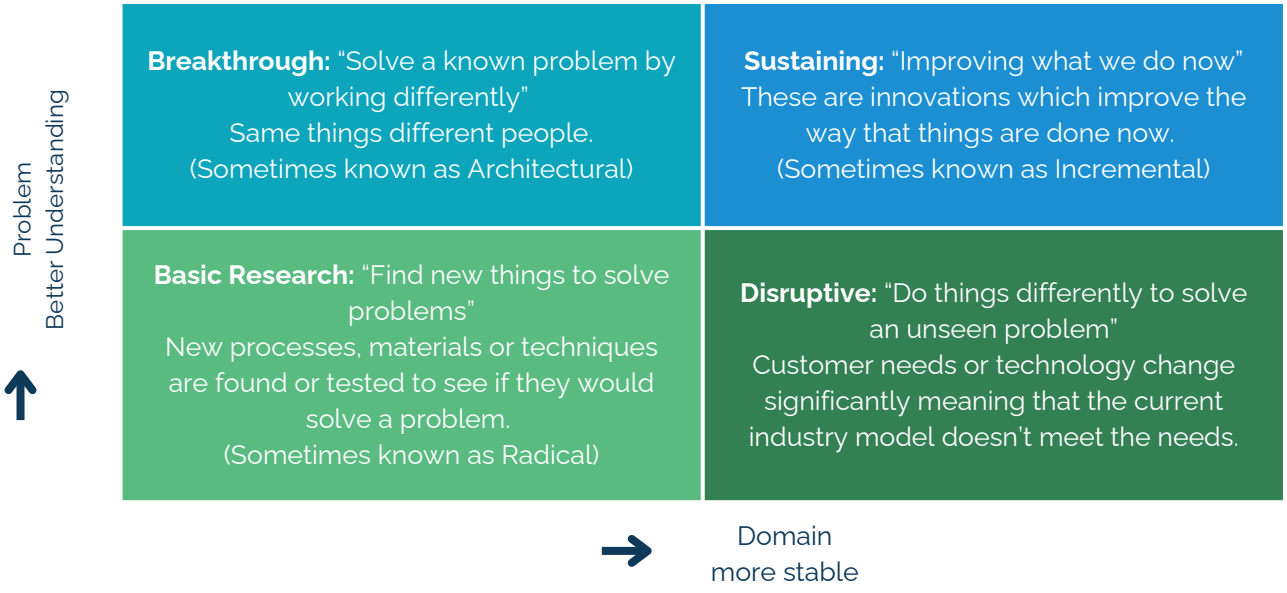

Figure 8: 4-types of Innovation Model

Considering each typical form of innovation:

Sustaining types of innovation provide incremental improvement to well understood challenges to a stable environment. These innovations often bring about low levels of impact compared to other types.

The innovations within **Basic Research** tend to be more uncertain and greater risk, however, their ability to deliver positive outcomes can provide high value.

Breakthrough and **Disruptive** innovations focus on challenges similar to those faced by Scotland's Railway, with Breakthrough innovations solving **known** and often cross organisation problems. Disruptive innovation often brings about change to **unknown** problems, changing the foundations of industry to bring about improvement.

The typical impact of the 4 innovation types is: low impact for Sustaining innovations, medium impact for Breakthrough and Disruptive innovations, and high impact, with a high risk, for Basic Research innovations.

5.1 Areas for Innovation

We have reviewed the CP6 identified innovations against the 4-types model and have identified that the **majority of innovations have been of the Sustaining type** where a well understood issue can be solved within the current model by one incumbent organisation.

Figure 9 shows that innovation has been implemented in areas where the Problem and the Domain are well understood, focusing on infrastructure, and allowing a Sustaining innovation model to be used. These innovations have been around greater efficiency of work, integration of Track-Train-Supply Chain, and some implementation of new technology.

There was little reference or recognition of innovation to support improved passenger experience, driving modal shift and potential for increased revenues.

Case Study Highlight: Passenger Accessibility - WayMap

The WayMap App provides simplified access across the rail network to improve accessibility encouraging more users on to the network. The app changes the way users navigate the station by moving station directions on to their phones rather than via signage. (Appendix A - Case Study 4)

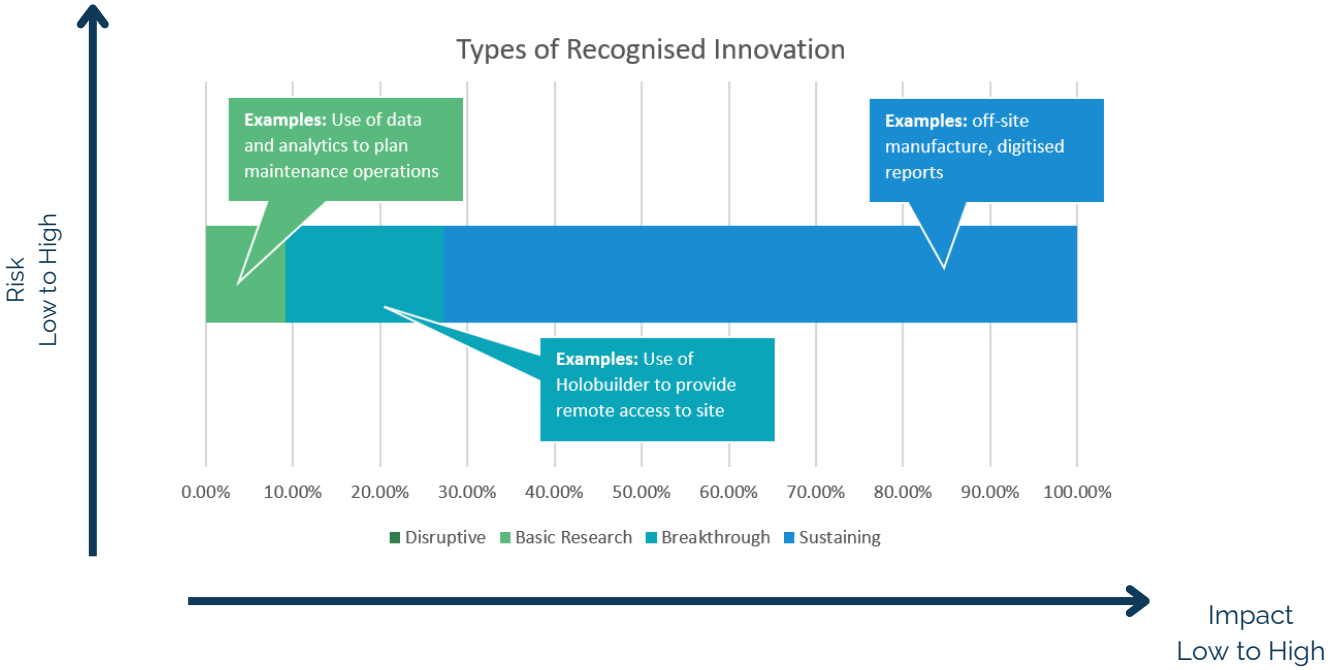

Figure 9: Types of innovation recognised within the survey

5.2 Future Areas

The survey also asked respondents to identify future areas of innovation, and to provide an insight into the anticipated impact of innovation and the ability to implement innovation.

The areas are split equally between Sustaining, Breakthrough and Disruptive Innovation for future areas, as shown below.

Figures 10 and 11 show a low score in Basic Research.

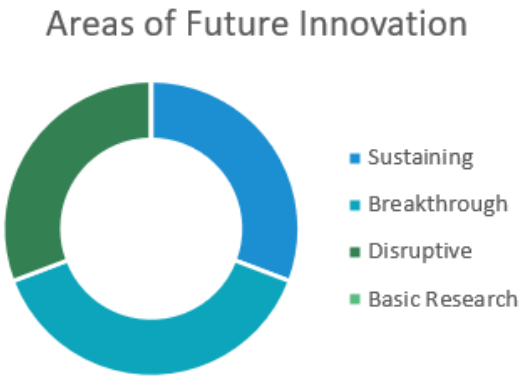

Figure 10: Areas of future innovation

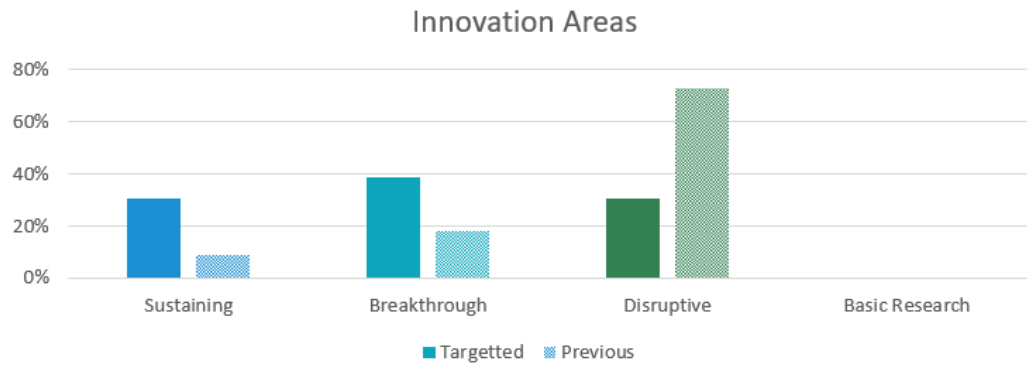

Figure 11: Comparison of previous innovation and future areas by volume of survey response

Industry recognises that more breakthrough and disruptive innovation is needed owing to the challenges faced. These are the areas that have the potential to deliver a significant step forward in outcomes.

5.3 Barriers to Innovation

Following on from analysis in 5.2, with the industry focus in the right type of area, the question then becomes 'where are the barriers to innovation?'

The survey shows a desire to move further towards Breakthrough and Disruptive innovations which have the potential to meet many of the improvements needed to deliver Scotland's Railway challenges.

However, it is unlikely that the full range of outcomes will be delivered without Basic Research and identification of new solutions.

The different barriers to the 4-types of innovation have been identified within the survey results with some barriers identified as having multiple impacts (Figure 12).

Figure 12: Barriers found within the survey to the 4-types of innovation

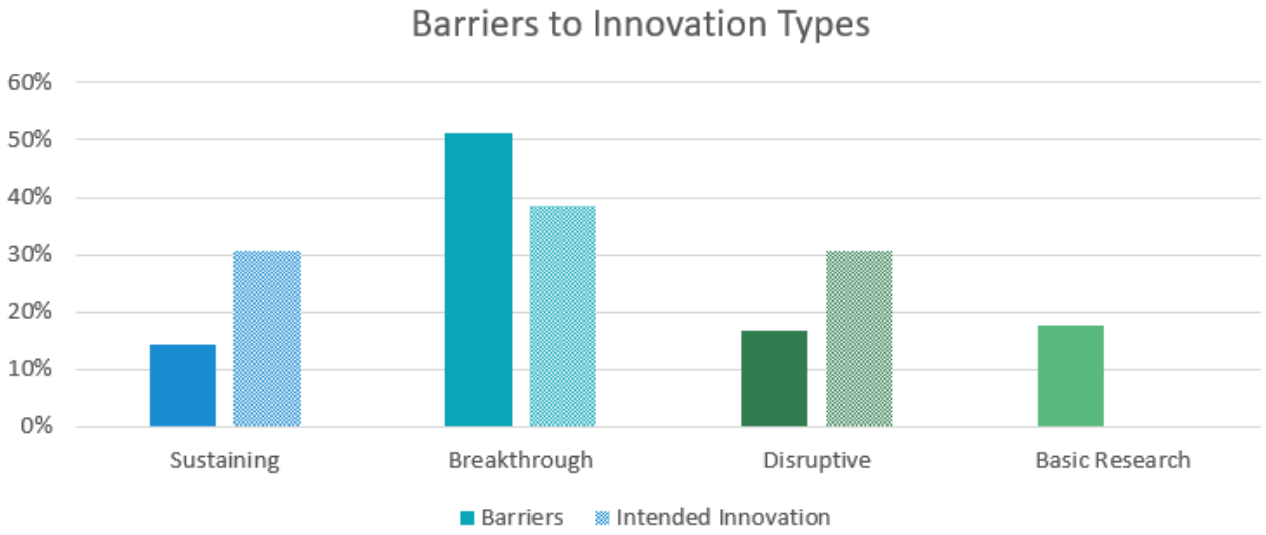

Figure 13: Barriers to innovation types compared against where innovation is desired

From the survey, we can see that Breakthrough innovation and Basic Research has the highest proportion of barriers identified (Figure 13).

Addressing the barriers to Disruptive and Breakthrough innovation areas should be a key focus, alongside efforts to prioritise basic research.

This Basic Research could include organisations such as the University of Strathclyde, GBRX, other partners within UKRINN's (United Kingdom Rail Research and Innovation Network) research network, and stakeholder organisations like Scottish Engineering, who have a broad membership of manufacturing and engineering which may also benefit Disruptive innovation.

Case Study Highlight: Arcadis' Carstairs Junction Digital Twin

Arcadis developed a digital twin to make design data available to all parties, using technology from outside of rail to improve cross-party collaboration. This saved £50m and reduced design time by 35% on the scheme. (Appendix A - Case Study 5)

The five common barriers to disruptive and breakthrough innovation identified within the survey were around:

1. **Collaboration between entities within Scotland's Rail sector is not considered high by respondents. This is perhaps due to the sector not fully adapting to the integrated track and train approach.**

2. **Historic technical and process practices, including standards, are accepted as the norm with minimal evidence of challenge.**

3. **The survey respondents stated that there was little evidence that the total or "Net-cost" to the Railway is considered during procurement events.**

4. **A perceived barrier is that the allocation of risk between customers and suppliers prevents further innovation as any risk of failure is borne by the supplier.**

5. **Respondents identified that Basic Research would aid the development of a pipeline of innovation ideas that would eventually be categorised as "Sustaining" once implemented.**

7 - CONCLUSION & RECOMMENDATIONS

We have prepared this paper as a measure of respondents views on the **current** state of innovation within Scotland's rail industry, identifying success stories and areas of potential, to bring increased value for passengers and the taxpayer alike.

Our study and engagement proves a level of acceptance within the industry of the need to change, recognising that the usual way of working won't resolve our complex and often interlinked challenges. We also recognise that much is already happening, with success stories across the sector that are often not fully promoted.

There is an increased need by organisations and individuals to continue to generate, drive forward, and implement innovations at greater pace including; technological, products, processes, behavioural, procurement or commercially focused changes.

Some specific next steps and recommendations based on the content of this White Paper are proposed overleaf. These are speculative at this stage and should be determined following a period of engagement with RIA members and key industry stakeholders recognising, as with safety improvement, that this will be an evolving and continuous journey of improvement.

FINDING	RECOMMENDATION	OUTCOME	OWNER
Perceived barriers to large-impact, Disruptive Innovation within Scotland's railway industry are identified as procurement (including programme funding) and leadership behaviours, including collaboration and supplier engagement.	Survey/engagement to understand if procurement approaches, and funding constraints are resulting in short-term thinking with a negative impact on an environment to drive innovation.	To continue measurement/ monitoring stakeholder perceptions on innovation, and demonstrate continued improvement.	RIA Scotland Innovation Working Group.
Innovation In Scotland's Railway should focus on driving efficiencies and create greater passenger value, with emphasis currently dominated by efficiency.	Devise a method to demonstrate innovation against key criteria; Efficiency, Increasing Passenger or Freight Revenue, Sustainability Examples might be a simple framework – e.g., Scotland's Railway Innovation "accreditation", where Innovation is demonstrable against key criteria. This could be supported using standards such as ISO 56000, a management standard needs of system innovators, e.g., to stimulate innovation, as a minimum each contract should have it's own innovation policy and approach (e.g., project specific charter).	To stimulate, measure and promote Innovation.	RIA Scotland Innovation Working Group.
A perceived lack of basic research, possibly owing to the profile of the respondents, with most being Suppliers (see Figure 3).	Devise a collaborative forum for Innovation. For example, the establishment of an industry wide Innovation Hub.	A collaborative environment for customer client, supply chain, and academic representatives and the next generation of industry (e.g., STEM engagement).	All stakeholder organisations.

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APPENDIX A: CASE STUDIES OF INNOVATION IN SCOTLAND'S RAIL INDUSTRY

As part of the survey, respondents were asked if they would like to share case studies of innovations from the sector. Several case studies were received, mainly focusing on technology and process efficiencies and are summarised in this Appendix A.

Note: Case studies have been adapted by the RIA Scotland Innovation team for conciseness from material supplied by the relevant organisation or from web sources. Any errors which may have been introduced are unintentional.

Case Study 1: Digitised process innovation to reduce time for train carriage refurbishment

Project description: In 2019, the Pendolino fleet underwent the largest fleet refurbishment in the UK, with 574 cars of the 20-year-old Pendolino™ fleet being modernised to return the mid-life fleet to an 'as new' condition.

Why is this innovative?
By teams taking strong ownership of 'their' vehicles (a defined set), they developed a fully digitised manufacturing execution system that encompassed logistics, parts records, testing and commissioning, and a full suite of return to service documents.

Who does it benefit?
Train operating companies benefitted from a quicker turnaround of refurbishments and the inclusion of technical upgrades such as seat occupancy systems, passenger counting, and remote access to CCTV.

Outcome: Car trains refurbished in 2 weeks utilising a fully digitised manufacturing execution system resulting in continuity of passenger service and zero defects at entry into service with the following:

- 5,500 refurbished 1st class seats
- 25,500 new standard class seats (2000+ extra seats added to the fleet)
- Additional wheelchairs space
- Additional luggage space in standard class
- Over 11 km of new interior carpets using sustainable British wool
- New on-board shop
- New tables with USB power points and wireless phone charging

RIA Scotland Innovation team comment:
This used the team's strong knowledge of the issues and created a digital system to improve what is done now through this Sustaining innovation approach. The activities performed on the vehicle remained the same however the way in which they were planned was made faster and more efficient.

Case Study 2: AI for project management

Project description: Traditional project management processes were proving inadequate in consistently delivering projects to planned budgets and timescales for a global logistics company and were looking for an AI-driven platform to:

- Accurately predict project outcomes to proactively identify projects at risk and areas for improvement
- Reduce budget overrun risk across the portfolio by identifying project features driving delay and pinpointing transformational priorities
- Elevate project data maturity by empowering teams with actionable insights and fostering a culture of data-driven decision-making and accountability

Why is this innovative? By combining advanced analytics and machine learning, Intelligent Project Prediction (IPP) was created to calculate project outcomes, with the aim of enabling better risk focus, improve decision-making, and enhance project management maturity.

Who does it benefit? This use of AI has made a demonstrable difference to effective project delivery in two specific areas: the quality of the data and the ability to manage budgets and prevent overspend, benefitting the client; and building confidence in the robustness and value of AI which has also demonstrated a reduction in failures and wastage, making a positive contribution to sustainability.

Outcomes:
Accuracy: Achieved 96% accuracy rate in predicting project outcomes, revolutionising planning, risk management, and decision-making processes.
Cost-Efficiency: Identified opportunities to optimise costs, potentially saving 18% of the portfolio budget by streamlining project delivery and resource allocation.
Enhanced Data Maturity: Experienced a significant increase in project data quality (22-91%), empowering teams with actionable insights and fostering a culture of continuous improvement.
Operational Efficiency: Enabled the organisation to streamline operations, optimise resource utilisation, and deliver projects more efficiently, contributing to economic growth and competitiveness.

greyfly.ai

RIA Scotland Innovation team comment: ***This Breakthrough innovation used techniques and processes from the relatively fields of ML and advanced analytics to address a known issue.***

Case study 3: Product innovation for vegetation clearance

Project description: Maintaining extensive vegetation along railway corridors is challenging and can pose risks to safety, operational efficiency, and reliability. Traditional methods of vegetation clearance, such as manual cutting or using ground-based machinery, are time-consuming, labour-intensive, and often require line closures. This has led to increased operational costs, safety concerns for workers, and potential disruptions to railway services. RSSI/Tiger Aviation have implemented an aerial saw technique for vegetation management. Mounted on a helicopter, this approach allows the aerial saw to reach difficult areas that ground-based crews would struggle to access.

Why is this innovative?
RSSI/Tiger Aviation are the first established operation in the UK who have been risk assessed to the satisfaction of the Civil Aviation Authority (CAA), which issues specific approvals for any work. This method significantly boosts the efficiency of vegetation management by covering large areas in a fraction of the time required by traditional methods.

Who does it benefit? This approach has led to a reduction in operational disruptions, ensuring more consistent railway operations. The CAA monitors and audits all operations, ensuring the highest levels of safety for operatives. Cost savings are seen through reductions in both labour and equipment expenses.

Outcome: The aerial saw solution has shown improvements in both efficiency and cost-effectiveness. As highlighted in a recent demonstration by RSSI and Tiger Aviation at Severn Valley Railway, the aerial saw demonstrated its cutting power and speed, clearing large expanses of overgrown vegetation in record time, clearing between 1 and 3 miles of vegetation in a single day in comparison to ground-based crews who could take up to a week to complete.

RSS INFRASTRUCTURE WITH TIGER AVIATION

RIA Scotland Innovation team comment: ***This Disruptive innovation approach is a significant change in the way that vegetation is managed using techniques used in other industries and is an example of doing things differently to solve a known problem.***

Case Study 4: Product innovation for passenger accessibility

Project description: WayMap has been developed as an app to deliver accessible navigation for everyone, whether indoors, outdoors or underground. Using step-based location technology, it aims to make every city in the world more accessible for everyone. WayMap is being tested at Birmingham New Street and Shepherd's Bush railway stations.

Outcome: Empowering users, particularly those with impaired mobility to travel more confidently.

Why is this innovative? WayMap's app is powered by AI-based positioning algorithms that remove the need for GPS, BlueTooth, WiFi and Mobile Data, alleviating the issue where mapbased apps only work intermittently, dependent on coverage.

WayMap works as a sophisticated pedometer, using motion sensors to establish which way the body is facing, and as a barometer to work out, for example, if the user has moved up or down a floor in a shopping centre. Its SmartStep algorithm is updated 100 times per second.

Who does it benefit? All transport users but especially those with visual impairments.

Outcomes: Empowering users, particularly those with impaired mobility to travel more confidently, resulting in increased fare revenues.

waymap

RIA Scotland Innovation team comment:
This solution is an example of Disruptive innovation to the industry model as it puts the ability to move through the station into the users hand rather than needing a person from the station team.

Case Study 5: Technology innovation through digital twins

Project description: Carstairs is a key rail junction that divides northbound trains between Glasgow and Edinburgh to London. The 50-year-old Scottish junction was remodelled to eliminate speed restrictions, accelerating and improving passenger journeys and rail performance.

Why is this innovative? Through the installation of new tracks to accommodate services without the need for a specific stop at Carstairs Station, it was possible to eliminate the need for non-stopping traffic to slow down. By upgrading the overhead line electrification (OLE) infrastructure through the junction, newer, more efficient train stock that emit 30% less carbon than current trains could be used

Who does it benefit? Taxpayers through reduced costs, staff by enabling digital modelling rather than trackside works.

Outcome: Improved communication among team members, detected and resolved clashes earlier reducing design time by 35%, and saved £50 million. Additional elements include improved signalling and upgrades to Carstairs Station itself to enhance the experience for arriving and departing passengers.

The most critical element of the package was that construction would only last 88 days with varying levels of rail closures to minimise the impact on rail traffic to a minimum.

RIA Scotland Innovation team comment:
The greater use of digital twins is a Breakthrough innovation allowing a known problem to be solved using new technology which enabled multiple parties to work together.

Case Study 6: Technology innovation through an improved communications network

Project description: Through its collaboration with ScotRail, supported by Scottish Futures Trust and the Scottish Government, Clarus is equipping Class 158 trains on Scotland's Far North Line with low-earth orbit satellite connectivity provided by Starlink to address long-standing communication challenges in the Scottish Highlands.

Beyond passenger services, Clarus is deploying Starlink terminals on measurement trains and enhancing trackside infrastructure, delivering precise, real-time data for diagnostics and remote monitoring. This comprehensive approach supports safer and more efficient rail operations across the UK by providing reliable connectivity even in hard-to-reach areas.

The Starlink platform, a proven satellite solution, is the first in the UK to gain safety approval from rail regulators. Working with ScotRail and Clarus, Starlink specifically adapted their terminals to meet the demands posed by the climate of the Scottish Highlands. Other solutions will be trialled as they become available.

Why is this innovative? With a constellation of satellites orbiting Earth at approximately 550 km, Starlink delivers low latency (~40 ms) and download speeds up to 220 Mbps, ideal for in-motion connectivity.

Who does it benefit? Supporting mission-critical applications such as live video feeds, infrastructure monitoring, and real-time vehicle condition data (RCM), Starlink connectivity on trains can enhance both safety and operational efficiency.

Outcome: This service supports:

- dynamic passenger information systems
- precise train tracking
- Reliable internet

enhancing the travel experience with uninterrupted streaming, video conferencing, and access to cloud services.

RIA Scotland Innovation team comment:
The team have developed a Disruptive innovation which changes the way that the industry currently works moving away from ground based solutions to a satellite approach.

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Get involved

To provide feedback on the report, please get in touch with Bob Docherty by emailing bob.docherty@riagb.org.uk.

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