Rail Technical Strategy

Innovating across Britain's railway

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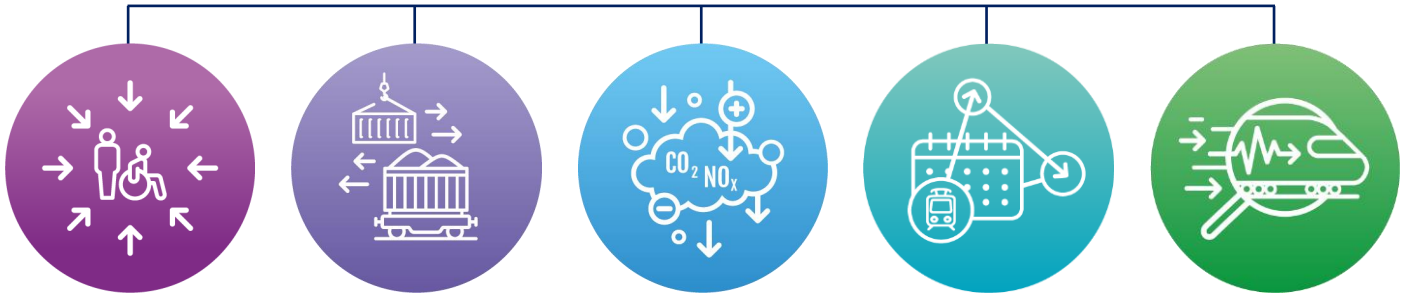

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DESIRED OUTCOMES

1. Progress towards industry's strategic aims
2. Steer research funding and initiatives
3. Inform long-term investment
4. Empower supply chain to deliver
5. Foster collaboration and share successes

Rail Technical Strategy

Innovating across Britain's railway

FOREWORD

Professor Paul Plummer

There is a broad consensus about key elements of reform needed for the railway including the need for a new guiding mind to establish an overarching strategy which enables consistent and joined-up plans for the whole railway. The Rail Technical Strategy will help to underpin that overarching strategy by aligning with desired outcomes and providing a clear steer to all those involved about the key areas where collaboration and innovation are most needed.

The RTS has evolved over nearly two decades. We've seen it become increasingly "owned" by industry as an enabler for change. The broad approach has been consistent and each evolution has built on strengths while also making improvements or adapting to the changing environment. Covid has accelerated changes in travel patterns and changed our perspective on safety. The importance of freight was always implicit but being more explicit about this will help enable a customer-focused and freight-friendly railway. The need for improved efficiency has also been ever-present but giving this more direct emphasis will also be helpful. The urgent need for climate action and growing inequality makes it ever more critical for rail to play its part in enabling as well as adapting to environmental and social change.

I've been pleased to be able to support the evolution of the RTS from my previous positions in industry and now from academia. The UK Rail Research and Innovation Network (UKRRIN) was designed to create powerful collaboration between academia and industry to provide a step change in innovation and accelerate new technologies to market. As such it illustrates the sort of collaboration that will be needed to respond to challenges and opportunities set out in the RTS.

Professor Paul Plummer
Lead for UK Rail Research and Innovation Network (UKRRIN).

Rail Technical Strategy

Innovating across Britain's railway

Darren Caplan

FOREWORD

The UK created the railways two centuries ago. Over that time, the UK rail industry has been at the forefront of innovation, delivering new technologies which have improved both connectivity and mobility for both passengers and freight for the benefit of the economy and society both nationally and regionally.

A positive outlook lies ahead for the global rail market with European rail supplier body UNIFE forecasting growth of 3% a year until the end of the decade fuelled by the prospect of 10,000 future rail project orders including greenfield investments, replacements and modernisation projects.

What's more, key global macroeconomic trends such as urbanisation, digitalisation and sustainability are driving demand for transport which, in turn, enhances the competitiveness of rail not least because of its low carbon credentials.

UK suppliers are well placed to capitalise on this upward trajectory given the growth in the export of rail-related goods and services across the world in recent years particularly in regions such as the Middle East and Australia. That reflects positively on the strength and depth of the UK's domestic market as well as the future potential for leveraging this internationally.

This Rail Technical Strategy provides a strong foundation for achieving these objectives. For the UK rail supply community, the Strategy provides a clear steer for our future direction. Alongside the UK Rail Research and Innovation Network, Network Rail's R&D Portfolio, the work of HS2 and TfL and organisations like RDG and RSSB, the Rail Technical Strategy can help support suppliers in delivering innovative new products and services and producing more value from the UK's £40 billion plus railway industry. I would urge all, whatever the size or discipline of your organisation, to engage with this important work.

Significant challenges, of course, lie ahead for the industry but UK rail is well-placed and ready to meet them. What's more, the opportunities from the Strategy are also considerable – a rail sector that is able to meet these challenges through innovation will not only provide greater benefits to rail users, it will be able to use these new technologies to export more around the globe, generate more investment and jobs, and attract even more talented individuals to join the sector.

And the UK will maintain its longstanding tradition of a cutting-edge, world-leading rail industry, building on our historic railway heritage.

Darren Caplan
Chief Executive, Railway Industry Association

October 2024

Rail Technical Strategy

Innovating across Britain's railway

FOREWORD

Mark Phillips

I'm delighted to endorse this refresh of the Rail Technical Strategy (RTS). This practical yet ambitious strategy sets out a path to a sustainable, efficient, and even safer future. By gaining industry agreement on the technical opportunities to drive progress against these priorities, the RTS complements the Sustainable Rail Blueprint and the recently updated Rail Health and Safety Strategy.

Since its 2020 release, the RTS has been a living strategy that reflects the latest initiatives to help organisations coordinate their technical developments. This full refresh, including a greater focus on freight, was needed to keep it relevant and valuable. I'm proud of RSSB's leading role in engaging right across the industry to make this happen.

RTS helps steer RSSB Research Programme towards agreed areas, confident that industry will see its value and take up the findings. It also fosters collaboration, providing a channel through which we can understand what technical developments other organisations are working on. This helps coordination and avoids duplication.

Standards – a major part of RSSB's role – are essential to technical development. Innovations often need a framework for safe and efficient adoption, which good standards provide. RSSB will continue to work with industry to create the evidence-based standards required to achieve the RTS goals.

RSSB's world-leading expertise in safety and risk is again essential in progressing towards the RTS vision. The introduction of new technical solutions needs to be underpinned by a sound understanding of how they affect overall risk. This is essential to successful innovation. And this is why we are working on further enhancing our risk modelling capabilities.

The RTS matters to everyone. Delivering against the technical challenges and opportunities it sets out will be good for passengers, freight customers, and the nation. I know that your energy and commitment will help to make it real.

Mark Phillips
Chief Executive Officer, RSSB

May 2024

About the RTS

Why do we need a Rail Technical Strategy?

The RTS sets a clear direction for the uptake of existing solutions and the development of new ones that are essential for industry to deliver value to its customers.

Since the 2012 version, the RTS has been valuable in aligning thinking and action in the GB rail network, and globally promoting the UK's rail expertise and approach to driving innovation.

The direction set in the RTS is informs the investment pipeline within industry organisations. Senior budget holders in infrastructure managers, vehicle owners, train and freight operators and OEMs have better visibility of the direction of travel when it comes to the technical needs and opportunities that the railway has.

The RTS is important to guide the prioritisation of existing dedicated research and innovation funds that the railway has and facilitate their coordination, including the establishment of easy pathways for progression through the Rail Industry Readiness Levels. It also allows the rail industry to influence and make the best of the R&D spending that exists beyond rail and the transport sector, which could have applicability to the challenges rail faces.

What is this current version aiming to achieve?

In order to maintain interest and achieve greater buy-in for rapid and coordinated technical progress, the current RTS has been developed with the following principles in mind:

More focused, with clarity on the agreed key problems, opportunities and solutions that need industry attention, rather than attempting to create a fully comprehensive plan

More compelling, in particular, setting out the steps needed in the short term, in the context of the longer-term vision

Less R&D centric, acknowledging that research and development is only part of any successful technical strategy, and therefore putting equal emphasis on the challenges and opportunity around successful deployment and adoption

This is a living, interactive strategy which, thanks to ongoing contributions from across the industry, becomes richer over time, captures and shares progress, and evolves to support industry needs and aspirations.

About the RTS

RTS Lead Authors

This edition of the RTS was authored by a core working group comprising representatives from RSSB, Network Rail, academic and industrial members of UKRRIN, and the Rail Delivery Group.

Governance and other key contributors

The strategy was developed collaboratively with key input and review provided by the Rail Industry Association, Rail Freight Group and Rail Partners.

Steering has been provided by the Technology Leadership Group who will continue to sponsor and promote delivery of the strategy.

Review, support and engagement

Over 100 organisations and more than 30 prominent cross-industry groups have engaged with the ongoing development of the functional priorities.

Anyone in the rail industry is welcome to contribute to its future development.

You can get in touch with the RTS Engine Room at rts@rssb.co.uk

Rail Technical Strategy

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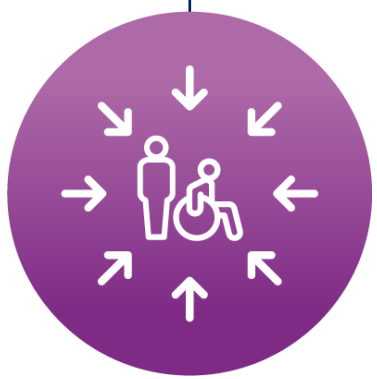
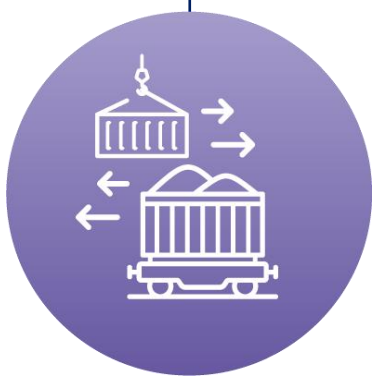
FUNCTIONAL **PRIORITIES**

The five functional priorities are industry agreed focus areas where new technical solutions are critical.
This document sets out key goals within the priorities, with a rationale and 2040 vision for each.
A more detailed 'routemap' describing stepping stones needed in the next five to eight years along with additional information and progress reporting, can be explored on the RTS website: www.railtechnicalstrategy.co.uk/rts-viewer



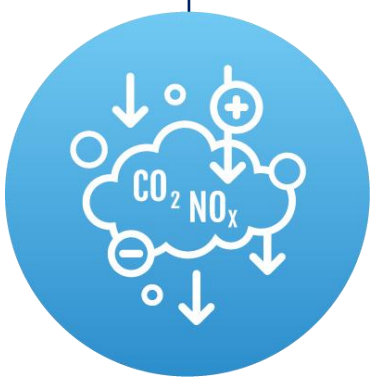
EASY TO USE FOR ALL

Empower customers to travel with confidence through reliable real-time information, intuitive payment systems, and accessible design.



FREIGHT FRIENDLY

Freight growth on the rail network will be enabled through better use of existing and new capabilities of freight assets, and improved whole system thinking with freight at its heart.



LOW EMISSIONS

Carbon and air emissions will be minimised by cheaper and less disruptive electrification, zero-carbon diesel replacement, greater efficiency and removing emissions at source.

OPTIMISED TRAIN OPERATIONS

Train services will be reliable and the capacity of the network improved by real-time management, better train planning and simulation, and shorter headways, together with new solutions at nodes.

EFFICIENT AND RELIABLE ASSETS

Reliability and availability of assets will be maximised by design, remote and automatic inspection, and targeted interventions, while whole-life cost is reduced.

Easy to use for all

Rail will deliver inclusive and innovative technological solutions empowering customers to travel with confidence through reliable real-time information, intuitive payment systems, and accessible design.

The rail industry is continuing to improve customer experience to reflect how people live and travel today. As the industry moves towards the creation of Great British Railways, we are working closely with Government to accelerate progress, and we remain committed to enhancing the overall customer experience.

Key goals

- Accurate, accessible and understandable real-time information
- Smart fare collection
- Accessible to all
- Multi-modal integrated journeys
- Reliable and fast on-board connectivity

Jacqueline Starr
Executive Chair & CEO
Rail Delivery Group

"Making rail easy to use for everyone isn't just a technical challenge – it's a commitment to inclusion, innovation and trust. We must embed customer needs at the heart of every technical solution. Innovation must serve inclusivity, simplicity, and confidence."

Easy to use for all

Jacqueline Starr
Executive Chair & CEO
Rail Delivery Group

Making rail easy to use for everyone isn't just a technical challenge—it's a commitment to inclusion, innovation, and trust.

To make rail truly easy to use for all, we must embed passenger needs at the heart of every technical solution. Innovation must serve inclusivity, simplicity, and confidence.

For the railway to thrive, every interaction—from planning and buying a ticket to boarding and receiving updates—must feel instinctive and accessible. This means simpler retail, smarter payment options, and real-time information that customers can trust.

Accessibility must be designed in from the start, ensuring digital tools work with assistive technologies and stations offer clear signage, step-free routes, and reliable support. Accessibility is not a compliance exercise; it's how we unlock independence and confidence.

Being easy to use also means joined-up journeys. Rail should connect naturally with other modes, supported by open standards and consistent design so the system feels familiar wherever you travel.

None of this works without trust. We will protect privacy, keep safety at the forefront, and ensure technology enhances—not replaces—the human touch. Our colleagues remain central to welcoming and reassuring passengers.

The goal is simple: a railway that works first time, every time, for everyone. By putting people first and letting innovation serve that purpose, we will deliver a railway that is genuinely easy to use for all.

FUNCTIONAL PRIORITIES

Explore the stepping stones towards each goal and relevant information including progress at:
www.railtechnicalstrategy.co.uk/easy-to-use-for-all/

EASY TO USE FOR ALL

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Innovating across Britain's railway

Goals	Why?	Vision for 2040
Accurate, accessible and understandable real-time information	Customers need to feel confident and in control, it's essential that travel is seamless and options are clear—especially during disruption. This reduces stress and builds trust in the system.	Real-time information is accurate, consistent, personalised and highly targeted based on customers' specific journey and personal needs.
Smart fare collection	For rail to be attractive it is key that passengers can easily buy rail tickets as part of their travelling options and door-to-door journey.	Buying door-to-door journeys, either in advance bookings mode or 'get up and go' is the norm, and rail always appears as an option when appropriate, with the best fare being charged.
Accessible to all	Reducing exclusionary barriers throughout the railway enable more people to travel, and to travel independently.	The level of customised support, convenience and inclusivity delivered by rail improves the travel experience for all and rivals other modes.
Multi-modal integrated journeys	In a fast-changing transport landscape it is key to make rail travel more convenient and less stressful for customers as part of their multi-modal journey. This includes being able to see information across modes for a journey and joined-up support.	Rail plays a key role in the provision of door-to-door, not just point-to-point transportation as part of an integrated, accessible multi-modal system which is easily navigable by customers.
Reliable and fast on-board connectivity	Customers expect to be always connected if they so choose.	Passengers can expect to remain seamlessly connected to a network to work online, access the internet, or make a call throughout their whole journey.

Freight friendly

Freight growth on the rail network will be enabled through better use of existing and new capabilities of freight assets, and improved whole system thinking with freight at its heart.

Rail freight makes a major contribution to the UK economy, providing an efficient and green way of moving goods around the country and alleviating congestion on the roads. Rail freight is already contributing £2.45bn to the UK economy. Meeting the long-term rail freight growth target of at least 75% by 2050 will deliver even greater economic and environmental benefits.

Key goals

- Increased network access for freight
- Safer freight operations and better asset management
- Enable greater intermodality and access for freight customers
- Greater asset utilisation and reduced freight journey times
- Low carbon freight and on-track machines

Maggie Simpson
Director General
Rail Freight Group

"The opportunity for rail freight has never been greater, with customers looking to move more by rail to reduce their carbon footprints, and government setting ambitious targets for growth. The focus on freight in the 2024 update of the RTS is therefore both timely and welcome."

Freight friendly

Maggie Simpson
Director General
Rail Freight Group

The new specific focus on freight within the Rail Technical Strategy (RTS) highlights the critical role that rail has in supporting the UK's supply chain network. Rail freight provides the most efficient, safe, and green way of transporting goods across the country, and its economic, environmental, and societal benefits are significant.

In 2023, the government announced a long-term rail freight growth target of at least 75% by 2050, providing confidence to those wanting to move goods by rail. Realising this and delivering a shift from road to rail will also support the government's 2050 net-zero policy. To drive this growth and to seize the opportunity before us, we need to address the challenges that the rail freight sector faces today.

Innovation is pivotal and will ensure we are advancing alongside other transport modes, to maintain and further enhance our competitiveness. We need to not only develop and improve what exists today, but embrace new ideas about wagons, terminals, and systems of the future. The goals and technical stepping stones identified in the RTS will open opportunities for Network Rail, Freight Operating Companies and End Users to do exactly this. And this is why I am delighted to be Sponsor for this RTS priority.

- So, what are some of these opportunities?
- Greater use of data, together with better and integrated systems, to allow for dynamic interrogation of the best options for moving goods from one point to another, reducing carbon and improving outcomes for customers.
- More dynamic and efficient paths to allow rail to compete effectively with road, and assets to be cycled more productively.
- New solutions to continue to digitise rail freight locomotives and wagons, enhancing safety, increasing reliability, and bringing cost savings.
- Better understanding of asset condition to ensuring timely interventions and minimal timetable disruption. This will become increasingly important with higher traffic volumes and increasing weather events, alongside the need to safeguard critical routes.
- Being innovative, dynamic and data driven in the service offering to attract those new to rail and break down the barriers they are experiencing.

Technology is critical to modernise, boost efficiencies, reduce costs, and further support an integrated supply chain. The rail freight sector needs to be on the front foot of this transformation. The direction and focus that this RTS priority gives to all freight stakeholders in working together towards a truly 'freight friendly' railway is essential to a successful transformation that makes rail the mode of choice for new and existing customers.

FUNCTIONAL PRIORITIES

Explore the stepping stones towards each goal and relevant information including progress at:
www.railtechnicalstrategy.co.uk/freight-friendly/

EASY TO USE FOR ALL | **FREIGHT FRIENDLY** | LOW EMISSIONS | OPTIMISED TRAIN OPERATIONS | EFFICIENT AND RELIABLE ASSETS

Rail Technical Strategy
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Goals	Why?	Vision for 2040
Increased network access for freight	The GB network is one of the most restrictive in the world due to its historic nature and legacy infrastructure. Easy and predictable access for heavier, longer, and larger freight trains is key to maintain and grow freight traffic. It also improves the efficiency of freight operations.	Compliant routes and pathing options for freight journeys are automatically determined and are responsive to freight needs. All key routes for Heavy Axle Weight traffic are maintained and do not require special dispensation access rights. The introduction of new locomotives, wagons, and wagon / box combinations is efficient and streamlined.
Safer freight operations and better asset management	Better monitoring of freight assets allows failure prediction and timely proactive timely intervention. This can significantly reduce unplanned maintenance and incidents on the network, including derailment risk.	Sudden asset failures and associated incidents on the network are regularly and successful prevented. Yards are significantly safer with workforce exposure to risk minimised.
Enable greater intermodality and access for freight customers	Rail freight is perceived as a difficult mode to start using by new customers. Growth opportunities can also be challenging for existing customers.	Existing and potential freight customers see rail as an attractive mode. Deployment of new connections to off-network locations is dynamic to customer demand and lower cost.
Greater asset utilisation and reduced freight journey times	Freight travels at lower average and maximum speeds than passenger services. This difference causes freight trains to be signalled into lineside loops or regulated at a junctions. Understanding the value of higher freight speeds and ways to increase these, is key to improving the attractiveness of rail and the utilisation of freight assets.	Full use of technical capabilities of freight trains combined with mechanisms to recognise the value of freight journeys results in significantly reduced journey times, and easier and better freight pathing.
Low carbon freight and on-track machines	There is currently no viable alternative to electrification or (bio)diesel to deliver the power necessary for the full range of freight journeys on the GB network. Electric traction offers capacity and operational benefits over diesel. Without action, rail freight risks being less favoured than other modes as they continue to decarbonise. This could cause long-term congestion and economic disbenefit if a lower proportion of freight is moved by rail.	There is a clear role and relevance for rail as part of an overall net-zero logistics chain.

Low emissions

Rail Technical Strategy

Modal shift from road and air travel to rail, combined with actions to lower rail emissions, can make a substantial contribution to tackling climate change and air pollution. Rail emissions will be reduced by new – full and partial – efficient electrification, zero and low carbon vehicles, and a whole-system, whole-life approach to managing carbon.

Critically, the new goal of Intelligent Energy Management of traction power has an important role to play in helping getting the right amount of power to the right places, at the right time.

Key goals

- Efficient new electrification
- Zero carbon self-powered vehicles
- Low carbon freight and on-track machines
- Intelligent energy management
- Cleaner air
- Quieter railway
- Lowering embodied carbon of key material

Malcolm Brown
CEO, Angel Trains

"The Low Emissions updated routemap offers greater depth of thinking on where and how technical development can unlock the changes required. Let's continue to use it to make progress happen."

Low emissions

Malcolm Brown
CEO, Angel Trains

Rail is responsible for a small proportion of the large quantity of emissions which transport generates. This is why modal shift from road and air travel to rail, combined with actions to lower rail emissions, are so important. This combination can make a substantial contribution to tackling two of the most urgent and significant threats we face.

Since I endorsed the previous edition of the Rail Technical Strategy (RTS), concerted, joined-up efforts across the industry have allowed progress to be made. The introduction of battery-hybrid trains into regular passenger service by Transport for Wales, and the robust guidance based on RSSB research now available for operators to produce Air Quality Improvement Plans are two exemplars, showing what is possible with the right strategic stimulus.

In my role as Chair of the Sustainable Rail Executive, I am extremely pleased with the complementary value of the RTS and the Sustainable Rail Blueprint (SRB). The SRB provides a framework to drive the transformation agenda, while the RTS offers greater depth of thinking on where and how technical development can unlock the change required.

The Low Emissions functional priority in this refreshed RTS builds on the 2020 one, but critically introduces the concept of Intelligent Energy Management. As rail consumption of electric power increases, the need to balance supply and demand becomes ever more critical and challenging. Traction power remains the major and most bespoke component of rail's electricity demand. In this context, intelligent management of traction power has an important role to play in helping both rail and the grid getting the right amount of power to the right places, at the right time.

The seven renewed key goals in the Low Emissions routemap include one in common with the new Freight Friendly priority. This 'shared' goal recognises the urgency to decarbonise the rail freight sector. And it is great to see how the other goals in the Freight Friendly priority are all geared toward freight growth and modal shift which is key for low emissions logistics.

Let's work together to ensure we stride smoothly, safely and rapidly across the stepping stones to the strategic visions for Low Emissions.

FUNCTIONAL PRIORITIES

Explore the stepping stones towards each goal and relevant information including progress at:
www.railtechnicalstrategy.co.uk/low-emissions/

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Goals	Why?	Vision for 2040
Efficient new electrification	Combined with modal shift, further electrification of the rail network is a fundamental step towards achieving the UK's 2050 net-zero target. Future electrification – whether full or partial - must be affordable, deliver operational resilience, and cater for smart interactions with trains.	Progress towards a net-zero railway by 2050 is well underway. [Also relevant to goals 2, 3, 4 and 7.] High-speed and high-intensity lines are electrified with high capacity, energy efficient systems that represent value for money. Battery and multi-mode trains, supported by partial electrification, operate successfully and efficiently on the network.
Zero carbon self-powered vehicles	Battery and multi-mode operations can deliver the requirements of passenger trains on lower-speed, lower intensity routes. As batteries and the associated charging infrastructure continue to improve, there is an opportunity to make the most of these developments.	
Low carbon freight and on-track machines	There is currently no viable alternative to electrification or (bio)diesel to deliver the power necessary for the full range of freight journeys on the GB network. Electric traction offers capacity and operational benefits over diesel. Without action, rail freight risks being less favoured than other modes as they continue to decarbonise. This could cause long-term congestion and economic disbenefit if a lower proportion of freight is moved by rail. [This goal also appears in the Freight Friendly priority.]	There is a clear role and relevance for rail as part of an overall net-zero logistics chain.
Intelligent energy management	Existing electrified lines face an increasing demand for power from electric and multi-mode services. Better understanding of real-time power demand and capacity, coupled with a strategy for alleviating constraints and reducing energy losses, is crucial to a low-emission railway.	Network traction power constraints are actively managed, with plans in place to remediate. Traction energy consumption is minimised. Demand for electrical power is managed dynamically to make the most of available capacity.
Cleaner air	Air quality is the most pressing environmental health risk in the UK, generating the urgent need to mitigate harmful pollutants from rail.	Air pollutants and noise from rail operations are minimised to protect the health and wellbeing of the workforce, customers, and local communities.
Quieter railway	The growth of housing in rail proximity, and demand for services to run for longer hours, make the noise pollution generated by rail increasingly unacceptable.	
Lowering embodied carbon of key material	Key materials, such as steel and concrete, which make up the fabric of the railway, have high levels of embodied carbon. As a significant purchaser, rail has a role to play in driving the reduction of embodied carbon.	The embodied carbon of rail assets is well understood and continues to be driven down.

Optimised train operations

Rail Technical Strategy

Highly reliable train services and greater network capacity will be achieved through flexible and robust train planning and simpler and safer real-time operations. These are underpinned by a strategic approach to improving signalling and train capabilities.

Delivering a reliable railway able to recovery safety and quickly when incidents and disruptions occur is key to retaining and attracting new passenger and freight customers. This is why 'improved recovery from incidents and disruptions' is one of the five goals.

Key goals

- Infrastructure and train capabilities to overcome capacity constraints
- Simpler and safer real-time operations and decisions
- Improved recovery from incidents and disruptions
- Reliable and flexible train planning
- More affordable solutions for rail

David Horne
Managing Director
LNER

"The Rail Technical Strategy is crucial to leveraging the technologies and innovations we need to deliver an efficient, reliable, and sustainable railway for our customers."

Optimised train operations

David Horne
Managing Director
LNER

The Rail Technical Strategy (RTS) provides a framework to steer and accelerate change in how the railway operates. It sets out clear goals and stepping stones to improve our services today and successfully adopt the technologies we need for future train operations.

Since the last iteration of the RTS, the railway landscape has changed considerably. The scaling back of some major infrastructure projects has brought the capacity challenge into sharp focus. Hence, the need to ensure reliable and flexible train planning that maximises the capacity available is as pressing as ever. And this goes hand in hand with the need to find ways to make best use of and future train and infrastructure capabilities.

Good, safe, and timely operational decisions on a busy mixed traffic network will increasingly rely on using all available information to keep customers moving. Trains and infrastructure are being fitted with systems that can improve the flow of information between staff, track and train. To deliver maximum value and simplify operations, the wider deployment of these systems needs to be co-ordinated.

It is essential to recognise the affordability challenge that the industry faces. So, an important test for any new solution, with its associated capital investment, should be about whether it helps to simplify operations. Another important test should be whether the solution has been driven by, and tested against a clear set of operational requirements.

Over the past 200 years, operation of the railway has continually evolved as new knowledge and technology has become available. Together with the other four priorities and the critical enablers, the refreshed Optimised Train Operations routemap will help channel effort and underpin delivery of the railway we need for our customers.

FUNCTIONAL PRIORITIES

Explore the stepping stones towards each goal and relevant information including progress at:
www.railtechnicalstrategy.co.uk/optimised-train-operations/

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Goals	Why?	Vision for 2040
Infrastructure and train capabilities to overcome capacity constraints	There is a need to cater for reliable high-capacity services in those parts of the network that are full either because of headway lengths or bottlenecks at nodes. And in progressing the roll out of digital signalling, there is the opportunity to extract early value from this investment.	Capacity constrains have been overcome in effective and efficient ways.
Simpler and safer real-time operations and decisions	A railway simpler to operate enables better and safer service delivery at lower costs. Solutions to improve operational tasks and decisions exists and offer short-term opportunities. The migration to new solutions, including digital signalling, must not add complexity and risks, and strive to deliver early benefits.	Operational tasks and decisions are optimised and automated through technology that makes the rail system easier to operate with customers at its core.
Improved recovery from incidents and disruptions	The ability of Control and front-line staff to safely, effectively and quickly manage and recover from incidents and disruptive events is critical to limiting disruption to customers. This requires a combination of new technologies and changes in current processes.	Rapid recovery from disruptions that minimise the adverse effects on railway customers is routinely achieved.
Reliable and flexible train planning	Timetabling plays an essential role in making the most of existing network capabilities and deliver a reliable railway. Having easier, agile and robust ways to change and add train paths allows to respond to changes in network availability, and passengers and freights demand.	Underpinned by greater automation and better use of data, train planning optimises the use of the network in a flexible and reliable way.
More affordable solutions for rail	The long-term viability of rail lines with low traffic is at risk. Ensuring future economic sustainability requires reducing both capital and operational costs, while offering safe, reliable service.	Lower-use lines are affordable to serve their societal and feeder function to the main network.

Efficient and reliable assets

Rail Technical Strategy

Rail assets will be more reliable and have lower whole-life costs, thanks to right time insights, efficient maintenance, improved resilience to a changing climate, speedier introduction of innovations, and better management of obsolescence.

Both start and end of life are critical to asset reliability and value. This is why two new goals feature in this priority. One aims to speed up and derisk the introduction of assets, and the other aims to help tackle growing and changing obsolescence challenges.

Key goals

- "Right-time" actionable insights
- Efficient, effective and safe maintenance, including renewals and overhauls
- Improved resilience to climate change and extreme weather events
- Speed up and de-risk introduction of assets
- Proactive management of asset obsolescence for safe & efficient operations

Martin Jones
Chief Engineer
Network Rail

Clive Burrows
Group Engineering Director
FirstGroup plc

"The RTS sets out a plan for development and application of technology solutions that will help the thousands of passionate and dedicated people across our industry deliver a resilient railway, fit for the future, that exceeds the expectations of our customers."

"There are plenty of technologies that we can exploit to unlock more efficient and reliable service for our customers. The challenge is to pursue and deploy them with ingenuity to harness real value now and in the future. The RTS is essential to drive and help coordinate the efforts required from across the industry.

Efficient and reliable assets

Martin Jones
Chief Engineer
Network Rail

I'm very pleased to co-sponsor this refreshed priority alongside Clive Burrows. As the rail industry reforms to deliver closer integration between infrastructure and rolling stock this presents a new opportunity to deploy innovative ways of working that optimise whole system performance, delivering greater value for passengers, freight customers and taxpayers.

Technology will help us achieve the dual aims of enhancing our understanding of infrastructure performance and risk and improving the working conditions of everyone building, inspecting and maintaining our fixed assets. Those people are critical to achieving the Rail Technical Strategy stepping stones. This needs to be a truly collaborative effort, with people from across our industry at the centre of creation, development and testing of new ideas.

We'll deliver more reliable railway infrastructure by enhancing our understanding of asset condition, the rate of change of condition and the root causes of degradation. The RTS embeds this principle by identifying clear milestones for the introduction of more effective monitoring and measurement technology, and for converting raw condition data into knowledge and insight to help us fine tune asset management processes towards the objective of 'right asset, right intervention, right time'.

Network Rail has championed the RTS since it was first published in 2007. As Chief Engineer I'm very pleased to be able to continue this support and commitment as the RTS is updated for 2024. It's one of the key foundations for cross-industry engagement and improvement, setting a common direction for our dynamic rail sector and providing a consistent reference point as we make critical investment decisions. I look forward to working with Clive, colleagues from our industry partners, and Network Rail's regions and routes to deliver the more efficient and reliable railway our customers expect.

October 2024

Clive Burrows
Group Engineering Director
FirstGroup plc

I'm very pleased to co-sponsor this refreshed priority alongside Martin Jones.

We both welcome the direction of travel towards greater 'vertical integration' with track and train coming closer together. This makes it easier to take a whole system approach when looking at how to best achieve our common objective of delivering for customers.

Closer integration between infrastructure and rolling stock, offers a clear opportunity to gather greater and better intelligence on both fixed and mobile assets using in-service trains – allowing for more timely intervention and a reduced need for dedicated monitoring/diagnostic services.

With this increased understanding of both the current state of our assets, and their anticipated degradation profile, we can optimise interventions – striving for approaches that are less intrusive, less disruptive and significantly more cost effective without compromising safety. Resulting in more predictable, reliable service provision and lowering the cost and carbon of operating the railway.

The pressures on the UK public finance will challenge the level of capital investment available to rail over the coming years. In this context, we need to make the most of the existing network – and this is where the efficient and reliable assets, and optimised train operations priorities come together.

From a rolling stock perspective, speeding up the introduction of new assets and improving the management of digital component, from obsolescence to cyber threats, are key. New technologies, such as synthetic testing environments, are important stepping stones captured in the RTS. In addition, the strategy identifies the core role of people's skills and passion to successfully drive change and innovation through the whole life cycle.

From the first iteration of the RTS in 2007, I am proud to have championed the strategy in a variety of roles. Currently, on behalf of the operator community, as chair of both the Sustainable Rail Leadership Group, and the Vehicle/ Train Control & Communications System Interface Committee, I look forward to working with Martin and industry colleagues to drive technical progress towards a more efficient and reliable railway.

October 2024

FUNCTIONAL PRIORITIES

Explore the stepping stones towards each goal and relevant information including progress at:
www.railtechnicalstrategy.co.uk/efficient-and-reliable-assets/

EASY TO USE FOR ALL

FREIGHT FRIENDLY

LOW EMISSIONS

OPTIMISED TRAIN OPERATIONS

EFFICIENT AND RELIABLE ASSETS

Rail Technical Strategy
Innovating across Britain's railway

Goals	Why?	Vision for 2040
"Right-time" actionable insights	The timely availability of actionable insights on asset condition is key to service reliability and efficient maintenance interventions. Solutions to monitor assets continue to grow and improve. These offer great potential if full value can be extracted from affordable deployments.	The wealth of asset data captured, particularly from in-service trains, is easily accessible and used to generate valuable and actionable insights. This allows operational decisions and asset interventions that deliver a highly reliable and efficient railway.
Efficient, effective and safe maintenance, including renewals and overhauls	Only by pursuing the best mix of short, medium and long-term interventions, can maintenance be truly efficient and effective. Increased automation could improve the safety and health of the workforce and, at the same time, increase the quality and consistency of the results.	Rail maintenance has been revolutionised through the integration of cutting-edge technology, data-driven decision-making, and a culture of continuous improvement. This ensure high levels of safety, efficiency, and effectiveness for maintenance interventions.
Improved resilience to climate change and extreme weather events	Extreme weather events have a significant negative impact on both the safety and reliability of the network. With climate change increasing the frequency of extreme events, there is a need to identify, prioritise, and deploy cost-effective responses and mitigations to increase the resilience of the network and its operations.	Rail assets and operations have improved their resilience to extreme weather events and continue to adapt to climate change in a targeted and risk-driven way.
Speed up and de-risk introduction of assets	Reducing the time and resources needed for the safe introduction of new assets could deliver important benefits. With the pace of improvement of digital environments, testing and validation can evolve to cut cost and time while also derisking the introduction of innovative solutions.	New assets and novel solutions are introduced easily, in a timely way, and robustly thanks to widespread use of digital environments and value-adding full scale physical testing.
Proactive management of asset obsolescence for safe & efficient operations	In the context of increased use of digital technology and financial constraints on renewals, the challenges of obsolescence management have changed and increased, requiring a more robust and informed approach.	Systems successfully cater for components with varied lifespans to exploit rapidly changing digital capabilities and the economic and environmental benefits of longer-lifespan assets.

Rail Technical Strategy

CRITICAL **ENABLERS**

DATA DRIVEN	Good understanding and exploitation of the railways' data asset underpins progression towards all functional priorities of the RTS.
EFFECTIVE INNOVATION CULTURE	Timely and successful deployment of novel solutions is made possible by collaborative research and innovation, aligned to capital investment decisions and timescales, and supported by the right culture to drive and de-risk change.
TECHNICALLY TALENTEND WORKFORCE	The railway continues to need people from a vast array of technical backgrounds to succeed, and success involves different technical disciplines having sound whole-system understanding. The fast-paced developments of digital technologies pose a further attraction, retention and upskilling challenge.

Success requires more than technical solutions

The technical success of the railway and our ability to make technologies deliver for our existing and future customers, depends on how we work together. Effectively bringing about business driven innovation, fully exploiting the extensive data asset, and ensuring that the rail sector attracts and develops ample technical talent.

CRITICAL ENABLERS

DATA DRIVEN

EFFECTIVE INNOVATION CULTURE

TECHNICALLY TALENTED WORKFORCE

Rail Technical Strategy

Innovating across Britain's railway

Strands	Description
Increasing data availability and understanding of its value	The principle of 'open by default' has great benefits but also costs and commercial implications. Hence making more rail data accessible requires understanding which data has high value and creating sufficient incentives for its ready supply.
Improving data interoperability	Making data more easily usable requires cross-industry standards and formats that reduce the time and cost associated with processing, integrating and federating data sets. Cross-industry standards and formats also have an essential role to play in making a wider set of knowledge and resources machine readable.
Supporting transition to new data driven technologies	Great insights from data increasingly come from emerging, fast-moving, data-driven technologies such as AI and Digital Twins. Hence the opportunity is to encourage and navigate the introduction and successful use of such technologies, making rail an informed customer and user.
Strengthening cyber resilience	Improving awareness of data-related threats and cyber resilience, including re-establishing desired status at pace following perturbation, is essential in an increasing digital railway.
Ensuring data quality	Systems designed to maximise trust in data, with quality systematically maintained against recognised metrics, with automated flags for any issues within critical data sets.

CRITICAL ENABLERS

DATA DRIVEN

EFFECTIVE INNOVATION CULTURE

TECHNICALLY TALENTED WORKFORCE

Rail Technical Strategy
Innovating across Britain's railway

Strands	Description
Bringing stakeholders together	Widespread use of the R,D&I common framework aids communication and coordination as knowledge develops and solutions progress through RIRLs. Increased sharing of initiatives via the RTS mechanisms gives initiatives cross industry exposure with greater opportunities to connect and establish synergies.
Improving commercial mechanisms and incentives	New types of contract and supplier engagement support in line with the new procurement act. Rail Reform presents a significant opportunity to strengthen current incentives and put new, better ones in place.
Accelerating implementation and roll-out	Planning the journey to adoption and benefit realisation is an integral part of any R,D&I initiatives. This includes consideration of the right balance between working toward the roll-out of close to market solutions and pursuing new low RIRL solutions.
Aligning funding	Public and private funded R&D investments in research complement each other and are targeted at the types of R,D&I activity that are most appropriate to them. This, together with increased visibility of deployment opportunities and capital investment plans, allows the timely delivery of the new knowledge and solutions industry needs and is ready to act upon.
Enabling an innovative mindset and culture	Organisations across the industry encourage, support and reward putting into real-world application new solutions that respond to a need. This includes proactively managing the risk that this generates. Innovation skills are recognised and embraced in the workforce and training supports this.

CRITICAL ENABLERS

DATA DRIVEN

EFFECTIVE INNOVATION CULTURE

TECHNICALLY TALENTED WORKFORCE

Rail Technical Strategy
Innovating across Britain's railway

Strands	*Description*
Attracting talent to rail	Rail established as an industry of choice for graduates in relevant technical disciplines. Rail perceived as an appealing career path for technology specialists in other domains.
Developing skills in parallel with new solutions	Required technical skills are planned for and developed in parallel with new technologies. Technological development includes consideration of what skills will be required to install, operate, maintain and decommission. Migration from current to future technical solutions is planned for in partnership with the workforce.
Retraining and upskilling to aid retention	The industry supports retention and development of the existing workforce by offering the ability to develop new skills in line with the changing operational and engineering requirements. People in industry are actively encouraged to be professionally curious outside their area(s) of technical expertise.
Technical competence and career progression framework	Clarity across the industry on the technical skills required. The workforce embraces new technology as a way to deliver better value for customers and to provide a rewarding career with ongoing opportunities for progression.

Rail Technical Strategy

Innovating across Britain's railway

DESIRED **OUTCOMES**

The Rail Technical Strategy exists to help industry deliver for its customers. It is a live, evolving strategy designed to reflect the changing landscape, celebrate successes and highlight where further effort and attention is needed to unlock technical progress.

These outcomes set out what success looks like for the strategy.

1 Support rapid **progress towards industry's strategic aims**	The RTS is part of a bigger strategic picture, showcasing the industry's agreed areas of focus and the pathway towards key goals. The goals for each functional priority have been mapped to show how progressing towards them will underpin progress towards the Strategic Objectives for Rail, and targets within other cross-industry strategies.
2 **Steer research funding and initiatives** to prioritise advances in agreed areas	Public-funded research, development and innovation will give precedence to activities that have a clear link to the goals and stepping stones set out in the RTS. This allows the wider research community, including commercial R&D, to collaboratively schedule multi-stage initiatives effectively.
3 **Inform long-term investment planning** for replacements and renewals	Budget holders for capital investment and operational costs understand the status of technological solutions, allowing them to plan for upgrade / overhaul / replacement.
4 **Empower supply chain to deliver** the technical solutions required by industry	Major contractors through to SMEs and startups can target their development efforts and funds with the confidence that there is a clear need for them.
5 **Foster collaboration** and provide a conduit for **sharing successes** and challenges	Through the development and ongoing monitoring of progress against the strategy itself, plus the collaboration mechanisms established via the RTS website, the right parties are brought together to achieve the shared goals.

Engage with the RTS

Explore the full strategy including the interactive functional priority routemaps at:

www.**RailTechnicalStrategy**.co.uk/rts-viewer

A live strategy for everyone to engage with

A solid strategic plan is just the first step of the journey towards achieving the aims set out. Major progress within industry cannot be achieved by one party, but requires joined-up efforts from many players. To deliver the short- and longer-term goals set out in the strategy, the whole industry and supply chain will need to continue to work together, including securing input from outside of the rail sector.

Since the release of the 2020 version of the RTS, there have been significant and long-term changes in the way we live and travel. These have required the railway to rethink its proposition to its customers and wider society, and the best structure to deliver it. As the rail industry reforms, this digital, living RTS aims to inform and complement wider thinking as it continues to evolve, ensuring that it is aware of the technical solutions available and that future technical developments remain relevant to the strategic direction of the rail industry.

Engage with the RTS

Rail Technical Strategy

Share the technical solutions you are developing and deploying

For the strategy to evolve and remain current, it needs to capture what wider industry is delivering or considering initiating in relationship to the five functional priorities and the enablers. The RTS provides mechanisms for sharing inputs from all parties, so we invite you all to let us know what you are working on.

Also, we are looking to expand the range of case studies featured in the RTS. These have a key role in helping the railway to celebrate and publicise its technical successes and learn lessons, so please share your stories with the RTS Engine Room. The aim is to help potential partners and customers find you and understand what is available whilst protecting your IPR.

Your feedback is welcome

We are always interested to know about new ideas and opportunities to accelerate towards the stated vision for 2040. Sharing thoughts across industry on these matters will be invaluable in continuing to challenge ourselves and make rapid, positive progress.

Get in touch with the RTS Engine Room at:

rts@rssb.co.uk

RTS Innovating across Britain's railway

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