Rail Technical Strategy

Innovating across Britain's railway

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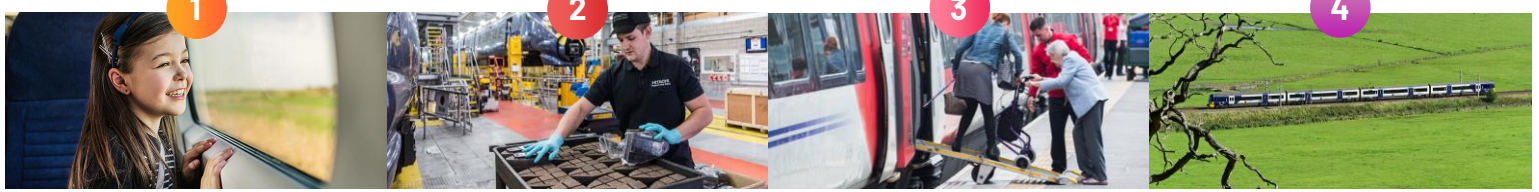


Andrew Haines
Chief Executive
Network Rail

"This RTS is a major shift, outlining how we are making a step change in innovation across the rail sector. Let's embrace this strategy and build on this platform for change."

Paul Plummer
Chief Executive
Rail Delivery Group

"We welcome this strategy and train operators will work together with industry partners to deliver against the RTS and innovate across Britain's railway now and for the future."

Darren Caplan
Chief Executive
Railway Industry Association

"A rail sector able to meet these challenges through innovation will provide greater benefits to rail users, export more around the globe, generate more investment and jobs, and attract even more talent."

About the RTS

The Rail Technical Strategy (RTS):

- Sets a clear direction for the development and uptake of existing and new solutions, informing investment pipelines within industry
- Aligns thinking and action, globally promoting UK's world-class rail expertise
- Stimulates supply chain to invest in innovative solutions in the most important areas
- Guides the prioritisation of existing research and innovation funds

This edition was developed around the following principles:

More focused bringing clarity on agreed key problems, opportunities and solutions

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

Less R&D centric putting equal emphasis on challenges and opportunities around successful deployment and adoption

Collaborative development

This edition was created collaboratively by a working group comprising representatives from RSSB, Network Rail and both academic and industrial UKRRIN partners.

It was developed with wider industry engagement and support including more than 100 organisations and over 30 prominent cross-industry groups.

Steering was provided by the Executive Technology Leadership Group.

The working group would like to extend specific thanks to the Rail Delivery Group and Railway Industry Association for their ongoing support and input.

RSSB A Better, Safer Railway

NetworkRail

UKRRIN UK RAIL RESEARCH AND INNOVATION NETWORK

Rail Delivery Group

National Rail

Railway Industry Association

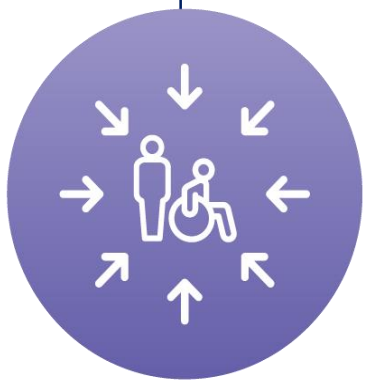
The voice of the UK rail supply community

Rail Technical Strategy

Innovating across Britain's railway

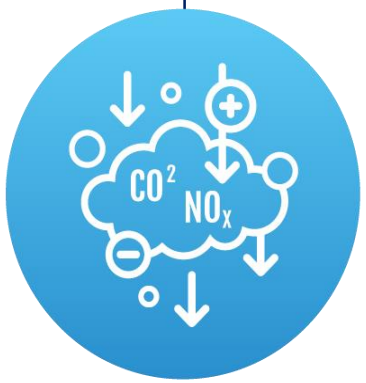
FUNCTIONAL **PRIORITIES**

The five functional priorities are industry agreed focus areas where rapid progress is needed and new technical solutions are critical. For each priority, explore the key goals and the 'routemap' that highlights the steps needed in the next five years to get to a sound position in 2025 and set the essential groundwork for progression towards the 2040 vision.



EASY TO USE FOR ALL

Rail will deliver an excellent travel experience to regular and occasional passengers thanks to dependable real-time information, innovative payment methods, and improved solutions for accessibility.



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.

RELIABLE AND EASY TO MAINTAIN

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

DATA DRIVEN

Data, recognised as a highly valuable asset, will have fit for purpose governance, access arrangements, systems and technical skills. These building blocks underpin the progression of all the other functional priorities which each have their own specific data requirements and opportunities.

Easy to use for all

Rail will deliver an excellent travel experience to regular and occasional passengers thanks to dependable real-time information, innovative payment methods, and improved solutions for accessibility.

Improving the overall experience and accessibility is essential to make rail the mode of choice for a much broader range of journeys and playing an important part in enabling a more inclusive society.

Key goals

- Accurate, accessible and understandable real-time information
- Smart fare collection
- Personalised services
- Accessible to all
- Door-to-door solutions
- Reliable and fast on-board connectivity

Anthony Smith
Chief Executive
Transport Focus

"New knowledge and technical solutions have a key role to play in making the railway passenger centric and easy to use. It is crucial that the rail industry puts passengers' needs and expectations at its heart."

Easy to use for all

RTS Innovating across Britain's railway

GOALS	WHY?	CURRENT POSITION (2020)	STEPPING STONES IN THE NEXT FIVE YEARS	VISION FOR 2025	VISION FOR 2040
Accurate, accessible and understandable real-time information	Making it easier for passengers to plan and manage their journey reduces stress, exclusion and time lost, and increases confidence.	Real-time information is available but not always reliable and useful. Also staff on the ground often don't have the same information. New need for information relating to biosecurity in rail environments.	Improvements in the timeliness, reliability and accuracy of the information needed for door-to-door travelling, including information on layout and current status of facilities of stations and trains. Personalised information sent to customers based on their journey and travelling patterns. Development of biosafety indicators that support customers and industry decisions. The availability of data enables new services from the wider market that cover door-to-door needs. These include information interface for mobile devices, hearing aids and station navigation tools.	Customers receive inclusive real-time information on journeys (including alternatives when disruptions occur) minimising stress and lost time, and boosting confidence.	Timely, easy to use and reliable door-to-door information with rail at its heart.
Smart fare collection	For rail to be attractive it is key that passengers can easily buy rail as part of their travelling options and door-to-door journey.	Ticketing is complex and offers limited flexibility. Lack of clarity on best price available. Limited cross-modal payment options, mainly in urban areas and for train-bus combinations.	Rail pay as you go to cover frequent, shorter and cheaper journeys (including city, regional and intra-regional). Smart ticketing on mobile devices to improve reservation and personalisation for less frequent, longer, more expensive journeys. Account-based ticketing underpins the Digital Fares and Ticketing Platform to allow simplification and personalisation. Digital Fares and Ticketing Platform enables richer services to passengers and third parties. Open data and suitable commercial agreements deliver multi-modal ticketing provision.	Payment and reservation experience for rail is easier and more inclusive for all journeys. Increased passenger confidence that they've got a valid ticket at the best value.	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.
Personalised services	Personalised services and assistance, where requested, make travelling by rail an easy and more enjoyable experience.	Minimal customisation and personalisation of train services. Limited availability and use of individual customer's data and their journeys to improve experience.	The underpinning customer data to provide personalised services is developed and customers are keen to share their data because its use is fair and clear and there are benefits to them. Open data and AI enhance the level of customisation of support and services. (Specific) real-time passenger feedback is proactively sought and made easy to provide. Passenger centric measures of rail performance are identified and used. New design solutions on trains make on-board tasks and activities easier and more pleasant.	Information on passenger movements, preferences and needs allows customised support and services that improve the experience of travelling by rail.	The level of customised support, convenience and inclusivity delivered by rail improves the travel experience for all and rivals other modes.
Accessible to all	Reducing exclusionary barriers throughout the railway enable more people to travel, and to travel independently.	Focus is mainly on step-free access to stations and platforms with limited initiatives for other capability impairments.	Deployment plan and guidance to speed up the adoption of existing step-free solutions (e.g. humps and low-floor trains). Assess new solutions to remove hazards and barriers for people with reduced mobility (e.g. gateless access and crowding control). Roll out tools for people with less visible disabilities to use the railway. Account-based digital services make booking and providing assistance easier. Inclusive design tools and measures to assess and cater for all capability losses are developed and used to inform stretching inclusion targets.	Passengers with capability impairments are better catered for. Inclusive design tools and measures drive action to maximise the proportion of the population who find the railway easy to use.	
Door to door solutions	In a fast changing transport landscape it is key to make it more convenient and less stressful for customers to use rail as part of their multi-modal journey.	Websites to plan and provide real-time support for door-to-door journeys exist but have significant limitations. Rail focuses on the delivery of train services, and customers are expected to sort out their first and last mile, with very limited services provided by rail to support their full journey.	Improve parking and connection facilities for existing modes (including electric vehicles) at stations. Develop operational concepts and facilities for connections with emerging modes (including micro-mobility). Data exchange in place to allow better connection decisions by transport operators and the travelling public. Feasibility studies on tools to optimise passenger flow within and across modes.	Passengers' first and last mile are better understood and catered for.	Railway plays a key role in the provision of door-to-door, not just point-to-point, transportation. Information to and from passengers used to manage capacity and optimise its use.
Reliable and fast on-board connectivity	Customers expect to be always connected if they so choose.	Phone and mobile data coverage on trains is patchy and unreliable.	Lessons learnt from 5G trials inform technical and commercial plans. Agreed overall plan to improve rail connectivity starts to be delivered. Regular reports on the extent and quality of mobile coverage on the railways are in place.	Good on-board voice and data connectivity is a given when travelling by rail.	

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.

Better air quality is key to the health of our passengers, staff and wider society. A fully decarbonised and energy efficient railway will ensure that the sector plays a key role in meeting net zero carbon ambitions for the transport sector.

Key goals

- Cheaper and less disruptive electrification
- Zero-carbon self-powered vehicles
- Low carbon freight
- Increased energy efficiency
- Reducing polluting emissions

Malcolm Brown
CEO
Angel Trains
Chair of the Decarbonisation Taskforce

"It is no longer a question of what's the business case, but what's the fastest and most efficient track to get to a net zero carbon railway."

Low emissions

RTS Innovating across Britain's railway

GOALS	WHY?	CURRENT POSITION (2020)	STEPPING STONES IN THE NEXT FIVE YEARS				VISION FOR 2025	VISION FOR 2040
Cheaper and less disruptive electrification	More electrification is fundamental to zero emissions, as well as giving great acceleration, reliability and operating cost benefits.	Concerns over cost and disruption following recent electrification schemes have undermined political support.	Standards and design for discontinuous electrification are adopted, including automated traction switching.	Rail has a clear power-supply strategy, including lineside, onboard and hydrogen. This takes account of smart grid, storage and load balancing opportunities.	Standards/incentives adopted to reduce the need for civil engineering while maintaining safety.	Faster, more detailed and more effective planning and route clearance is enabled.	New electrification schemes are meeting cost and disruption criteria.	All high-speed and high-intensity lines are electrified.
Zero-carbon self-powered vehicles	Where maximum journey speeds are under 100mph, there is increasing optimism that hydrogen and batteries will deliver a cost-effective low-carbon alternative that still delivers against operational and timetable requirements.	There are around 2,500 <100mph diesel vehicles currently active, many of which run on lines unlikely to be electrified.	Standards for hydrogen and battery trains and associated infrastructure are adopted.		In-service fleet deployments for hydrogen- and battery-powered trains.		Clear zero-carbon replacement plans for Sprinters (Classes 150-159).	All self-powered passenger vehicles are zero carbon.
Low carbon freight	There is currently no viable alternative to electrification or diesel power for rail freight that delivers the necessary power. There is a need to maximise benefits from electrification, as well as from hybrid and bi-/tri-mode locomotives.	Rail freight, with its significant reliance on diesel, runs the risk of being penalised while alternative modes may be more carbon intensive and increase congestion.	Options, criteria and business case to retrofit traction options are developed.	Clear understanding of where electrification could provide tipping point for freight traction.	Energy-optimised timetable and real-time train speed profiles are enabled for off-peak operation.		Clear understanding of options and funding for freight decarbonisation.	Clear role for rail as part of overall net zero logistics chain.
Increased energy efficiency	Reducing energy consumption (losses and useful consumption) is often a cost-effective way to reduce carbon and can have immediate benefits for existing rolling stock.	The industry is neither incentivised nor aligned to improve the efficiency of rolling stock or infrastructure.	There is a strategy for reducing losses, especially on DC network.	Clear and agreed technical requirements for rolling stock efficiency and emissions reduction, including retrofit, are adopted.			Clear programme to reduce energy use is being delivered across the network.	Energy required per passenger vehicle km is minimised. Smart 'rail power network' that minimises traction carbon at source.
Reducing polluting emissions	Air quality is the most pressing environmental health risk in the UK. There is a need to balance the best route to long-term decarbonisation against the more pressing need to mitigate harmful air pollutants.	While overall emissions from rail are low, they can be significant locally. The industry currently has limited understanding of the scale, location and risk of emissions.	Low-cost intelligent emissions monitoring and risk mapping is in place.		A programme of trials to test and compare mitigation options is delivered.		Robust mitigation is in place, based on risks.	Rail has a negligible impact on local air quality.

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.

High service reliability, more agile and robust train planning solutions, and improved solutions to better manage and increase capacity where needed are at the very heart of ensuring that rail retains and attracts new customers.

Key goals

- Flexible and reliable train planning
- Improved real-time operations and decisions
- Improved degraded operations
- Signalling and train capabilities support higher route capacity

Patrick Verwer
Chief Executive Officer
Govia Thameslink Railway

"Highly technical and sophisticated solutions to optimise train operations offer unprecedented opportunities, but we also need solutions that bring simplicity and agility to the way we operate the railway to deliver greater benefit to the customer more quickly."

Optimised train operations

RTS Innovating across Britain's railway

GOALS	WHY?	CURRENT POSITION (2020)	STEPPING STONES IN THE NEXT FIVE YEARS	VISION FOR 2025	VISION FOR 2040
Flexible and reliable train planning	There is a need to reduce the lead time and improve quality of future timetables. Easier and more robust ways to add / change paths at short notice allows services to be adjusted to meet passenger and freights needs.	The timetabling process has a long lead time and the working timetable generated doesn't learn from actual running times. The 'short-term' and 'very short-term' planning processes are very manual and not robust.	Single common model of GB rail infrastructure used for all planning. Prioritised improvements of train planning data. Greater integration of crew and stock planning for long and short term planning. Solutions to allow the working timetable to learn from actual train performance. Development and validation of new simulation tools to reflect the complexity of the railway and allow the outcomes of different optimisations to be compared and understood. Solutions available to increase flexibility and robustness of very short-term planning.	Improved working timetable allocates allowances optimally, decreasing the risk of significant disruption if perturbations occur. Train paths are added easily and reliably at short notice. Increased (predictable) quality of service during disturbances and faster recovery.	Demand-based operations: planning and re-planning of trains to meet customer needs can be achieved and communicated in near real-time. Timetable development is informed by real-world operational performance.
Improved real-time operations and decisions	Real-time train performance can be significantly improved by reducing the variability of train operations, and by improving traffic regulation and management during normal working and disruption.	Manual train handling leads to acceleration, braking and coasting lacking consistency. Initial deployments of Traffic management (TM) and Connected Driver Advisory Systems (C-DAS) are used in a few locations. Shared understanding of where to deploy optimisation solutions and how to get best value out of them is limited. Richer data to better understand disruptions is starting to be explored. Incidences of Signals Passed at Danger remain a problem.	Open-source software infrastructure description Crew and rolling stock resources linked to traffic management (TM). TM integration with signalling systems. Wider roll-out of TM to support, and where appropriate, automate decisions in perturbation. Widespread roll-out of C-DAS in conjunction with TM to improve passenger and freight performance. Elements of ATO-ETCS piloted to remove variability in driving profiles. Agreed strategic deployment plan for driving task support systems to maximise value for money. New data driven tools to prevent and help mitigate disruptions. Define the capability gaps remaining to improved real-time operations and decisions during disruption. Trial and initial fitment of ETCS Limited Supervision on non-ETCS infrastructure.	Strong business case in place for widespread roll-out of TM based on positive results from early implementations. Reduction of variability in acceleration, braking and coasting on a key routes. Data insight used to inform real-time decisions and to prevent disruption. SPAD risk is virtually eliminated, with positive impact on service reliability.	Real-time optimisation of trains across the network together with effective prevention and recovery from disruptions.
Improved degraded operations	Current degraded working takes time to set up and significantly reduces throughput of trains.	Degraded Mode Working System (DMWS) has been developed in the lab but not yet piloted.	Mainline trials of DMWS. Agreed deployment plan for DWMS which exploits quick wins enabled by some of its elements. Exploration of alternatives including hybrid solutions that interface with the signalling system.	Reduced disruption during signalling failures.	All lines have or are migrating to a digital signalling solution.
Signalling and train capabilities support higher route capacity	There is the need to fit more trains on those parts of the network that are full either because of headway lengths or because of bottlenecks at nodes.	Thameslink is successfully ramping up its capacity but traditional signalling and management of nodes continue to limit capacity on most of the network. The migration strategy to digital signalling is unclear. Conventional signalling is based on the worst performing train, which means that the improved performance of modern rolling stock in terms of braking and acceleration are not utilised. Reliable braking in low adhesion remains a challenge.	Agreed migration strategy and roll-out plan for radio based ETCS with no lineside signalling. Lessons identified and implemented from Thameslink mainline ATO deployment over ETCS Level 2. Optimised ETCS braking curves for freight. Validated freight train integrity devices. Enhanced train position systems. Block lengths shortened and optimised by automated design for new schemes. Faster operating, inherently safe, point mechanisms piloted. Rationalisation of train classes and applicable speeds to create homogeneous operations.. Fundamental review of operational principles for mixed-traffic. Double variable rate sanders specified for new trains; prioritised retrofitting for existing trains . Magnetic track brakes for all new, frequent stop trains. Train doors and interior layouts optimised during overhaul and for new build to minimise dwell time.	Schemes deploying radio based ETCS with no lineside signals are in delivery. The overlaying of ATO can be planned and delivered in a more informed way. Capacity in the process of being increased at key bottlenecks thanks to better design and solutions. Use of existing capacity is maximised Predictable and reliable braking unaffected by railhead conditions.	Trains can run closer together safety.

Reliable and easy to maintain

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

More reliable assets needing less out-of-service time are key to increased customer confidence and demand. Lower whole-life asset costs and increased understanding of how humans and machines can best work together, will help establish a thriving sector.

Key goals

- Improved reliability and availability of existing systems
- Safe and rapid inspection and repair
- Step-change in reliability, availability and whole-life cost for new assets

Dyan Crowther
Chief Executive Officer
HS1

"Reliability and availability underpins the experience of passengers and freight customers and to achieve that we must implement technology as system improvements rather than isolated projects."

Reliable and easy to maintain

RTS Innovating across Britain's railway

GOALS	WHY?	CURRENT POSITION (2020)	STEPPING STONES IN THE NEXT FIVE YEARS			VISION FOR 2025	VISION FOR 2040
Improved reliability and availability of existing systems	Reliability that is appropriate to the role of rolling stock and fixed assets in the system reduces disruption to services and drives cost efficiency through less maintenance. Services should only be disrupted as a last resort when assets fail. Increasingly complex railway systems raise the likelihood of service disruption through faulty interactions of assets or sub-systems. Greater resilience needed to cope with system stresses including climate change.	The timing of failures is unpredictable resulting in over-cautious inspection and maintenance or emergency intervention and delay. Response to faults can overlook, or take insufficient account of, wider operational implications. Individually reliable components and systems can interact to delay trains.	Identify rolling stock and fixed assets to be prioritised for improved reliability and availability, based on their performance impact. Agree principles and rules to report defects and repairs, allowing a system-level diagnosis of complex faults.	For high-priority assets and their operations: • Identify and assess improvement options • Review fault response to ensure services can keep running with minimal disruptions. Pilot cross-industry reporting system to prove its benefits in managing complex faults.	For high-priority assets, pilot and roll-out improvements to the assets, their management, fault response and operating approaches that keep services running. Increase the range of assets covered by this reporting system and feed enhanced system-level requirements into design specifications.	System resilient to many localised failures. Improved reliability by designing refinements that have high performance impact. Improved availability by accommodating failures to in-service assets with 'smarter' operations. Knowledge is routinely applied to improve system reliability, with the workforce guided by data and maintainers engaged in design.	System resilient to most localised failures. All assets performing with a known and appropriate level of reliability at component, sub-system and system levels and causing minimum disruptions.
Safe and rapid inspection and repair	Targeted interventions based on the condition of rolling stock and fixed assets. Minimised downtime for maintenance and repairs can have significant positive impact on both costs and customer satisfaction. Lower risk to workforce and less disruption can be achieved by more automated inspection and repair methods, and decision support.	Progress towards optimal inspection and monitoring, but remote inspection and monitoring (RCM) and non-destructive testing is only used for a limited set of assets. Where deployed, RCM is starting to move workforce away from live operational environments. Most maintenance and repairs require rolling stock being temporarily removed from service or track possessions. Safety-driven initiatives to reduce workforce risk are focused on improving current procedures.	Identify which high-priority (cost and impact) rolling stock and fixed assets could best use RCM, aligned with available sensor and comms technology. Agree with industry and ORR the economic and safety case for condition-based inspection and maintenance. Identify assets suitable for robotic and Artificial Intelligence (AI) inspection and maintenance.	Deploy RCM systems to high-priority assets and use the data to optimise inspection, servicing and replacement schedules based on asset conditions and performance. Demonstrate robotic and AI inspections in live environments with remote supervision from the workforce. Prove initial robotic and AI repair concepts.	Develop and deploy RCM systems to more rolling stock and fixed assets. Evolve RCM algorithms to improve their prediction accuracy. Roll out of robotics and AI inspection. Demonstrate robotic and AI repair solutions in live environments.	Condition-based inspection and maintenance (optimised for practicability) is widely used, replacing periodic inspection and maintenance. Widespread use of robotics and AI to identify – and in some cases rectify – asset faults. Workforce has been trained on remote supervision, leading to fewer and shorter withdrawals from service or track possessions and greater safety.	All assets inform owners about health, degradation of performance and remaining service life. Railway maintenance is highly automated. Workforce typically co-ordinate automated repairs in live operational environments, often remotely.
Step-change in reliability, availability and whole-life cost for new assets	Future railway systems are designed to minimise single points of failure and deliver reliable service including under future climatic conditions. Upgrades of rolling stock and fixed assets are affordable and can deliver lower operating costs and a higher performing railway. Opportunity to create high-value, safe roles for our workforce, designed to exploit new asset capability.	The case for, and path to, next generation assets is not always clear and whole-life cost is considered too narrowly. New generation asset design is not always driven by reliability and availability, especially at a system level. Design thinking and enhancements to the current generation of assets provide insights to inform new specifications. Renewals and mid-life refurbishment present opportunities but are often used to replace like-for-similar.	Incorporate targets for Mean Time To Repair and Between Failures and ease of repair in asset specifications and sub-systems. Workforce and technologists co-create opportunities and co-design new way to exploit new technology for safety, reliability and value. Identify priority retrofit solutions to deliver a step-change through asset upgrades.	Develop revised design specifications incorporating design for reliability and avoiding single point of failure. Develop tools to plan and assess the case for transitions to step-change performance of assets.	Use revised specifications when replacing assets. Pilot co-designed operating concepts and systems. Apply the tools to inform industry planning.	Maintenance strategy and requirements are always specified at design stage as part of optimising whole-life cost. Key train and infrastructure requirements, or equivalents, set at an appropriate level of detail, system-level outputs and long-term asset strategy.	New assets designed for availability through non-disruptive repair; easy renewal; and reduced whole-life cost and environmental impact. New assets designed for reliability at system level and for future climatic conditions. They do not have single points of failure and include in-built health monitoring. Future transitioning and re-purposing of assets considered as part of design.

Data driven

Data, recognised as a highly valuable asset, will have fit for purpose governance, access arrangements, systems and technical skills. These building blocks underpin the progression of all the other functional priorities which each have their own specific data requirements and opportunities.

Overcoming the barriers to greater awareness and exploitation of the industry's data assets will unlock a multitude of new opportunities to better serve customers, drive efficiency and target further technological progress.

Key goals

- Easy access and sharing of data, including real-time data
- Robust industry-wide data governance
- Clear business case for data sharing
- Tools and skills for better data exploitation

Will Wilson
Chief Executive Officer
Siemens Mobility Limited

"This priority is at the very core of the Rail Technical Strategy, underpinning all its elements and essential for the success and competitiveness of the future railway system and offerings."

Data driven

RTS Innovating across Britain's railway

GOALS	WHY?	CURRENT POSITION (2020)	STEPPING STONES IN THE NEXT FIVE YEARS	VISION FOR 2025	VISION FOR 2040
Easy access and sharing of data, including real-time data	It is essential to improve business efficiency and effectiveness, recognised in government and industry policies. Timely data allows real-time system improvements and enhanced decision-making for railway customers.	A limited range of data is available through industry platforms/APIs. Most data sets are not available or accessible. A range of assets and other sources generate data in real time, but this capability is not widely exploited.	Raise industry awareness of existing data sets, including static, real-time and legacy. Collate data catalogue of industry data sets. Identify industry 'use cases' for increase data sharing that can accelerate progress in the other four RTS priorities. Identify data needed for the agreed 'RTS use cases' and enable data sharing under agreed conditions. Develop prototype National Access Point (NAP) system and move it into a fully functioning system. Create and facilitate open data sharing mechanisms.	The combination of the rail data catalogue, National Access Point for rail data, and greater data sharing makes it easier for business and innovators to understand and access industry data. Compatibility of rail National Access Point approach to what is done in other modes and sectors allows linking to non-rail data sources.	Ambitious strategies on data accessibility and exploitation are being implemented. These have ensured that rail is recognised as a leading data driven industry that manages, shares and exploits data to the benefit of our customers, the industry, and wider society.
Robust industry-wide data governance	It is an essential enabler for greater sharing of data and assurance of data quality.	Several organisations are developing, or have developed, information management frameworks.	Agree a cross-industry information management framework (IMF), including cyber-security issues. Develop and apply the IMF to data sources underpinning the RTS priorities. Develop and apply of IMF principles to all new data sources. Identify governance-related metadata. Incorporate metadata into the build and population of the NAP.	All RTS 'use case' data sources shared in line with information management framework.	
Clear business case for data sharing	This is a key enabler for business across the industry to prioritise and justify making data available.	There is limited research focusing on quantifying the benefits of opening up data sources. Traceability capabilities exist but are not used by the industry.	Develop framework and a methodology for valuing rail data sources. Use the framework to identify priority data set from industry and innovators 'wish list'. Ongoing development of business cases to enable increasing amounts of open or shareable data.	The benefits and costs of sharing data are both much better understood and agreed across-industry. Widespread ability to build cross-industry business cases for the sharing of data.	
Tools and skills for better data exploitation	Advanced data capabilities are essential for the railway to drive and be competitive and integrated with other modes.	Rail expertise exists for traditional analytics. Cross-industry competence in new approaches to data is limited. Industry is not always an informed buyer and user of 'big data' and 'smart data' solutions.	Identify skill gaps within industry. Develop and implement (re)training, support and guidance. Develop new capabilities and outputs related to data, including digital twins and advanced AI, so that data can be easily connected to create greater value. Focus digital twins, AI and other data analysis developments that underpin the other four functional priorities.	Industry-wide, easy-to-use analytic tools and guidance supporting the railway to move from 'big data' to 'smart data'. A highly competent and skilled workforce that can mine value from data.	

Rail Technical Strategy

BUSINESS DRIVEN INNOVATION

Collaborative research & innovation pulled by industry that leverages academic and supply chain expertise

RAPID BENEFIT REALISATION

Streamlined, reliable and timely deployment of novel solutions driven by sound long-term planning

DIGITALLY TALENTED WORKFORCE

A highly technologically literate and diverse workforce across the industry that advocates and embraces digital solutions

CRITICAL **ENABLERS**

Making it a success goes beyond 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. Bringing about business driven innovation, findings ways to accelerate successful take up of new technologies, and ensuring that the rail sector attracts and develops ample digital talent.

Rail Technical Strategy

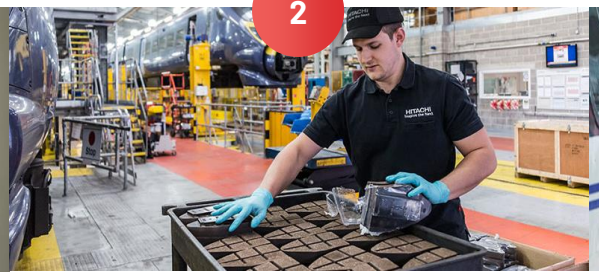
DESIRED **OUTCOMES**

The railway exists to move people and goods from place to place in a safe and efficient manner. It also has a responsibility to contribute to protecting the environment and supporting wider society.

1

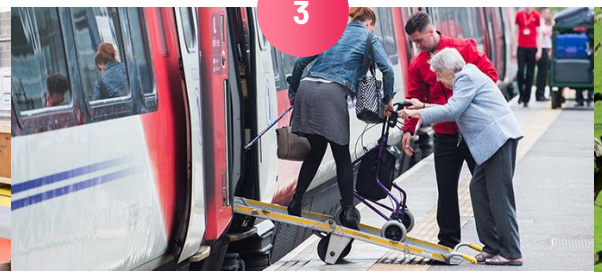
HAPPY CUSTOMERS
The mode of choice for passengers and freight

2



A VIBRANT SECTOR
A railway that attracts investment and talent

3



STRONGER SOCIETY AND ECONOMY
An accessible and affordable mode that supports the UK economy

4

BETTER ENVIRONMENT
Sustainable operations with a positive environmental impact

As technology advances these core outcomes need to be remembered, so that the maximum overall benefit is achieved.

The well-established 'Four C' challenges of reducing cost and carbon, increasing customer satisfaction and providing agile capacity remain pertinent and align with the outcomes targeted by the Rail Technical Strategy.

The four outcomes described here provide a framework in which the technical priorities established in this strategy should be considered.

Engage with the RTS

Rail Technical Strategy

Explore the full strategy including the live components at:

www.RailTechnicalStrategy.co.uk

A live strategy for everyone to engage with

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 input from outside of rail.

This digital, living RTS aims to inform and complement evolving thinking.

Share the technical solutions you are developing and deploying

We invite you all to let us know what you are working on to capture what wider industry is delivering or considering initiating in relationship to the five functional priorities.

We are also looking to expand the range of case studies featured in the RTS to help the railway celebrate and publicise technical successes. The aim is to help potential partners and customers find you and understand what is available whilst protecting your IPR.

Your feedback is welcome

Individuals and organisations can add to the picture, and constructively challenge the direction of travel and its speed.

We are interested to know about new ideas and opportunities to accelerate towards the stated vision for 2040.

Get in touch at:

rts@rssb.co.uk

RTS Innovating across Britain's railway

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