Efficient and reliable assets

RTS Innovating across Britain's railway

GOALS	WHY?	STATUS IN 2024	STEPPING STONES OVER THE NEXT 5 TO 8 YEARS	VISION FOR 2040
"Right-time" actionable insights 1	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.	Rolling stock data availability greatly varies by age of fleet. Increased insight is available for fixed linear assets, particularly thanks to in-service train-borne monitoring solutions. These are opening new opportunities for the future mix of monitoring solutions. Network Rail's Intelligent Infrastructure programme has provided a framework for greater data integration. The challenges of extracting actionable insights from these developments and using them to change established ways of working remain.	Review, prioritise and share with supply chain the current asset monitoring challenges. Introduce technology to accurately and repeatably capture the location of new and existing assets, mapping this information to an updated single version of the truth network model for fixed infrastructure. Establish efficient and effective frameworks for multi-party data capture, data storage, data sharing and integration, and post-processing insights. These need to cover data ownership, costs, and liabilities. Develop a cross-industry strategy for future investment and adoption of RCM solutions to inform Network Rail infrastructure monitoring fleet upgrade, make the most of in-service monitoring, and rationalise current and future solutions. For a wider range of assets, demonstrate the data quality that can be achieved from measurements taken from in-service trains when compared to calibrated sensors on the Network Rail infrastructure monitoring fleet. This needs to include consideration of level of fitment needed on in-service trains and the data requirements of end users managing asset condition and operational risks. Integrate right-time asset insights into maintenance cycles, continuing to move away from routine inspection and maintenance of both rolling stock and fixed assets. ↗1,2	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 2	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.	Numerous initiatives to make maintenance safer and more efficient have been undertaken. Promising research on automated solutions, for example to repair linear assets, are navigating the challenges related to business case and cultural acceptability.	Continue the technical development and operationalisation of specific solutions such as Discrete Defect Repair, Panoptic Bridge Inspection, Tenanted Arch Inspection and Automated Tunnel Examination to inform the roadmap to wider adoption of autonomous maintenance technology. Develop a dedicated 'boots off ballast' strategy for fixed infrastructure inspection, maintenance and renewal. Ensure updates to the Rulebook support the adoption of autonomous inspection and maintenance solutions to come such as the Network Rail Robotic Inspection & Maintenance Vehicle demonstrator. Develop standards on the communication, navigation and data transfer required to enable safe, reliable autonomous plant operation. Where lineside site working is still unavoidable, pilot and roll out a range of solutions to improve workforce safety and reduce exposure to occupational health hazards such as manual handling, slips trips and falls and exposure to noise, fumes, and dust. Develop the strategy and specification for in-service monitoring and diagnostic of ETCS systems. Explore introduction of edge computing on-board asset monitoring systems for real-time data processing and analysis. ↗1,2 Improve KPIs for depots to inform investment decisions. Encourage use of tech to monitor health, fatigue and well-being of maintenance workers. This includes roll out of existing tech, and monitoring of emerging solutions. Develop robust cost frameworks for key asset types that enable comparison of the whole-life cost of different capital investment options as well as different maintenance and renewal options, including the cost of sustaining obsolete design vs pursuing upgrades. ↗2,3,5 Develop validation and assurance principles for AI-powered solutions designed to generate insights and support asset driven decisions. ↗1,2,3 Agree a common asset and data ontology to enable data captured from different sources to be easily federated, including rules for capturing asset location at different levels of accuracy. This links to the need to define and gather information on network capabilities and constraints identified in the 'optimised train operations' priority. ↗1,2,3,4,5	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 3	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.	Extreme weather events, such as the 2022 heatwave and the prolonged rainfall in 2023, had significant safety and performance consequences. As a result, rail is in the process of improving forecasting capability and operational response to extreme rainfall. For extreme heat, engineering standards for track have been updated and new inspection capabilities developed. There are still significant knowledge and capability gaps to move from reactive to proactive interventions.	Improve algorithms to turn 'weather forecasts' (temperature, rainfall and wind) into 'rail forecasts'. These improved forecasts will allow for better 'early warnings' based on safety and reliability risk. Review operational rules relating to extreme weather. Develop and improve tools to ensure that the operational response for extreme weather events is informed by right time asset conditions and robust 'rail forecasts'. ↗Optimised Train Operations: 2,3 Include in the review of assets monitoring challenges, new and different needs driven by extreme weather events (e.g. rail thermal stress; drainage systems; ground saturation; air con system). This needs to consider how extreme weather would influence frequency and granularity of the data required. ↗1,3 Improve consistent recording and mapping of the impacts of extreme weather events on rail assets and operations. Develop a system view of priority interventions from regions, routes and operators, and a cost-benefit analysis framework to inform the selection of weather and climate resilience investment decisions. This should also consider other transport modes to deliver best 'value' for national and regional connectivity. Analyse and re-define asset engineering standards for mitigating extreme weather events and improving climate change resilience, considering both technical and economic considerations.	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 4	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.	There is consensus from industry and supply chain that testing and validation requirements for new assets are not always clear and proportionate. The ability to gather data from full-scale accelerated trials remains limited, leading to long timescales for the testing, validation, and acceptance of novel products such as composite sleepers. Digital testing solutions are rapidly evolving and improving but there are no agreed criteria on how to assess their quality.	Enhance guidance and support on efficient and effective pathways to testing, validation and approval. Review challenges and opportunities with testing, validation and acceptance of specific asset groups, leading to the production of helpful guidance. Improve availability of asset data that is representative of different parts of the GB rail network to feed into digital testing tools. Improve validation and assurance processes for digital testing tools (and associated synthetic environments) to enable greater and more informed use of these and more focussed and value-adding physical testing. Ensure operational scenarios, use cases, and testing parameters are clearly defined from the outset and drive validation and assurance. Explore commercial models and technical enablers for testing data to be made more widely available. Develop Minimum Viable Product of a synthetic environment to accelerate design, testing and validation of ETCS renewals and support their transition into BAU (part of Network Rail T190). Use lessons from this to inform the development of synthetic environments to accelerate design, testing and validation of other asset types.	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 5	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.	The industry is still experiencing a tactical response to product obsolescence which is not well co-ordinated across organisations facing similar challenges. Pressures on renewal investments increase the need to keep assets in operation for longer.	Achieve increased modularity in components for faster and easier maintainability and replacement, for example for capacitors and semiconductors. Investigate commercial approaches to enable a viable and affordable supply chain for legacy components and systems. Improve information sharing to enhance prevention and dynamically respond to cyber security threats. Develop skills in parallel with new solutions and ensure competency management caters for legacy assets. ↗4,5 Repair and maintain Solid State Interlocking components to extend asset life, including the creation of a database of units to understand availability. Develop set of requirements to easily address compatibility, upgrading, and replacement issues of digital components (hardware and software) in all new assets.	Systems successfully cater for components with varied lifespans to exploit rapidly changing digital capabilities and the economic and environmental benefits of longer-lifespan assets.