



# Reliable and easy to maintain Progress against short-term vision

GOALS	WHY?	RECENT PROGRESS AGAINST STEPPING STONES			VISION FOR 2025
<p><b>Improved reliability and availability of existing systems</b></p>	<p>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.</p> <p>Services should only be disrupted as a last resort when assets fail.</p> <p>Increasingly complex railway systems raise the likelihood of service disruption through faulty interactions of assets or sub-systems.</p> <p>Greater resilience needed to cope with system stresses including climate change.</p>	<p>Identify rolling stock and fixed assets to be prioritised for improved reliability and availability, based on their performance impact. <u>Various</u> Porterbook has opened a modern Asset Management Facility (AMF) at Long Marston Rail Innovation Centre, to support trialling and testing of innovative traction tech.</p> <p>NR and Arcadis pilot performance-based data analytics and technical insights model on 19km of Western Route.</p>	<p>For high-priority assets and their operations: identify and assess improvement options, and review fault response to ensure services can keep running with minimal disruptions. <u>Various</u> First-of-a-Kind Reliable and Maintainable Assets Rail competition for high maturity demonstrations launched in June 2023.</p>	<p>For high-priority assets, pilot and roll-out improvements to the assets, their management, fault response and operating approaches that keep services running. <u>Various</u> Northern equipping up to 40 Class 335 trains with LiDAR cameras, thermal imaging software and HD CCTV to record infrastructure defects, environmental factors and maintenance issues.</p>	<p>System resilient to many localised failures.</p> <p>Improved reliability by designing refinements that have high performance impact.</p> <p>Improved availability by accommodating failures to in-service assets with 'smarter' operations.</p> <p>Knowledge is routinely applied to improve system reliability, with the workforce guided by data and maintainers engaged in design.</p>
<p><b>Safe and rapid inspection and repair</b></p>	<p>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.</p> <p>Lower risk to workforce and less disruption can be achieved by more automated inspection and repair methods, and decision support.</p>	<p>Identify which high-priority (cost and impact) rolling stock and fixed assets could best use RCM, aligned with available sensor and comms technology. <u>Various</u> NR's Intelligent Infrastructure (II) plans for CP7 includes a focus on predictive asset management and monitoring data to underpin decision making. Planning to be integrated across industry, aligning access and resources.</p>	<p>Deploy RCM systems to high-priority assets and use the data to optimise inspection, servicing and replacement schedules based on asset conditions and performance. <u>Various</u> NR's Intelligent Infrastructure (II) plans for CP7 includes plans to consolidate and exploit asset condition and usage data to optimise asset repairs and enhancements.</p>	<p>Develop and deploy RCM systems to more rolling stock and fixed assets. Evolve RCM algorithms to improve their prediction accuracy. <u>Various</u> Angel Trains and Cordel used LiDAR and co-located video, on the Didcot to Paddington route, to create a survey-grade digital twin aligned to NR's linear reference system. Data that is captured can be used to enhance the AI algorithms and deliver new insights for NR.</p>	<p>Condition-based inspection and maintenance (optimised for practicability) is widely used, replacing periodic inspection and maintenance.</p> <p>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.</p>
<p><b>Step-change in reliability, availability and whole-life cost for new assets</b></p>	<p>Future railway systems are designed to minimise single points of failure and deliver reliable service including under future climatic conditions.</p> <p>Upgrades of rolling stock and fixed assets are affordable and can deliver lower operating costs and a higher performing railway.</p> <p>Opportunity to create high-value, safe roles for our workforce, designed to exploit new asset capability.</p>	<p>Incorporate targets for Mean Time To Repair and Between Failures and ease of repair in asset specifications and sub-systems. <u>Various</u> New Greater Anglia/Stadler FLIRT bi-mode fleets achieving punctuality figures between 93% and 99% on routes where the new Stadler trains are running.</p>	<p>Develop revised design specifications incorporating design for reliability and avoiding single point of failure. <u>Various</u> Development of FFA-G wagons by Freightliner/Greenbrier Europe/Wabtec Axiom Rail – the FFA-G wagon is 2 tonnes lighter per platform and uses low track force bogies to help reduce track damage.</p>	<p>Use revised specifications when replacing assets. <u>Various</u> RIS-0703-CCS Issue 2 published by RSSB, to help suppliers and signalling layout designers to develop, design and implement lineside signalling systems that follow good practice.</p>	<p>Maintenance strategy and requirements are always specified at design stage as part of optimising whole-life cost.</p> <p>Key train and infrastructure requirements, or equivalents, set at an appropriate level of detail, system-level outputs and long-term asset strategy.</p>
		<p>Agree with industry and ORR the economic and safety case for condition-based inspection and maintenance. <u>IBD</u> There is currently no clear mechanism to support the coordination necessary to understand the case and support transition from periodicities.</p>	<p>Identify assets suitable for robotic and Artificial Intelligence (AI) inspection and maintenance. <u>Various</u> NR announced a partnership with Switzerland's national operator (SBB), which will focus on using AI to inspect steel bridges and track on the UK network.</p>	<p>Demonstrate robotic and AI inspections in live environments with remote supervision from the workforce. Prove initial robotic and AI repair concepts. <u>Various</u> One Big Circle's AIVR technology will be used in a NR pilot to monitor low adhesion in Wales during Autumn 2023.</p>	<p>Roll out of robotics and AI inspection. Demonstrate robotic and AI repair solutions in live environments. <u>Various</u> AAR Rail demonstrated its Automated Discrete Repair machine to NR in January 2023, with an in situ low pre-heat weld restoration process.</p>
		<p>Workforce and technologists co-create opportunities and co-design new way to exploit new technology for safety, reliability and value. <u>Various</u> East Midlands Railway project with the University of Sheffield will work with operational staff to build a representational model of the Nottingham Eastcroft depot which will form the basis of a virtual depot simulation tool, to plan and stress test operational scenarios.</p>		<p>Pilot co-designed operating concepts and systems.</p>	
		<p>Identify priority retrofit solutions to deliver a step-change through asset upgrades. GTR's first C387/1 Great Northern Electrostar train has been retrofitted with Alstom ETCS in-cab signalling as part of the East Coast Digital programme. Dynamic testing at NR's Rail Innovation Development Centre will complete by the end of 2023.</p>	<p>Develop tools to plan and assess the case for transitions to step-change performance of assets. <u>Various</u> Vehicle/Track Interaction Strategic Model (VTISM) updated by RSSB to provide improved modelling capabilities for vehicle/track interactions and long term asset maintenance/renewal planning</p>	<p>Apply the tools to inform industry planning.</p>	