WHOLE-SYSTEM APPROACH
Specifying assets in a whole-system context and a whole-life perspective, they will initially cost more... but the components will work well together, the system will be reliable and passenger needs fulfilled...

...subsystems will be ‘tuned’ to the wider system, assets last longer, maintenance cheaper, less downtime, safer and more reliable railway

...customers will be impressed and more will arrive

Train tuned to track, track tuned to train

Sensors send signal from the track and train to satellite

Pantographs and wires work in harmony

Sensors send signal from the track and train to satellite

Train tuned to track, track tuned to train

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VISION
A whole-system approach enables the rail industry to implement change easily and improve reliability, availability, maintainability and safety

OBJECTIVES
An industry-wide framework for a whole-system approach
Coordinated planning, delivery and operations
Integrated asset management techniques

STRATEGY
Adopt a whole-system approach
Improve industry whole-system modelling capability and tools
Develop a set of aligned asset management plans for the railway

ENABLERS
Effective cross-functional and cross-industry communication
Common modelling and planning tools
Common asset information systems
Best practices in whole-systems approaches
WHOLE-SYSTEM APPROACH

CONTEXT

3.1 The RTS 2012 whole-system is the rail sector, its assets, organisations, operations and stakeholders. It is the railway's people, processes and systems. The railway has many thousands of assets owned, operated and maintained by a range of organisations, each with their own business objectives, priorities, timescales, policies and incentives.

3.2 The inherited railway was often designed as single sub-systems and not as a whole. This legacy presents many constraints on service quality and requires a whole-system approach for a cost-effective and efficient upgrade.

3.3 The whole-system engineering challenge has been recognised:
   • TSLG has been formed to provide technical leadership for the industry
   • System Interface Committees (SICs) have been established to examine and improve performance and cost across sub-system boundaries
   • The Rail Delivery Group (RDG) has been established
   • Industry initiatives for a whole-system approach are increasing, such as RTS 2012, cross-industry remote condition monitoring (XIRCM), cross-industry information systems (XIIS) and whole-life and cost asset management.
   • The RUS process supports planning on a whole-industry basis (eg Network RUS: Passenger Rolling stock)

VISION

3.4 The rail industry adapts easily to change and implements innovative new designs and methods using a whole-system approach.

3.5 The industry's embedded whole-system approach has increased reliability, availability and safety at reduced cost and is easier to maintain. Advanced signalling and traffic control systems have reduced the likelihood of train collisions and a whole-system approach has reduced the rolling stock collision requirements and saved train weight, cost and energy consumption.

3.6 Cross-industry coordination of the design and development of sub-systems and components reduces duplication and minimises negative cross-system impacts.

3.7 Improved remote asset monitoring, including RCM and fewer asset failures increases the reliability of infrastructure and rolling stock. Across the industry, updated maintenance policies and tested contingency plans result in customers rarely experiencing disruption.

OBJECTIVES

3.8 A whole-system framework has been established within which suppliers can develop products with confidence to meet the industry's requirements. Cross-industry strategic planning allows new solutions to be developed and implemented easily. The diverse planning horizons within the industry are aligned to deliver whole-system, whole-life solutions.
3.9 Greater collaboration within the industry fosters coordinated planning and operations which has led to increased levels of reliability and resilience. Customer satisfaction is raised through the improved service levels.

3.10 Asset management is aligned across the industry. Excellent asset knowledge and evidence-based decision-making improves performance at lower cost and with less business risk.

**STRATEGY**

3.11 A cross-industry, whole-system approach to design, maintenance, delivery and safe operation should be adopted. A holistic understanding of the railway is needed to identify risk factors during design stages to allow for any necessary adjustments. This approach would avoid duplication of effort, reduce negative impacts and simplify the introduction of new components and processes.

3.12 Effective whole-system planning requires models suitable for industry, innovators, academia, suppliers and investors. These models could be used to understand the impact of changes to the whole system and support whole-system research and development by:
  - Using a virtual design and development environment
  - Defining requirements, especially across sub-system boundaries
  - Analysing priorities between competing options
  - Testing resilience
  - Optimising the system

3.13 Life-cycle costing tools would optimise decision-making processes for maintenance and renewal. The tools should be able to model a variety of options, including the impact on services, passengers and technicians, to provide comprehensive assessments for work volumes, costs and outputs.

3.14 The industry should collaborate to develop a set of aligned asset management plans for the railway. Common policies and strategies, that encompass a full range of outputs ranging from service delivery to environmental impacts, are required to manage the industry’s assets. Aligned asset management plans should facilitate the implementation for other parts of the industry, operations and external parties.

**ENABLERS**

3.15 Better organisational structure and communication channels between all industry stakeholders are necessary to improve technical and asset interfaces. Improved collaboration between rail operators, engineers and asset managers and close interaction with planners will help to develop and deliver appropriate rail technologies.

3.16 Cross-industry alignment and planning need to remove constraints on operations and services for future infrastructure requirements - be it passenger, freight or international traffic. Alterations to infrastructure system capability/flexibility should be within the prevailing processes and procedures and adhere to whole industry requirements.
3.17 Infrastructure routes and train operating companies (TOC) should form alliances to communicate better and work towards common goals. Collaboration could address issues at the wheel/rail interface, such as rolling contact fatigue (RCF) more efficiently through Vehicle-Track Interaction Strategic Model (VTISM) and TrackEx\textsuperscript{19}. Work carried out by the five SICs, including VTISM, demonstrate the importance of understanding the impact of operational change on individual railway assets.

3.18 The industry needs to establish a common standard language and catalogue for sub-components. Currently, each railway asset is assigned a code by each organisation that uses it. For example, a set of automatic doors at a station may be numbered DR001 in NR’s asset register and SEF102 in the TOC’s register. A single industry asset register which is accessible, accurate and provides real-time updates is very likely to simplify and improve the quality of asset information.

3.19 Asset information underpins a modern approach to asset management. Adopting ISO 55000, the international development of the British PAS 55 standard for asset management, would offer a more consistent approach throughout the rail sector and improve the flow of information for risk-based safety, maintenance and other operational decisions. Consolidating existing system types of asset information, for example, ORBIS (Offering Rail Better Information Services) would also improve consistency across the sector.

3.20 Careful attention should be given to learning from proven best practices. For example, different approaches to route-based alliances could provide useful best practice lessons to aid the development of a whole-system approach for the railway. This would help the rail industry to adapt faster to changes in technology and accelerate potential cost savings.

\textsuperscript{19} TrackEx is a systems analysis tool used to plan and manage track degradation. It is an NR bespoke product and used by the industry.
ADOPT A WHOLE-SYSTEM APPROACH

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Develop a set of aligned asset management plans for the railway

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