Safety, Technical & Engineering Strategic Plan

NetworkRai

March 2019

The business is currently in the midst of a strategic review (100-day plan). The outcomes of which may ultimately impact some elements of the Business Plan. At the present time there remains a level of uncertainty around the outcomes of the review and the likely implementation of them. Therefore this Strategic Plan is not based on any 100-day plan outcomes. However, on the completion of the review and the associated action plans; any outcomes that will impact on the overall business plan will be reflected through the change control mechanism.

Foreword



Jon Shaw - Group Director, Safety, Technical and Engineering

The Safety, Technical and Engineering (Group STE) function is the Technical Authority for Network Rail. We drive better train performance and safety through technical leadership, providing assurance and expert support to the business across asset management, engineering, maintenance, operations, health and wellbeing, safety, security, quality, environment and sustainability and information management.

First and foremost Group STE is here to support the Route businesses to efficiently meet increasing expectations from their customers whilst keeping passengers, the public and the workforce safe. Sometimes that support is provided directly and at other times it is through supporting other business areas including System Operator, Infrastructure Projects, Route Services and Group Digital Railway, as well as providing the primary interface and influencing with external bodies. For much of the rail network that support means helping the Route businesses achieve 21st Century safety and performance from what are fundamentally 19th Century assets.

Group STE provides the framework to enable Route businesses to deliver and innovate through efficient and optimised standards, processes and tools to reduce costs, improve capability and increase performance to achieve a right time railway both now and for the long term.

We are at the leading edge of international railway practice and technology development. Our expertise covers the whole railway system and encompasses wide-ranging collaborations across the rail sector and with other industries in the UK, Europe and internationally. Through these we are building world class knowledge and new capabilities to provide timely, sustainable and efficient support. Our broad and deep relationships with suppliers, research and technology organisations and Government enables us to build and maintain partnerships that share costs and knowledge and that shape and co-ordinate national and international investment. We lead the influencing of external bodies in the shaping of legislation and regulations which otherwise could negatively impact Network Rail, for example European and other railway agencies, bodies and institutions.

In Group STE we help Routes and other business areas to drive safety, performance and cost-competitiveness through key national programmes for short to medium term change including:

- Intelligent Infrastructure to make the Internet of Things (IOT) a railway reality with data becoming intelligence for all of our railway assets, predicting and diagnosing failure so that Routes can intervene without disrupting passengers and freight;
- Electrical safety including remote isolation and securing to improve access;
- Leading health, safety and sustainability on the railway to eliminate accidents, improve weather resilience and adapt to climate change;

We also support the Digital Railway programme to deliver sustainable asset costs and get more capacity from the network.

We manage the R&D portfolio to build a pipeline of change through technology with a particular focus in CP6 to drive further progress in asset sustainability to reduce the cost of, and need for, renewals. We have listened to concerns over perceived gaps between the outputs of R&D and Route priorities and have put in place a radically reworked plan, including ways of working, to translate ideas into impact with pace and present a programme which is Route-led.

Group STE have published 50 challenge statements to steer supplier product development, established a pipeline of challenges to standards to facilitate innovation and progressed reforms to asset protection and product acceptance. We also have turned our inherited test tracks, at Melton and Tuxford, from commercial liabilities into busy self-sustaining facilities. These not only enable critical activities such as testing prior to new train or product introduction or the First in Class testing for ETCS fitments to support the Digital Railway, but house world-leading rail technology R&D in the form of mobile connectivity and sensor networks for improving passenger experience and asset reliability and operational monitoring.

I am proud to lead Group STE in supporting our Route businesses to advance and exploit technical capability, enabling the railway to offer better, safer and more secure transport opportunities for passengers and freight.

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Section 1: What is Group STE?



Chief Rail Technology Officer

The Chief Rail Technology Officer (CRTO) directs Technology and is the executive sponsor for the Research & Development portfolio, underpinned by innovation, and is supported by the Engineering and Asset Management team.

The CRTO provides the vision and leadership to Network Rail's technology strategy and its contribution to the rail sector's Rail Technical Strategy Capability Delivery Plan. The CRTO role drives the key technologies for NR and their interface with the wider railway system, directing Network Rail's technology priorities to meet the needs of Route customers, funders and stakeholders. This leadership role extends across Group STE, overseeing the quality of technical papers and the effective development of new technology proposals; and extends to providing leadership in Europe and internationally.

The CRTO leads the framing of opportunities for the GB railway to contribute to infrastructure productivity under the National Infrastructure Assessment and the

UK's Government's industrial strategy. The CRTO's remit operates within a climate where Great Britain voted to leave the European Union. The focus is on considering the impact Britain's EU exit may have on standards, funding and future programmes.

Chief Engineer

The Chief Engineer includes the engineering & asset management, maintenance and operations principles functional areas. A key focus is to strive for asset sustainability.

Engineering and asset management brings together all of the company's engineering disciplines to provide engineering leadership and manage the network's engineering capabilities to deliver a world-class railway. Under the technical authority role the team sets the engineering vision, strategy, engineering research and development requirements, policy, controls, frameworks and assurance across the engineering disciplines, using engineering expertise to make today's railway better for tomorrow. The team creates the framework for the management and development of assets, technology and people; to provide engineering expertise and leadership to continually improve asset safety, performance and costs.

Programme Director, ORBIS & Intelligent Infrastructure

The Programme Director is responsible for the effective delivery of the Intelligent Infrastructure programme, responsible to provide Routes the support for the realisation of business benefits. Substantial implementation of asset sustainability, building on the capabilities introduced through the ORBIS programme in CP5.

Working with the Chief Engineer, the Director defines and enables the delivery structure for programme, providing alignment to overall STE and strategic Network Rail objectives, and driving performance of the programme to meet its agreed scope and roadmap. The Director ensures alignment to overall governance and assurance of programme activities, to ensure quality and safety of the outputs delivered by Intelligent Infrastructure.

Chief Quality, Health, Safety & Environment Officer

The Chief Quality, Health, Safety & Environment Officer (QHSE) includes passenger and public safety, workforce safety, occupational health and well-being, ergonomics and environment & sustainability including social responsibility, quality and business improvement including lean.

Under the technical authority role, the QHSE team sets the policies, strategies and standards for QHSE and manages the competencies and capabilities within the function for all of Network Rail. QHSE leads continuous improvement and drives toward excellence within the areas of quality, health, safety

and environment enabling performance improvement across Network Rail. The key areas of focus are to: Save lives and protect people from being injured; keep our workforce healthy; take care of the environment; drive our social responsibility; and develop and run the Network Rail Integrated Management System and assurance programmes to enhance compliance and performance.

The team runs key national programmes through the Home Safe Plan and the Responsible Railway Plan which are owned by the business and governed by Group STE.

Chief of Operations, Security & Information

The Chief of Operations, Security and Information team (COSI) includes the security and information management disciplines. Under the technical authority role COSI provides security leadership and governance across the Network Rail business and sets overall direction and corporate strategies for information management.

COSI manages the Research and Development portfolio to support the Chief Rail Technology Officer, the company product development and acceptance processes and the strategically important Rail Innovation and Development Centres (RIDC) at Tuxford and Melton. The RIDC team lead the development and operation of the two geographically separated test sites to provide safe and operationally representative railway testing and trialling facilities for new and modified infrastructure, equipment, rolling stock, plant, and technology demonstrators.

COSI leads the provision of project management capability to enable successful delivery of all Group STE projects and national change programmes. COSI manages the delivery of a programme of business change for the function, with a key focus on embedding and sustaining change, and realisation of benefits. The strategic planning and controls area provides project and programme reporting, analysis, forecasting and commercial management support across Group STE.

Section 2: Purpose, Role, Vision

Group STE delivers value as a Technical Authority and services provider to assure a safe and reliable railway by equally embracing the roles of Chief Rail Technology Officer, Chief Engineer, Chief Quality, Health, Safety and Environment Officer and Chief of Operations, Security and Information. The Technical Authority and services provided by Group STE respond to the needs of Routes and wider stakeholders, underpinning their activities and plans and enabling risks to be managed and benefits to be generated. The Technical Authority and services provided by STE drives 7 key targets summarised in Fig 1 and set out in Fig 2 on page 11. Key elements of the Technical Authority and services are summarised on page 10 and in Fig 1.

Although presented differently from the plan published in February 2018, the purpose, role and vision are consistent with the previous plan. The refreshed format creates a rationalised view of Group STE's accountabilities, the key delivery themes, functional areas and improvement life-cycle. The substantive change is to re-scope the R&D portfolio which is narrowed from the whole railway system to focus on infrastructure management to support our primary goals of asset sustainability, network performance, safety, security, cost efficiency and network growth.

Technical Authority

Group STE provides the Technical Authority for Network Rail owning, developing and maintaining strategies, policies, standards, processes and tools and undertaking industry co-ordination across Network Rail's key technical areas. These areas are: Engineering and asset management; maintenance; operations principles; health and safety; security; sustainable development; quality; information management; and technology and Innovation.

The Technical Authority provides an assurance framework to ensure risks are managed to an acceptable level and that capability and competency continue to be developed for the safe, reliable and effective functioning of infrastructure assets. It includes setting the framework and requirements for monitoring, assurance, investigation and benchmarking activities and deriving and acting on intelligence from monitoring, assurance, investigation and benchmarking activities as part of a continual improvement cycle.

The Technical Authority serves the Routes and System Operator both directly and through the Route Services Directorate, Infrastructure Projects and the Digital Railway. Group STE works closely with the GB rail sector to ensure the technical authority function is delivered for the whole railway system. In particular providing technical leadership including setting standards through the System Interface Committees established by the Railway Safety Standards Board and through the Technical Leadership Group cosponsored by the Rail Delivery Group and Rail Supply Group.

Group STE collaborates with European and international railway organisations - and with technology organisations and infrastructure managers across other sectors - to share best practice, innovate and co-invest to research, develop and productionise technology applications for a better railway.

Services

Two types of service are provided: managing targeted national programmes and providing expert services. These support Network Rail Routes to manage performance for a safe, reliable, affordable and growing railway. The value from services is ultimately realised for rail passengers and the economy through route delivery plans and, more widely, through the plans of freight and passenger train operators and suppliers.

Managing targeted national programmes

Five national programmes deliver enhanced capability improvement in line with route priorities.

1. Driving performance through Intelligent Infrastructure

Intelligent Infrastructure will improve asset management across Network Rail; eliminating failures through product and maintenance regime design and capturing, analyzing and exploiting asset data to make better planning decisions about investment in our assets. Ultimately the goal is to improve the availability of the infrastructure by supporting the Routes to achieve a greater than 6.6 % reduction in the level of service affecting failures in CP6. This is achieved by understanding what is likely to go wrong when and the impact a failure will have on the operational railway so we can intervene before it impacts train services.

2. Driving safer, quicker access through Electrical Safety Delivery

The Electrical Safety Delivery (ESD) programme will reduce safety risks to track workers, reduce the impacts of achieving electrical isolation and improve the productivity of maintenance and renewal activities on electrified sections of the network. The programme brings together priority needs to improve the safety of our workforce and to drive down the costs of managing the railway in an environment where opportunities to access the railway are reducing.

3. Home safe plan, including everyone fit for the future

A safer railway is driven through changing the way we work and the way that passengers and the public interact with the railway. Our <u>Home Safe Plan</u> provides a structured approach to safety, comprising risk reduction projects covering Workforce safety, public safety, train accident risk, health and wellbeing, ergonomics and management systems. It is delivered as part of everyone's role through the Home Safe Plan and alongside the industry health and safety strategy 'Leading Health and Safety on Britain's Railway'. Key Programmes are run in close cooperation with the business, unions, industry partners and other stakeholders.

4. Responsible railway plan

A sustainable railway is driven through changing the way we work and the way that passengers and the public interact with the railway. It underpins performance and is led through integrated QHSE programmes. It is delivered as part of everyone's role through the Responsible Railway Plan. Key Programmes are run in close cooperation with the business, unions, industry partners and other stakeholders.

5. R&D portfolio including the European Shift2Rail programme

Research and Development (R&D) de-risks technology. It builds the business case and supports first in class deployments, leading to new capability to improve safety, reliability, cost efficiency and growth. Our future success is critically dependent on the right investment in R&D and as a result each R&D project has a Route business sponsor to ensure the developing projects meet their requirements and deliver the required benefits. The R&D portfolio is aligned with the industry's R&D plan that was developed under the Rail Delivery Group and Rail Supply Group for the whole railway system.

Providing expert services

Expert services are provided across a range of technical areas to promote efficient best practice in many areas in line with international leading approaches, supporting consistency across route businesses and bringing a single voice to positioning technical interests for the GB railway.

• **Technical Authority** Own, develop and maintain strategies, policies, standards, processes and tools and industry co-ordination

- A Engineering and asset management
- B Maintenance
- Operations principles
- D Health and safety

- Security
- Sustainable development
- Quality
- Information management
- Technology and Innovation
- Management system, Assurance Framework and investigation requirements
- Capability & Competency Development

2. Managing targeted national programmes

- A Driving performance through Intelligent Infrastructure
- B Driving safer, quicker access through Electrical Safety Delivery
- C Home safe plan
- Responsible railway plan
- R&D portfolio (including Shift2Rail)

Providing expert services

- Modelling, analysis and benchmarking
- Testing and trialling facilities

The Technical Authority defines and oversees how we run a safe and reliable railway. The scope extends across 9 key technical areas where Group STE owns, sets, develops and maintains strategies and policies in line with business objectives. This encompasses standards, processes and tools and industry coordination through primary points of contact.

The Technical Authority builds understanding and oversight of key risks by establishing, maintaining and enhancing the risk control frameworks including ownership for system risks and setting the framework and requirements for monitoring, assurance, investigation and benchmarking activities. Learning is achieved by deriving and acting on intelligence from monitoring, assurance, investigation and benchmarking activities as part of a continual improvement cycle.

We provide frameworks against which the organisation develops the technical capability of our people.

To complement the Technical Authority role, Group STE offer two types of service:

The 5 **targeted national programmes** deliver enhanced capability improvement in line with stakeholder priorities: Driving performance through infrastructure; driving safer, quicker access through Electrical Safety Delivery; Home Safe Plan; the Responsible Railway Plan; and the R&D portfolio.

Our **expert services** provide specialist support in response to route needs. Services also contribute to wider industry needs to fulfil duties under our licence and contribute to the role of the railway across transport and industrial strategy to build a better Britain. Figure 1 - Key elements: Roles, needs and targets

Key Targets For CP6

Top priorities for route customers, stakeholders and funders are reflected through 7 key targets for a safer, more reliable, more cost efficient and growing railway. These cover asset availability, exploiting technology, developing new technology solutions; carbon reduction, health, safety and wellbeing of our workforce and safety of trains and level crossings.

Customer, Stakeholder & Funder Needs

Route, stakeholder and funder priorities are shaped, developed and delivered across 4 key communities: Asset management; Quality, Health, Safety and the Environment; Technology & Innovation; and Security and Information

Technical Authority

The Technical Authority defines and oversees how we run a safe and reliable railway. The scope extends across key technical areas where Group STE owns, develops and maintains strategies, policies, standards, processes and tools and industry co-ordination.

Managing Targeted National Programmes

The 5 key national programmes deliver enhanced capability improvement in line with stakeholder priorities: Driving performance through Intelligent

Infrastructure; driving safer, guicker access through Electrical Safety Delivery; Home Safe Plan; the Responsible Railway Plan; and the R&D portfolio.

Providing Expert Services

Health S. Nental Our expert services provide specialist support in response to route needs. Services also contribute to wider industry needs to fulfil duties under our licence and contribute to the role of the railway across transport and industrial strategy to build a better Britain.

New Technology Improve Asset Availability Asset Management and Operations



Technical Authority

- assuring a safe and reliable railway

2.

3.

Reduce Energy

Carbo

Security and Information

Managing Targeted National Programmes

Providing **Expert Services**

Quality, Health, Safety & Environment

Reduce Train Accident Risk

Reduce

afety Risk

8

Technology Innovation

Reducesing

Workforce

Section 3: Objectives and Stakeholder Priorities Key Targets for CP6

Figure 2: Key targets for CP6

Improvement area	Objectives	Target	Enabled by	Comment
Health and wellbeing of our workforce	To reduce mental health related sickness absence	A reduction of 25% in occupational and part occupational component of mental health absence instances from the average CP5 exit baseline, by the end of CP6.	Home Safe Plan	The mental health and resilience project will continue into CP6 with a further focus on training, education and deployment of wellbeing ambassadors to achieve a supportive health culture in the workplace. Our long term aim is to reduce occupational related mental health sickness absence, such as work related stress, which currently stands at an average of 373 instances per year. We will also focus our efforts on reducing the stigma associated with mental ill health thus encouraging open and honest discussions at work. We aim to decrease the reporting of non-classified condition sickness absences, which in turn, will allow us to accurately report the true impact of mental health related sickness absence and other health conditions.
Safety of our workforce	To further reduce workforce safety risk	A further reduction in the Lost Time Injury Frequency Rate (LTIFR) to 0.17 for each Route	Home Safe Plan	To keep improving workforce safety our focus will be on both technical improvement, maturing behavioural safety, implementing a new integrated management systemand the delivery of projects through the Home Safe Plan and local route plans, with all projects selected based on risk. The key focus areas will be: • Safer trackside working • Safety leadership • Fatigue risk management • Integrated management system
Safety of trains	To further reduce train accident risk	A further 10 % reduction in train accident risk from the CP5 exit baseline	Home Safe Plan	This reduction will be achieved primarily through improved inspection techniques, better asset management and further improved operations and risk management. Within CP6, Network Rail have identified over 50 key initiatives to continue to reduce train accident risk. The key contributors to this reduction will be: • Improvement to the way we inspect, maintain and renew our drainage assets • Targeted vegetation management • Measures to reduce the risk of underbridge scour at higher risk sites • Further risk targeted investment and remediation of our structures assets • Further level crossing risk reduction initiatives • Review of our solid state interlocking signalling assets
Safety at Level Crossings	To further reduce level crossing risk	A further 5% reduction in level crossing risk from the CP5 exit baseline	Technical Authority	Whilst there is no 3rd party funding available for CP6, routes will continue to invest in improving the safety of level crossings. In CP6 we aim to reduce level crossing risk by a further five per cent, taking into account the predicted growth in rail services, the number of road journeys continuing to rise and localised pressure from population growth. This will be achieved through targeting higher risk user-worked and footpath crossings, automatic half barrier road crossings, open crossings and some bridges and diversions to enable closure, with each decision being tested using ALARP principles. The key contributors to this reduction will be: Installing overlay systems at passive crossings, replacing telephones and whistleboards where possible • Renewing automatic level crossings with safer designs • Development and rollout of automatic full barrier crossings • Red light safety cameras • Risk-based closures where opportunities arise • Targeted level crossing safety awareness campaigns
Eporary & Carbon Lovols	Non-traction energy reduction	A further reduction of 18% from the CP5 exit baseline	Responsible	To play our part in delivering the UK's carbon emission reduction targets, we will continue to become more energy efficient and reduce our carbon emissions by supporting
Energy & Carbon Levels	Carbon reduction from non- traction operations	A further reduction of 25% from the CP5 exit baseline	Railway Plan	management standards.
Asset Reliability	To improve the availability of the infrastructure, supporting the routes to achieve a reduction in the level of service affecting failures in CP6	Greater than 10 % reduction in the level of service affecting failures by the end of CP6	Driving Intelligent Infrastructure	A critical factor underpinning train performance is the reliability of Network Rail's assets. By the end of CP5, we are forecasting to have reduced the number of service affecting asset failures by 17 per cent. This reflects the benefits of devolution with local teams having a better understanding of their assets, enabling better targeting of maintenance and renewals. Routes are forecasting to reduce the level of service affecting failures by a further 6.6 % during CP6. This is lower than the levels achieved during CP5, which included an improvement of 11 per cent in the first two years of the control period. This reflected an improved focus of asset management activities on critical assets. As a result, we achieved a step change reduction in failures. The improvement in asset reliability will be achieved through continuous improvement and our Intelligent Infrastructure programme, which has been at the heart of Network Rail's strategy for many years. We are unquestionably leaders in the way we use train-borne inspection devices to monitor the condition of track such as through the use of ultrasonic testing, machine vision inspection of track and eddy current crack sensing. Our ORBIS programme has transformed how we turn vast amounts of data into insight to optimise asset management decision making.
Technology and innovation	Solutions to improve future safety, reliability, cost efficiency and growth	Solutions forecast to realise a NPV of £1.6 billion over 20 years	R&D Portfolio	The R&D portfolio is focused on infrastructure R&D with over half the portfolio addressing improved asset sustainability. The target benefit is modelled as many of the solutions will be developed during CP6 for implementation in CP7. It assumes a baseline plan with £245 million NR investment matched with £112 million from third parties to give a total investment of £357 million in CP6. Benefits are adjusted taking into account their likelihood of success based on previous success rates of R&D and their Rail Industry Readiness Level (RIRL) maturity. Benefits also assume costs and timing for implementation and that plant and equipment (such as robotic equipment) can be manufactured and leased through external owners and not require major capital outlay by NR.

Section 3: Objectives and Stakeholder Priorities Key Targets for CP6

Figure 3 - Performance Meetings to manage stakeholder priorities



Section 3: Objectives & Stakeholder Priorities

Understanding Stakeholder Priorities

STE has a particularly large scale and complex relationship with stakeholders. STE's role is to simultaneously: provide assurance to the Executive, DfT, ORR and other regulators over the health, safety, security, information, environmental performance, the sustainability and reliability of the railway assets and the development and introduction of new technology; whilst offering services to support the Routes and other business areas mitigate risks and drive improvement for the benefit of customers. STE undertakes this dual role for 10 of Network Rail's 25 strategies as well as managing the live railway assets at the RIDCs and leading national programmes including Electrical Safety Delivery, Intelligent Infrastructure, Home Safe Plan, Responsible Railway Plan and the R&D Portfolio.

Figure 4 sets out the primary outcome under each of the 10 strategies and how these are measured. It also sets out their key stakeholders (including customers) and the primary ways in which those stakeholders and customers are engaged. Our dual role of providing both assurance and services means that understanding needs goes handin-hand with critical review and challenge within Network Rail and with external stakeholders. Needs from the Routes and central functions are understood and maintained through the mechanisms established under the Business Performance Management Framework (BPMF). A key vehicle to articulate these needs are challenge statements that guide technical development led internally in Network Rail and in the supply chain. 50 challenge statements are currently available on the <u>Network Rail website</u>. Needs from external stakeholders are established through engaging across a wide variety of external bodies.

Group STE operates to the Business Management Performance Framework (BPMF) which is our vehicle for driving continuous improvement in our overall performance. This is achieved through four components; a clear understanding of our roles and accountabilities, a robust framework of performance meetings, (fig 3) performance measures and reports and demonstration of the Network Rail behaviours. As such, the BPMF provides the framework against which stakeholder priorities for future expenditure are understood.

The Technical Authority role and stakeholder priorities for services are shaped, developed and delivered through dialogue with stakeholders from Routes, other central functions, industry and funders – the goal to support Routes to achieve high performance. This is formalised under the BPMF which provides the framework against which emerging cross-organisational priorities are understood so that the business has a unified understanding and alignment of continuous business planning process steps.

Within the BPMF stakeholders across the business are core attendees at 'Horizontal' integration meetings which align the performance needs of the Routes, and the services and solutions provided by Group STE. The BPMF meetings are not the only means of shaping, developing and delivering the Technical Authority and services – with engagement happening at many levels - but all decisions on priority needs are governed through this formalised meetings structure.

The key process for Executive, Route customer and other stakeholder governance of the Technical Authority and services are set out under : asset management; quality, health, safety and the environment; technology and innovation; and security and information.

Asset Management

For the Chief Engineer the insight from stakeholders is brought together under the asset management committee which ensures Network Rail has the right national strategies, policies and strategic initiatives to improve the Asset Management system, now and in the future. It is attended by the Chief Engineer, Route Managing Directors and Managing Directors from the Directorates. The process under the asset management committee (see Figure 5) includes asset managers and directors from the route businesses and engineering directors from Infrastructure Projects. Priority actions are informed from assurance data and trends from the level 2 risk assurance review and Chief Engineer assurance review meetings, establishing a focus on the top 5 issues for each professional head. At executive level, this is driven from the Business Assurance committee. Integration under the BPMF is summarised in Fig 5.

Section 3: Objectives & Stakeholder Priorities

Understanding Stakeholder Priorities

Quality, Health, Safety and the Environment

For the Chief Quality, Health, Safety & Environment Officer, stakeholder insight is brought together under the Quality, Health, Safety and Environment (QHSE) Committee. It is attended by Group STE Director, Route Managing Directors, Managing Directors and Chief Financial Officer. The process under the QHSE committee includes feedback from the periodic Route Operations and IP business reviews, the Integration Review Group and from the National Health, Safety & Welfare Council (attended by Trades Unions health and safety representatives). The quarterly National Safety, Health and Environment Review Group (NSHERG) meeting, attended by senior functional representatives is responsible for endorsing policies, strategies and plans to manage safety, health and environment risks and opportunities. The periodic Safety, Health & Environment (SHE) Integration Review meeting, attended by Route and IP heads of SHE provides a forum for engaging with the SHE community across the business and is attended by Heads of Route Safety Health & Environment and Heads of Safety & Sustainable Development from IP. Expected

outcomes are; proposed QHSE strategies, changes to policy and standards, and a portfolio of initiatives for QHSE Committee approval. Key QHSE challenges, opportunities and Priority actions are informed by the Safety, Health and Environment Performance (SHEP) report including: key SHE KPIs and metrics; 'deep dives' into specific workforce, train and station safety, public safety, health and wellbeing and environment risk themes; and the findings from assurance activities which are also considered at the Business Assurance Committee. Stakeholder insight for quality is provided through the quarterly Quality & Continual Improvement Board.

Integration under the BPMF is summarised in Fig 6.

Information and Security

For the Chief of Operations, Security and Information priority actions for security are informed by the Route Security and Resilience Councils and through the enterprise risk Business Assurance Committees, along with KPI and incident reporting from Network Rail's Fusion unit within the British Transport Police. In addition to the Network Rail Routes, DfT as the railway security regulator and the Train Operating Companies are significant stakeholders in railway security. Their priorities are informed through the regulations set out in the National Railways Security Programme, formal Security Risk Assurance Matrices, owned by DfT and developed cross industry, and by the industry Policing and Security Group and the National Railway Security Council.

The priority from an information perspective is to be able to share and create more value from the data with our partners, suppliers and general public whilst ensuring we meet all our regulatory obligations. We engage with a network of Information Risk Owners and Information Champions in the Routes to help us understand their challenges and to ensure the development of information management processes and tools (such as the Information Asset Register, Knowledge Information and Data Competency Framework and Information Maturity Assessments) reflects route needs. Alongside this there is Route representation on the Information Steering Group which provides strategic direction to the whole organisation. Figure 4 - Outcomes and measures for the 10 strategic areas and RIDC facilities

Strategic area / facility		Outcome	Measure	Customers	Customers engaged through:
Technology (including R&D)	Chief Rail	Enable routes to deliver a more passenger-friendly, reliable, cost- efficient and safer railway	Benefits from R&D portfolio	Route Businesses, System Operator, IP, Route Services, Digital Railway, DfT, Transport Scotland, regional government, BEIS (industrial strategy)	R&D portfolio delivered as a sets of change programmes with all projects having an identified route customer. External customers engaged through a new advisory board and an Innovation Leadership Group, Governance
Innovation	Technology Officer	Improve pace, ambition and engagement with ideas to action as part of a high performance culture	Innovation Maturity Assessment	All Network Rail Businesses, All Suppliers, TLG, CDP, Group STE Investment Panel	brings together inout from internal and external customers to prioritise and review the R&D portfolio. Suppliers engaged with opportunities through our published challenge statements.Innovation Leadership Group, R&D Board, Innovation Community of Practice
Engineering & Asset Management		Improve maturity in asset management including optimal decision-making	ISO 55001 alignment, AMEM score, Asset Data quality score, Service affecting failure	Route Businesses, IP, Digital Railway, Group STE	Asset Management Framework Committee and Operations Framework Committee, Heads of Maintenance Delivery periodic meeting, Intelligent Infrastructure governance group the Directors of Route Asset
Maintenance	Chief Engineer	Maintenance delivered efficiently and effectively with service affecting failures trending to zero	Opex reduced by 2.5 % , reducing Service Affecting Failures	Route Businesses, IP, Digital Railway, Group STE	Management meeting, UK Engineering Directors Meeting (HS2, TfL, CrossRail, HS1), Technology Leadership Group, System Interface Committees, ISCG, TPSG and Heads of Operations Delivery meeting. National Asset Management Review, Asset Technical Reviews & Engineering Strategy
Operations Principles		Reduce train accident risk and contribute to reduced DPI through increased operational control	Operational close calls Delay minutes	Route Businesses, IP, Route Services, Digital Railway, Group STE	Meeting. Suppliers Engineering Directors forum, Rail Delivery Group & National Task Force (the train operators Group)
Health & Safety		Improve maturity in health and safety risk management and achieving Everyone Home Safe Every Day and Everyone Fit for the Future	RM3 score, Health & Safety KPIs	Route Businesses, IP, Route Services, Digital Railway, Group STE	
Quality	Chief Quality, Health, Safety and Environment Officer	Stronger systems through integrated management, better assurance and structured improvement	Employee Engagement, Compliance / Non-Conformance levels, Improvement Capability level	All Network Rail Businesses, All Suppliers, ORR	Route Operations and IP business reviews, Integration Review Group, National Health, Safety & Welfare Council, Quality & Improvement Board, industry System Safety Risk Group
Environment & Sustainability	Uniter	Improved maturity in measuring and managing environmental and social risks, and increased socio-economic benefits to local communities	Lineside neighbour complaints, ISO 14001 and ISO 50001 alignment, progress towards zero emissions, E&SD KPIs	Route Businesses, IP, Route Services, Digital Railway, Finance, Property	
Security		Reduced losses from security incidents through a formal systematic approach	Level 1 security risks, Departmental Security Health Check (DSHC), DfT inspection report, KPI reporting	Route Businesses, IP, Route Services, HR, Digital Railway, Group STE	
Information Management	Chief of Operations, Security & Information	Improved maturity in information management through enterprise wide information governance Meet regulatory requirements on information management (eg GDPR, information security, Freedom of Information) and DFT's Joint Rail Data Action Plan	Information risk assurance, Information Asset Register, Enterprise Content Management	All Network Rail routes and central functions, All Suppliers, TOCs, FOCs, ORR, DFT, the general public, Value from Data work package	Establishing formal governance structures and a management system that provides clear roles and accountabilities DISIC, Industry Senior Information Risk Owner group, Information Steering Committee. Innovation Leadership Group, R&D Board, Innovation Community of Practice
Rail Innovation and Development Centres		Safe and operationally representative rail test centres for the Rail Industry	Long Term Injury Frequency Rate; Customer pipeline at capacity; income generated services the cost of operating and maintaining both facilities, including a contribution to the renewals and enhancements to sustain and grow the capabilities of both test centres	STE, IP, Route Services, Digital Railway, Asset Information Services, NR Telecoms, Government bodies (DFT, ORR, RSSB, RAIB, BEIS, DCMS (for telecoms), Shift2Rail), Academia (UKRRIN, universities, research organisations, industry collaborators, other test facilities), RSSB, operations & maintenance contractors, train manufacturers, TfL, London Overground, London Underground, Freightliner	RIDC strategy and capacity rail industry workshop, Industry Working Groups, R&D Board

Section 3: Objectives & Stakeholder Priorities

Understanding Stakeholder Priorities

Technology and Innovation

The Chief Rail Technology Officer (CRTO) has established R&D priorities with industry at a whole railway system level. These were developed under the Rail Delivery Group and Rail Supply Group for the whole railway system, reflecting the needs and views of customers, funders and stakeholders. The priorities are set out in the industry's R&D plan and the Rail Technical Strategy Capability Delivery Plan. Under the CRTO the application of technology to the railway through innovation is brought together and delivered under a single integrated R&D portfolio to meet railway needs from new technology across Network Rail. The R&D portfolio, as managed by Group STE, is aligned with, and makes a substantial contribution to, the industry's R&D plan. The R&D portfolio has one Executive sponsor – the CRTO supported by an R&D Board with participants drawn from across Network Rail including senior representation from Routes. Each programme within the portfolio has a chief of specialist area as Senior Responsible Owner with Routes engaged as lead customers across the R&D programmes. Advice from industry customers, stakeholders and funders is achieved through an industry advisory group.

We have engaged heavily with: the National Infrastructure Commission to shape the development of the National Infrastructure Assessment; the Rail Supply Group to develop the Sector Deal now in place with the Department for Business, Energy and Industrial Strategy and the Department for Transport to support its Strategic Vision for Rail published 29 November 2017.

Figure 5 - Governing Asset Management priorites



Figure 6 - Governing Quality, Health, Safety and the Environment priorities











Section 3.1: The Technical Authority

Overview

The role of the Technical Authority defines and oversees how we run a safe and reliable railway. Group STE will drive excellence as a technical authority through CP6, assuring the Network Rail executive team and Board and supporting routes by owning, developing and maintaining policies, standards, processes and tools and undertaking industry co-ordination across the Technical Authority Areas - The Technical Authority scope. The Technical Authority drives implementation through an assurance framework that is being extended across all these areas through an Integrated Management System and through managing the technical capability and competency development of our people.

Summaries of key challenges and risks, actions to address and the difference these are expected to make are summarized for The Technical Authority areas in Section 4. Outcomes and measures across these areas are shown in Figure 4.

Security

Quality

Sustainable development

Information management

Technology and Innovation

Technical Authority Scope

- A Engineering and asset
- management Maintenance
- Operations principles
- Health and safety





managed fairly and optimised for the benefit of all. The Technical Authority informs the System Operator of new developments and ways of working, providing valuable feedback to the network capability and strategic planning processes on future technical capability and costs as well as system-level design for early stage programme development

Setting strategic direction and policy in line with business objectives

The Technical Authority, in consultation with a wide range of internal and external stakeholders including the government, wider industry, customers and the System Operator, undertakes a key part in establishing and agreeing the overall business objectives from a corporate perspective. From these objectives it is able to set the overall future strategic direction and define the associated policies in line with its scope. Examples of these include the Rail Technical Strategy, the Transforming Safety & Wellbeing Strategy, Asset Management Strategy and individual Asset Policies.

Section 3.1: The Technical Authority

Management system, assurance framework requirements

Providing, improving and integrating our management systems

Group STE provides a core structure to the management systems within which the Routes and other business functions have flexibility to operate. Our Technical Authority role provides Network Rail's management systems across the Technical Authority areas. Whilst there are established management systems already in place, such as the Health & Safety Management System and Asset Management System, they need to be formally reviewed on a regular basis and there is an ongoing need to improve and integrate the systems. This is being achieved through the development and introduction of an Integrated Management System (IMS).

The IMS will ensure the full scope of the Technical Authority is addressed through a joined up framework that is pro-active, risk-based and aligned to international best practice for driving performance, efficiency and customer and stakeholder satisfaction. With the introduction of the integrated management system we will, for the first time, have a consolidated view of our business process architecture which will enable us to identify our highest risk processes and the ones which simultaneously deliver the most value for our Route customers whilst improving compliance.

What will the Integrated Management System offer for Network Rail?

- The mechanism for devolution providing a framework for routes to define methods for delivery to suit their local operating conditions whilst still conforming to mandatory requirements. This provides the opportunity and flexibility for agile decisions to be made by the people closest to the work.
- Clear high-level policies for core business areas in conformance against the requirements of a number of ISO standards (9001, 14001, 45001, 55001 as a core)
- A consolidated view of our operating model in terms of our processes and how they fit together to deliver value for our customers, and also a clear understanding of each of the characteristics of those processes and how they operate such as the accountabilities, responsibilities, inputs/outputs etc.
- Content required to discharge our identified processes, organised, presented and stored in a simple and accessible way for users to access and understand with ease through a single repository.

Having this enterprise-wide consolidated view of our management system provides a platform to adopt a more proactive, risk based approach to both our assurance and improvement initiatives. By understanding our risks and how they relate to our processes in our management system, we will initiate targeted, informed programmes to improve compliance and performance for the future. The implementation of our first generation system at the start of CP6 will enable us to build maturity in this area, and embed the approach outlined in order to improve the value we deliver to our customers. This allows us to deliver a targeted programme of process improvement, ensuring processes are delivering to their optimum, and associated KPIs provide us with early warnings that allow us to address processes before risks become reality.

This will require an increase in scope of the Level 2 Assurance. It will cover the entire management system and not just be focused on Engineering, Operations and Health & Safety.

Measuring quality

Network Rail has a well-established scorecard which is the basis for managing performance. This scorecard will be supported by the development of Network Rail's Key Performance Indicators for Quality. The Quality KPIs will focus on quality performance including cost of non-

quality, non-conformances, re-work, corrective actions and customer complaints. These KPIs will inform and prioritise improvement work at a national and local level.

Assurance framework

The effectiveness of, and compliance to, the policies, process and standards in our management system is measured by our assurance activities. These clarify risks and help to direct improvement activity. Network Rail has established models of assurance, which will be improved by linkages between processes and ISO standards and legislation as well as links between organisation and processes in the Integrated Management System. The improvements will lead to clearer and more valuable system and compliance audits at all levels of the organisation. The aim is to drive value based audits and investigations – not just focusing on each individual finding when an audit or investigation is performed but also looking at what the information combined tells us through trends and analysis providing input at a strategic level. Our assurance services are outlined below:

- Functional audit programme currently delivered against our existing engineering standards and controls framework in delivery units, managed stations, operations, works delivery and cross functional audits.
- Engineering verification programme delivered in conjunction with the functional audit prrogramme.
- Principal Contractor licensing Site audits of where are principal contractors are working to ensure compliance against our frameworks.
- Plant operating scheme (POS) audits (jointly with RISQS)
- Recommendations Management placement, management and facilitation of recommendations made internally, from ORR and RAIB.
- Incident Investigation provide independent investigation service where the incident is deemed L3.
- Product Acceptance ensures safety critical products are fit for purpose on the operational infrastructure
- Affected Party Assurance Certification for new trains

 fulfills obligation sunder the Railways & Other
 Guided Transport Systems Regulations (ROGS

Understanding and oversight of key risks

At the heart of the management system is the need to have a sound and complete understanding of risk relating to the business objectives. This provides focus in determining where efforts are best applied in identifying and implementing controls to both sustain and improve upon current business performance. It is important that the Technical Authority has a good understanding of the associated costs to establish how this can be achieved through the most effective means.

The Technical Authority has 'professional heads' for each of its disciplines, supported by subject matter experts, who have a detailed understanding and overview of risk at national level. In addition to the insights gained from the performance monitoring and learning elements of the management system, much of this knowledge is gained through established interfaces with the Routes, other Network Rail directorates, RSSB, Rail Delivery Group members, suppliers and other industry partners.

Establishing and maintaining the baseline risk control frameworks

Underpinning the policies set by the Technical Authority are the detailed requirements of the control framework which are aligned to the key risks. These risk control frameworks are owned by the relevant 'professional head'. Whilst some requirements are detailed in legislation or Railway Group and Industry Standards, the majority are captured within Network Rail's suite of company standards and processes. The Technical Authority provides the baseline requirements for the Routes and business functions, some of which are mandatory whilst there are others for which agreement to implement alternative controls can be sought.

Enhancing the risk control frameworks

In order to continually improve there is a need to regularly review the baseline control frameworks to determine whether there are better ways of working. The Technical Authority has a key role in this through commissioning research, seeking innovative solutions, sponsoring and enabling technology development, and approving products and systems for use. It achieves this through its established relationships with universities, innovation centres, RSSB, European and other international railways, the supply chain and other industry partners. An example of this is the industry Technical Leadership Group that creates and maintains the technology vision for the railway in Great Britain, facilitates the delivery of innovation, and explores system wide and boundary interface issues.

The Technical Authority also undertakes benchmarking and encourages the sharing of good practice, alongside structured continual improvement of business processes, tools and methods, as a means to improve overall effectiveness and efficiency of the risk controls. Examples include use of the Asset Management Excellence and Rail Management Maturity Models.

Learning from performance monitoring, assurance activities and investigations

The Technical Authority collates and analyses data at national level across its scope. A quarterly analysis of assurance outputs and of the key points from the analysis and review of level 1 assurance activity outputs is led by Group STE and reports into the National SHE Review Group.With support from Group STE, each route is developing plans to improve the collation and analysis of the outcomes from their assurance activities.

The level 2 functional audit programmes provide valuable learning to our engineering colleagues and offer insight into where our processes and procedures may require improvement to enable our colleagues to better discharging them on the ground.

Continued performance monitoring enables trends to be examined and causes to be identified, providing feedback for owners to maintain and develop their risk control frameworks. This is further supplemented by intelligence obtained from assurance activities in relation to the implementation and effectiveness of the controls including learning obtained from investigations into incidents. The Technical Authority also tracks the implementation of national level investigation recommendations and assurance actions.

Learning from incidents

Group STE defines the policy, procedures and competence arrangements for reporting and investigating all safety events across the company. These events are investigated according to their potential to cause harm.

A fair culture policy sets out how safety investigations will be undertaken in conjunction with the relevant Trades Unions. Recommendations to improve policy, procedures, competence arrangements and technology improvements are reviewed at a national level and allocated to lead managers to progress. There are robust processes and assurance in place to ensure that actions against these recommendations are closed out and sustained through our audit and assurance frameworks.

By leading use of the Risk Management Maturity Model (RM3), Group STE helps the business identify strengths and areas needing structured continuous improvement. We work collaboratively with our Route colleagues to develop improvement plans against the RM3 model and are a key stakeholder with RSSB in the model's use and development.

Developing the capability of our people

The Technical Authority has the role of developing the capability and competence frameworks in relation to the disciplines within its scope for the company as a whole. This includes establishing talent and progression pipelines both within the company and also working with others such as universities, schools and professional bodies to be able to provide the people that will meet our future needs. It also has a role in establishing professional communities for the disciplines across the company, examples of which include the Route Asset Manager forums and Safety Health & Environment Integration Group.

Figure 8 - Risk Management and Maturity Model



Section 3.2: Managing targeted national programmes

2A: Driving performance through Intelligent Infrastructure

The Intelligent Infrastructure programme is a strategic initiative to improve asset availability across Network Rail; eliminating failures through product and maintenance regime design and capturing, analysing and exploiting asset data to make better planning decisions about investment in our assets.

Ultimately the goal of the programme is to improve the management and availability of the infrastructure, supporting the routes to achieve a minimum national position of a 6.6 % reduction in the level of service affecting failures in CP6 by:

- Understanding the likelihood of individual asset failure
- Forecasting the impact this would have on the operational railway
- Predicting when failure will occur
- Planning intervention prior to service disruption

Safety improvements, and other benefits, will be delivered alongside the performance improvements, with the introduction of more effective work planning, reducing the exposure of staff to the operational railway. The programme will build on existing capabilities across asset management and the maintenance lifecycle to improve maintenance maturity. Research, development and technology innovations will be utilised to enhance capabilities. This will be enabled by:

- Developing solid data and systems foundations
- Modernising maintenance and product standards to align with cross-industry best practice
- Enhancing the autonomous monitoring footprint to provide predict and prevent capabilities
- Exploiting data sources across all Routes to more effectively manage asset availability and improve decision support capability
- Providing Route teams with tools to efficiently plan maintenance
- Enhancing our people's experience using enterprise solutions to provide a single source of truth, including making Ellipse the core of all asset management activity

The II programme is an evolution of several workstreams initiated in the CP5 ORBIS, Ellipse Exploitation and Maintenance Effectiveness programmes, which are brought together to form a single integrated programme. This approach will enable a business transformation focussed on culture and people, with a strong alignment to Routes' initiatives and priorities. The programme scope and benefits will be enabled through a number of projects that will be delivered across the CP6 period.

These projects are categorised as:

- Core enablers, including Data Governance and Validation and Ellipse foundation work
- Essential Systems Renewals across Disciplines and Monitoring
- Planning Projects such as Asset Lifecycle planning and Planning Organisational Change
- Optimisation Projects including Systems Modelling
- Discipline centred projects

Programme definition work is complete and delivery arrangements are being put in place to allow the project to start on day one of CP6. The Programme is working closely with ATRs and Routes to ensure a roadmap of change that supports their business plans and enables the Routes to manage their assets more effectively and efficiently. 3.2A

Figure 9: Key elements of the Intelligent Infrastructure programme



Figure 10: Expenditure and benefit for Intelligent Infrastructure



Overall Programme Cost and Benefit

Section 3.2: Managing targeted national programmes

2B: Driving safer, quicker access through Electrical Safety Delivery

The Electrical Safety Delivery (ESD) programme forms part of the Home Safe Plan and is driven by an urgent need to mitigate the Level 1 electrical power risk "Failure to deliver and implement an effective electrical system management framework leading to a serious safety incident, non-compliance to legislation, prosecution and significant rise in programme costs." ESD was endorsed by NR's Executive Committee in February 2015.

ESD aims to reduce safety risks to track workers, reduce the costs and impacts associated with achieving electrical isolation and improve the productivity of maintenance and renewal activities on electrified sections of the network. The productivity gained through the implementation of ESD initiatives is an average time saving of 40 mins per possession. The programme brings together priority needs to improve the safety of our workforce and to drive down the costs of managing the railway in an environment where opportunities to access the railway are reducing. The ESD programme spans CP5 and CP6. In CP5, investment is focussed on installing assets to help improve compliance with the Electricity at Work Regulations (EaWR) and improve electrical safety on the DC electrification system. In CP6 the ESD programme will build on trials carried out during CP5 on the 25kV AC electrification system. It will install or renew remotely controlled and electronically secured assets that will reduce electrical safety risk, improve compliance and improve the efficiency of taking electrical isolations. The spend and benefits profile are shown in figure 11; and the change in capability, route by route, is shown in figure 12.

ESD Provides 50% reduction in electric shock risk specifically:

- Eliminating, or reducing the use of, AC earthing straps and DC shorting straps which are high-risk with life threatening consequences; and
- Reducing the need for work to be undertaken with overhead of third rail electrical conductors live through the ease and speed of isolations

Marginal benefits are also available from reductions in incidents from manual handling and road traffic accidents.

The benefits are clear when viewed in the light of challenges facing a route. Wessex faces substantial challenges that can be unlocked through ESD.

- Risk issues when accessing the infrastructure to carry out isolations including contact with electricity, contact with trains, slips, trips, falls and manual handling and driving.
- Performance issues from a backlog of maintenance and renewals and train service affecting failures.
- Productivity issues from restrictive mid-week night access windows, insufficient working time to complete tasks in one shift, constraints from the need to maintain a core overnight freight service to Southampton. ESD offers solutions which are summarised in figure 13.

Figure 11: expenditure and benefit for ESD



Figure 13: summary of solutions offered by ESD



- Significantly reduces the need for short circuit straps less driving, less accessing the infrastructure, less manual hand
- Provides secure and reliable protection with safe and easy operation
- Significant Reduction in the use of Sub Contractors
- Faster Isolations providing more working time
- Increased Standardisation of isolation plans
- Standardisation of diversionary train routes & berthing arrangements
- Less disruptive access
- A shift to more planned access and less late notice change



- 20% increase in available working time per mid week night access
- Better deployment of mainenance teams
- More work achievable per isolation, allows better packaging of work
- More miles and work per rail machine shift (i.e. HOBC, Rail Grinder)
- Capability to gradually reduce backlog cycle

Figure 12: status of ESD

Scotland

- CME installation
- Single Approach OLE implementation
- Remote Securing implementation

LNE

- CME installation
- Single Approach OLE implementation

Anglia

Single Approach OLE implementation

South East;

• 1500 CMSds installed

LNW

- Single Approach OLE implementation
- Remote Securing implementation
- 61 CMSds installed
- 898 CME installed

Western

- Single Approach OLE implementation
- Remote Securing implementation

Wales

- Single Approach OLE implementation
- Remote Securing implementation

Wessex;

- Single Approach implementation
- Remote Securing implementation
- 606 CMSds installed

National;

- Single Approach OLE national implementation
- Single Approach DCCR develop/ national implementation
- Single Approach HV development/trial
- Electrical Design Standard updates

Future Potential - DC Safer Isolations technology is designed to take advantage of remote securing. A suitable emote secure solution will enable even more performance, safety and compliance benefit to be realised from his investment.

NB: % coverage refers to progress toward remote operation

CME – Circuit Main Earthing CMSd – Circuit Main Short Device GBV5 – Green Book Version 5

Section 3.2: Managing targeted national programmes

2C: Home Safe Plan

Key Targets under this investment are to:

- Build on the forecast 15 % reduction in risk to the public at level crossings in CP5 by targeting a further 5 % reduction by the end of CP6.
- Reduce occupational and part occupational component of mental health related sickness absence by 25 % from the average CP5 exit baseline, by the end of CP6.

Key projects in the Home Safe Plan for CP6 are:

- Level Crossing Risk Reduction
- Safer Trackside Working
- Manual Handling
- Suicide Prevention
- Fatigue Risk Management
- Mental Health and Resilience



Reducing the risks of Trackside Working

The Safer Trackside Working Programme supports Network Rail's ongoing target to reduce the risk of track workers being struck by a train. It supports the Track Worker Safe Access Strategy, which is a phased risk reduction strategy delivered through the design, development and deployment of new higher integrity protection and warning systems.

Benefits from the Safer Trackside Working Programme are being realised in phases commencing with initial deployments of tactical solutions in CP5 to give some early reduction of risk. The second wave of benefit will be realised through deployment of further tactical solutions during CP6 and a third phase of benefit will start to be realised when strategic solutions are deployed as part of the deployment of digital train control technologies under the Digital Railway programme.

Leading proactive fatigue risk management in the rail industry

Fatigue presents one of the most widespread risks throughout the rail industry, with the potential to affect everyone regardless of role and location. Consequences can impact workforce, operational and public safety.

Group STE will provide processes and systems to support better understanding and management of fatigue risk. The introduction of a new standard that reflects the needs of the industry is the starting point, adopting best practice from recent successful standard implementation and supported by the provision of tools and guidance on fatigue risk assessment and rostering.

Manual handling

Learning from other process and service industries and driven by number of incidents caused by manual handling it is key to this programme that risks are identified and mitigated for all manual handling activities.

Vehicles will have to be adapted to avoid higher risk handling tasks. We have invested significantly in CP5 to better understand the significant risks, to develop and adopt practical solutions. In CP6 our focus will be on deploying safer equipment, better handling aids and more integrated solutions that reduce handling risks.

Suicide prevention

Around 250 people choose the railway each year to take their own life. The impact on their families and the railway staff involved at the scene is devastating; and the impact on passengers through train delays is disruptive and costly. Group STE manages an industry–wide world-leading programme, working collaboratively with external partners that has a track record of significantly reducing railway suicides, providing performance and wider societal benefits.

The CP6 programme extends proven interventions work and engaging with local health authorities and charities to further reduce the numbers of suicides. Campaigns will continue to extend the reach of interventions to the wider travelling public. The CP6 programme will also deliver further targeted deterrents such as fencing and patrols in areas with most incidents.

To supplement the planned suicide prevention strategy, we will work with the Samaritans to deliver a million hours of volunteering across the railway industry in a "Million hours challenge". We want to make sure that all railway staff are more aware of volunteering opportunities, want and know how to volunteer and are more easily able to volunteer for the Samaritans, so that a million hours of volunteering takes place over five years across the railway industry. We will also work with the Samaritans to make it easier for Network Rail and wider industry colleagues to volunteer.

Level Crossing Risk Reduction

Accidental deaths and injuries are now prevented, and the opportunity for access for trespass or deliberate selfharm are reduced, at 1100 closed level crossings. In CP6 level crossing risk reduction will move from focussing on level crossing closures to adopt an 'As Low As Reasonably Practicable'

risk-based approach. This will be efficiently achieved by deploying technology developed in CP5. Deploying active warning systems, avoiding communication errors, helping users take good decisions and deterring deliberate misuse will sit at the heart of the CP6 strategy. Development and deployment of a solution mitigating risk at the highest risk half-barrier crossings will be part of the programme. Encouraging responsible use will be achieved through education, communication and enforcement campaigns including further targeted roll out of technology and our continued partnership with the British Transport Police.

Mental Health and Resilience

Mental health continues to be one of the top causes of sickness absence within Network Rail and is equally recognised as one of the top national causes of sickness absence within the UK, with a significant impact on the

economy. At Network Rail, we lose on average 43,079 days to Mental Health absences each year. Whilst there are many variables which may lead to mental ill health, it has been identified, via Network Rail's Business Intelligence platform, of all mental health absence, an average of 373 instances can be attributed to an occupational or a part occupational element. An occupational element can be described as a perceived work-related component that is contributing to a workers decline in mental ill health ultimately resulting in absence. We are therefore committed in reducing occupational and part occupational components of mental health related sickness absence by 25 % from the average CP5 exit baseline, by the end of CP6. We will also continue to drive forward the deliverables and benefits of our Mental Health and Resilience project to address stigma, ensure that all staff have the necessary tools to understand mental health and wellbeing, provide the correct support services to those that are suffering with mental ill health and encourage accurate reporting of medical conditions.

Section 3.2: Managing key national programmes

2D: Responsible railway plan

The Responsible Railway Plan is a portfolio of projects designed to investigate, and embed, opportunities to improve the environmental, social and economic performance of the railway. Key targets for CP6 under this investment are to: reduce energy consumption by 18% to achieve a 25% reduction in the rate of CO2 emissions; zero (non-hazardous) waste to landfill and 90% waste recycled or re-used; compliant to ISO14001 and 50001; a target of biodiversity net gain for all infrastructure projects above £20 million value and a biodiversity risk assessment for all maintenance and renewals projects above £5,000 or 150m in length; Social Performance plans for all projects over £20 million; increased asset resilience to weather and climate change; and sustainable procurement practices.

Priority projects in the Responsible Railway Plan for CP6 include:

- Managing Carbon in Infrastructure
- Weather Resilience and Climate Change Adaptation
- Creating a Social Value Framework
- Biodiversity Information and Risk Management
- Managed Stations Recovery and Metering



railway plan

Managing Carbon in Infrastructure

Tools have been developed to calculate the carbon emissions during the life-cycle of certain infrastructure assets and, as carbon emissions are a good indicator of production and operational efficiency, it is possible to identify opportunities to improve efficiency and costs through the asset life-cycle. This project embeds carbon accounting into Network Rail's asset construction and operational activities thus contributing to the CP6 carbon reduction target.

Weather Resilience and Climate Change Adaptation

Adverse and extreme weather conditions significantly impact railway safety, reliability and performance causing an average of 1.5 million delay minutes per year at a cost of up to £300 million per year. The Weather Resilience and Climate Change Adaptation (WRCCA) programme will embed future weather consideration into business planning and asset management processes from CP6 increasing the resilience of the railway, improving safety and performance and reducing the cost impacts from weather events. This will be achieved by integrating WRCCA requirements into asset management frameworks and Route Adaptation plans and providing WRCCA quidance and expertise to decision makers.

Creating a Social Value Framework

Running Britain's railway is not just about transporting passengers from 'A' to 'B'; it is a vehicle for connecting communities, creating jobs, regenerating areas of social deprivation and driving socio-economic growth. Network Rail's social performance strategy aims to: create social value through design; be a considerate constructor during railway works; and leave a positive legacy for future generations. To measure success we need a way of measuring social value. This project creates a framework for the business to identify opportunities to create social value and evaluate its impacts.

Biodiversity Information and Risk Management

The discovery of unknown ecological constraints creates significant risks to the effective delivery of infrastructure development, asset renewals and maintenance schedules from unexpected costs or delays, legal action and reputational damage. While biodiversity information is routinely collected in advance of works, this is stored inconsistently in different locations across the business. This project creates a framework whereby biodiversity information is pulled together, centrally stored and used to identify and plan for potential ecological constraints.

Managed Stations Recovery and Metering

Utilities usage in our managed stations is complex. Numerous users, both internal and external to Network Rail rely on the supply of utilities to undertake their operations. These include retail tenants and Train Operating Companies (TOCs). Periodic changes and improvements to the managed stations over the years has led to a spaghetti of wiring, supplies and subsupplies which have become difficult to trace and monitor. This means that efforts to assign utilities usage to, and recover costs from, third parties have been problematic or nearly impossible in the past. This project establishes a robust meter/ tenant management system aligned to Network Rail's utility billing system and appraise options for a long-term sustainable solution to these problems.

Section 3.2: Managing targeted national programmes

Research and Development (R&D) de-risks technology. It builds the business case and supports first in class deployments, leading to new capability to improve safety, reliability, cost efficiency and growth. Network Rail's future success, and the future success of the railway as a critical part of Britain's transport system, is critically dependent on the right investment in R&D.

What we'll deliver through the R&D portfolio

The R&D portfolio is an integral part of our asset sustainability plan across all infrastructure assets including signalling. It delivers a substantially greater benefit to asset sustainability than applying the same investment to increase the delivery of renewals and benefits are sustained cumulatively through subsequent Control Periods. The R&D portfolio supports key objectives for the Routes beyond asset sustainability including network performance, safety, security, cost efficiency and network growth and generates an NPV of £1.6 billion over the next 20 years (CP6 to CP9).

It delivers improvements to support the policy objectives of the Department for Transport and Transport Scotland in areas such as asset performance with track, structures and earthworks, weather resilience and safety. The R&D portfolio supports wider government objectives, set out in the **UK Government's Industrial Strategy white paper** (published November 2017) and the Scottish Government's policy to increase inclusive economic growth, by connecting universities with industry through the UK Rail Research and Innovation Network, underpinning the growth of companies in the rail supply chain, supporting export opportunities and enabling the rail sector to compete domestically and globally in the future world where mobility will be offered as a service.

For CP6 we have brought together R&D activity across Network Rail under one portfolio to improve the way we manage and co-ordinate R&D, an approach supported by the ORR. The portfolio is centrally managed with strong engagement from the Routes as customers, engagement from heads in the Technical Authority as sponsors and advice from wider industry through a new industry advisory board. Key programmes under the R&D portfolio are shown in figure 14.

The R&D portfolio is funded from £245 million of capital investment by Network Rail matched with £112 million of third party investment, primarily from suppliers and other infrastructure managers, to give a total investment of £357 million. Funding from other infrastructure managers not only increases the return on investment but generates a shared commitment to success with other infrastructure managers and suppliers. The R&D portfolio is aligned with the **industry's R&D plan** that was developed under the Rail Delivery Group and Rail Supply Group for the whole railway system. Managing R&D under one portfolio simplifies our ability to co-ordinate with investment in R&D by wider industry to achieve improvements across the railway as a whole system.

How we'll deliver the R&D portfolio

R&D presents different risks and issues compared to renewals and enhancements. To improve the quality of governance for R&D, we have introduced improvements to reflect these differences including a gated process under the Rail Industry Readiness Levels framework which draws on best practice for R&D management from other industry sectors.

A major challenge with R&D is achieving both ambitious application of new technology whilst ensuring that the R&D products can readily be deployed. For CP6, our governance applies a framework, overseen by a cross-Network Rail group including Route customers, that looks beyond progress of the technology itself to ensure it is being industrialised to enable supply at scale and commercialised to enable uptake by Route customers. The R&D portfolio places a major emphasis on strongly connecting the pipeline of R&D outputs with future improvement and efficiency planning by Routes.

3.2E

Figure 14: Key programmes in the R&D portfolio

The pace and effectiveness of R&D is being secured through mechanisms including:

- a tailored procurement strategy that includes the use of innovation partnerships to take R&D into the supply of products and services
- 2. accelerating supplier-driven industrialisation through the UK Rail Research and Innovation Network (UKRRIN) which ensures academic research is successfully industrialised
- accelerating time to first deployment, increasing the likelihood of success and enhancing value through our Commercial Accelerator, established in 2018, to generate strong value propositions and accelerate the route to market; and
- strengthening the connection of R&D into business change programmes such as Intelligent Infrastructure.

Detailed proposals for the R&D portfolio are published as the R&D response to the Draft Determination under Network Rail's PR18 Draft Determination response.

Case study: Better value from R&D

The most effective way to bring new technologies into use is by sharing the costs, sharing the risks and sharing the rewards. Under the CRTO, Group STE has shared our vision for the GB railway system with European colleagues, the result of which has been a joined-up vision for rail technical strategies in GB and the rest of Europe. The framework has been established over the last decade with the Association of European Infrastructure Managers' European Rail Technical Strategy in 2008, the second GB Rail Technical Strategy published in 2012 and the European Rail Technical Strategy in 2014. In 2017, publication of the Rail Technical Strategy Capability Delivery Plan for GB (RTS CDP) and



the Rail 2050 vision for Europe link the opportunities from technology to the capabilities we need to reinforce rail as the backbone of Britain and Europe's mobility.

A major result from this collaboration has been the biggest ever European public-private partnership for Research and Development into the rail sector - the Shift2Rail Joint Undertaking. The Joint Undertaking's mission is to deliver focused research and innovation (R&I) and marketdriven solutions by accelerating the integration of new and advanced technologies into innovative rail product solutions. Shift2Rail receives its public funding through the European Commission's Horizon2020 programme which in turn is the biggest EU Research and Innovation programme ever with nearly €80 billion of funding available over 7 years from 2014. It receives its private funding through members that include eight founding members from the European rail industry, one of which is Network Rail. There are five Innovation Programmes (IP) spanning the railway system. Network Rail co-ordinates the infrastructure

Innovation Programme (IP3). But Network Rail has a major stake in other programmes in particular IP2, which underpins the development of capability to enable intelligent operations through the Digital Railway, and IP4. We continue to influence European R&D as a thought leader, actively participating in the European Rail Research Advisory Council to advise the European Commission.

Section 3.3: Providing expert services

3A: Modelling, analysis and benchmarking

Benchmarking

Group STE is building on benchmarking against external organisations built up over ten years, focusing on comparisons of costs and performance with other European railways and on the identification of good practices in rail and other sectors. Benchmarking has the potential to provide insights into good practices, act as a catalyst for collaborative working and produce significant tangible and intangible benefits.

The foundations are in place to establish benchmarking as a core business process. A strategy and road map were developed in 2017 and issued in March 2018, including a benchmarking process, an organisational model and set of enabling tools and processes. Priority needs to improve the Technical Authority, currently being set out, will be progressed through benchmarking analysis in the first year of CP5 and shared. This expected to realise a 30% improvement in benchmarking maturity which will underpin better targeted improvements to policies, practices, processes, tools, technologies and competencies across the Technical Authority areas in particular health & safety, sustainable development, engineering & asset management, operations principles and security.

Group STE is continuing to develop and improve NR's capability in benchmarking, lateral learning and continuous improvement and supporting the delivery of organisation-wide lean leadership. This includes identifying opportunities to change current standards and as we encourage the industry to challenge our standards, as we committed following the review by Professor Peter Hansford, to help us deliver better value. An example of benchmarking in action can be seen with the changes we have already brought about, with further improvements in hand, to our process for accepting new products on to the railway.

We will continue to establish the most relevant comparator organisations through involvement in industry forums, and established work with professional institutions. This includes work with international railways, and UK infrastructure providers. Of particular importance is how to gain greater value from information - we will continue to consider the emerging guidance on Building Information Modelling as a key reference source.

Asset modelling

Group STE, together with finance, provides asset modelling capability to support decisions for asset management interventions. We manage strategic models, looking out up to 40 years, that are used to support periodic funding reviews with the ORR, to assure Route Plans, to calculate access charges, and to calculate the depreciation of infrastructure. Network Rail is recognised as having a relatively strong capability, at least on a par with the best railways and utilities.

Strategic models are complemented by planning tools including the Decision Support Tools that have been developed under the ORBIS programme. These bring together asset information from various sources to support short to medium term decisions through visualisation. They include the track Linear Asset Decision Support tool (LADS) and similar tools for S&C, electrical power, operational property, signalling and level crossings. Track and E&P teams can access the information they need, when they need it. Data within the DSTs allow engineers to better understand degradation rates and provides evidence to carry out timely and cost-effective interventions.

"The benefits are huge: I'd estimate we were treating just 50-75 per cent of the correct track areas – now I'm confident it's closer to 100 per cent. I'm now able to direct tamping machines to the exact fraction of an eighth of track that needs work. This is without doubt the greatest development I've seen for displaying asset data." Steve Kingston, TME, Wales

Group STE is building 'Intelligent Infrastructure Analytics' to support the shift from scheduled preventive maintenance to risk-based predictive maintenance. This enables a reduction in failures and a more efficient maintenance regime. The specialist team in Group STE, built through a strategic partnership with the University of Nottingham, applies automated computational techniques including machine learning which will be used to support routes automate their detection and response to anomalies and provide decision support to optimise maintenance.

Section 3.3: Providing expert services

3B: Testing and trialling facilities (Rail Innovation and Development Centres)

Testing and trialling facilities are offered for use across Network Rail and industry through two sites acquired in 2009 and 2014 which are now owned and operated by Group STE – RIDC Melton in Leicestershire, and RIDC Tuxford in Nottinghamshire. Details of these facilities – the Rail Innovation and Development Centres (RIDCs) are available on the Network Rail website – www.networkrail.co.uk/ridc.



The RIDCs provide a safe operating environment for the testing and validation of new and modified rolling stock, plant, on-track machines, infrastructure, equipment and technology. The facilities are offered to Network Rail and the wider industry and already support several rail industry major programmes including Crossrail, ETCS First in Class for the Digital Railway, and 5G.

The RIDC facilities are multi-customer. As well testing and validating rolling stock and equipment the RIDCs provide a critical enabler for the Network Rail R&D portfolioand wider industry research. Industry examples include trials for the application of sand to improve the quality and consistency of friction between wheels and rails to improve the reliability of braking and in turn improve performance and potential capacity.

And for Network Rail includes establishing a 'sand pit' environment where high capacity communication

connections between trackside and trains are explored and new technologies are applied to turn telecoms equipment into a sensor network to monitor risks to the railway such as trespass. The latest R&D project at RIDC Tuxford is the Drainage Theatre – this is the first of its kind in the world and will include functionality to support remote monitoring, flood modelling, capacity and capability modelling, silt management, ground survey technology, robotic inspection and repair.

This development is being further advanced with the RIDCs as the lead for the Centre of Excellence in Testing with university and manufacturing suppliers as partners under the UK Rail Research and Innovation Network (UKRRIN). The RIDCsalongside other test facilities supports the UKRRIN Centres of Excellence in Infrastructure, Rolling Stock and Digital Systems to accelerate new technologies and products from research into market applications.





Section 4: Risks, Opportunities, Constraints and Assumptions

Technology

Creating prototype systems and equipment as part of new ways of working to enable routes to deliver a more passenger-friendly, reliable, cost-efficient and safer railway.

	Why	Outcome Vision		
Opportunity	Focus on priorities for the rail infrastructure to meet the needs of the routes and other NR businesses by addressing the challenges and strategic goals under asset sustainability, network performance, safety, security, financial efficiency and growth. Align to the Rail Technical Strategy Capability Delivery Plan (RTS CDP) which forms the industry's blueprint to transform the railway against 12 key capabilities.	Feels Like	All customers have confidence that technology solutions are being progressed with urgency to meet the most pressing business needs. They perceive a mix of incremental, step change and game-changing technology solutions and see evidence through RIDC and the wider UKRRIN.	
Risk	Development and Introduction of Technology. Failing to develop and introduce the technology Network Rail requires, resulting in an inability to meet our control period strategic business plan outcomes.	Customers Say & Do	Customers see the pipeline of emerging systems and equipment and understand the potential opportunities it unlocks. Customers believe it's vital to plan to exploit emerging technology and do so, governing its progress to	
	How		deliver benefits.	
Owner	Senior Programme Manager (R&D)	Looks Like	nere is a shift from solution-led R&D to needs-led R&DT. usiness customers of R&D are engaged directly across the R&D.	
Action 1	Deliver NR's R&D portfolio under strong and transparent governance, applying a proven delivery approach (MSP4NR and the Product Delivery Framework) and incorporating learning from CP5 to assure deliverability.		portfolio with the technical authority engaged through their ownership of challenge statements and technology roadmaps. Actively seeks advice from wider industries and sectors.	
Action 2	Strong and active route customers across the R&D portfolio leading the way at pace to first in class deployments.	Behaviour	R&D starts with implementation of the solution in mind. Achieved through close collaboration with technical, commercial and operational colleagues with a relentless focus on the business case.	
Action 3	Leading and delivering 6 R&D programmes including continuation of Shift2Rail fulfilling NR's legal commitments until 2024.			
Action 4	Delivery mechanisms to support greater investment with collaborative commercial arrangements and partnerships including the UK Rail Research and Innovation Network (UKRRIN).			
Action 5	More and quicker route to first in class deployments, accelerating the market readiness of systems and equipment and integrating at pace into planning in NR and industry. Delivering differently through open for business principles.	S.C.C.		

Innovation

Innovation is critical to delivering value to the Rail industry from all the Research and Development programmes and technology transfer from other industries, supporting improvement across the business and playing a particularly important role enabling the rail industry Rail Technical Strategy Capability Delivery Plan (RTS CDP) with a planning horizon of 30 years.

	Why	Outcome Vision	
Opportunity	Increasing opportunities, accelerating the pace of development and increasing participation across NR and industry to discover and exploit new approaches and technologies.	Feels Like	The organisation promotes new ideas and it is easy to introduce new technologies and changes that add value.
Risk	Directly enables the 'Development and Introduction of Technology' risk - Failing to develop and introduce the technology Network Rail requires, resulting in an inability to meet our control period strategic business plan outcomes.	Customers Say & Do	Customers see the benefits of our investment in R&D and T in their everyday lives. Industry partners, Suppliers, SMEs and new entrants work
	How		products and services on the railway.
Owner	Head of Innovation and Information Management	Looks Like	There is a clear and supportive innovation framework to introduce novel products and services to the railway.
Action 1	Understand and influence policy. Support the progressive introduction of innovation through existing procurement channels as well as inputting in the design of future procurement methods.	Behaviour	Everyone feels accountable for innovating and finding better solutions to problems in the industry. There is a culture that is open to new ideas and
Action 2	Create the collaborative environment to enable effective cross-industry innovation.		ways of working.
Action 3	Help industry build & measure capability, providing a framework so that railway businesses are clear on what good looks like in terms of designing innovation into an organisational structure to create value. The work will provide a clear view on how innovation is delivering the company goals and ensure we can quantify the value it brings.	54. ····	
Action 4	Challenge barriers to market adoption, establishing clear and visible process to connect Technology to market opportunities and ensure those market opportunities are well understood at all levels of decision-making and committed to. A particular aim will be to improve uptake of non-safety products into market.	M	

Engineering & Asset Management

Developing our people and improving process, technology and information to better manage infrastructure assets for a safe, reliable and sustainable railway at optimal whole life cost.

	Why	Outcome Vision		
Opportunity	To continually improve safety whilst driving down cost through optimised asset management policy, standards, assurance and innovation.	Feels Like	Like A high performance culture where key processes are known, tracked	
Risk 1	Asset management excellence. Failing to develop, embed and demonstrate excellence in asset management, resulting in an inability to achieve efficiencies, CP6 outputs, and long term sustainability.		and improved on a continuous basis. Planning across all required disciplines aligned, with integrated decision support tools.	
Risk 2	Data quality governance and assurance. Failing to provide appropriate governance and assurance of asset data quality leading to inaccurate or unknown accuracy of asset-related data.	Customers Say & Do	Customers see information insights from upskilled staff and analytics	
Risk 3	Electrical safety. Failure to deliver and implement an effective electrical system management framework leading to a serious safety incident, non-compliance to legislation, prosecution and significant rise in programme costs.		allow greater knowledge of infrastructure systems, allowing better decision making.	
	How	Looks Like	Continuous improvement projects, Standards and controls can be proved	
Owner	Chief Engineer		to be effective. Comprehensive benchmarking measures exist.	
Action 1	Complete NR policy and standards baseline which improves safety and performance, optimises cost and ensures compliance with legislation.	Behaviour	Challenge and suggestions are welcomed, for example from suppliers and NR colleagues challenging standards and seeing those challenges feed through into better policy.	
Action 2	Introduce single competency framework and transparent multiple career path for professional engineers and asset managers.			
Action 3	Introduce a whole life cost modelling and planning system for policy development, volume and expenditure forecasting, work bank planning and delivery.			
Action 4	Introduce technology for faster, safer isolation of electrified lines.			
Action 5	Deploy systems engineering approach including robust requirements management and scope definition (PDSS) and Technical Stage Gate process part of business as usual.			

Maintenance

Driving efficient and effective maintenance through alignment of standards, business systems, benchmarking, maintenance reliability initiatives and business improvement. Delivering the Intelligent Infrastructure Programme

	Why	Outcome Vision		
Opportunity	To enable Network Rail routes to deliver efficient and effective planned maintenance for all their operational assets through common tools, processes and technology as part of a fully integrated asset management strategy.	Feels Like	Customers feel engaged through strong collaboration to agree trade-offs between network availability and sustaining asset reliability to balance performance and cost.	
Risk	Maintenance. Failure to provide a suitable framework and associated delivery plan to enable the routes to achieve maintenance cost, safety and performance optimisation leading to Network Rail not achieving its applicable corporate objectives.	Customers Say & Do	Routes will see benefits to performance and cost from the integration of intelligent infrastructure with their operations. Asset managers focus on optimising whole-life cost options and capture in Route Asset Management Plans.	
	How	Looks Like	People are pivotal to planning, delivery and	
Owner	Professional Head of Maintenance		reviewing maintenance and provided with the necessary tools, skills and competence. We target 90% rostered hours being worked and overtime hours being less than 10%.	
Action 1	Deliver the Intelligent Infrastructure programme including asset condition monitoring and advanced data analytics for optimised			
	maintenance intervention.	Behaviour	Actively sharing and receiving good practice and	
Action 2	Cleanse asset registers and integrate condition data enabling a predictive maintenance strategy optimising cost, risk and		participating in structured continuous improvement.	
	performance.			
Action 3	Deliver Integrated Works Planning to enable assets to be managed as a system, increase production efficiency, optimise network availability, reduce wastage and improve safety.			
Action 4	Establish a framework to evolve maintenance culture through targeted and continuous coaching, development and team building creating improved behaviours, safety and efficiency.			
Action 5	Embed Risk Based Maintenance across all asset systems to optimise operational expenditure whilst reducing service affecting failures.	Solution Table		

Operations Principles

Evolving operations principles in line with changing needs and opportunities for a safe and efficient railway by ensuring staff have the data, tools, equipment and systems to make informed decisions to manage the operational, safety and performance risks.

	Why	Outcome Vision			
Opportunity	Operations principles are necessary to implement Technical Authority policies for a safe and efficient railway.	Feels Like	Despite increasing pressures on our operational staff the railway feels like a safe environment.		
Risk	A dependency of the engineering and asset management risks and maintenance risks. A key dependency to manage is the support of the trade unions.	Customers Say & Do	Customers' are able to respond more coherently in times of perturbation through integrating the National Operations Control. Customers see operations principles developed hand-in- hand with technology development.		
	How	Looks Like	Continuous development and improvement of Operations Principles standards and controls. Providing transparent		
Owner	Head of Operations Principles		procedural and competence frameworks whilst ensuring operational compliance with legislation.		
		Behaviour	Providing Leadership for Operations Principles & Standards to		
Action 1	Build on a robust assurance process established by the end		delivery of Operational frameworks.		
			and a state and the second		
Action 2	Improve the integration of future technologies into business as usual so that it is effective and efficient as business as usual by the end of CP6.				
Action 3	Implement the Integrated Management and Quality Management Systems.				
Action 4	Pull through new technologies to address the operations challenge statement.				

Safety

Drive continued and sustainable improvement of safety in close collaboration with the routes and the key stakeholders inside and outside Network Rail focused on culture, systems and technology changes to deliver our vision of Everyone Home safe Every Day.

	Why	Outcome Vision	
Opportunity	To protect our passengers, the public close to the railway and the workforce efficiently to get everyone home safe every day through high expertise, efficient action plans and value based assurance at all levels of the business.	Feels Like	We care about the safety of all railway workers and everyone using, and neighbouring, the railway.
Risk 1	Level crossings safety. Failure to enable the business to avoid fatalities and injuries at level crossings leading to a serious incident and political, reputation and performance impact.	Customers Say & Do	We are seen as Europe's safest railway.
Risk 2	Workforce safety. We fail to safeguard our workforce resulting in injury, single and/or multiple fatalities to Network Rail staff (employees and contractors).	Looks Like	We become a company where occupational injuries are a thing of the past.
	How	Behaviour	We benchmark ourselves with the best inside and outside the rail industry.
Owner	Chief Quality, Health, Safety and Environment Officer		
Action 1	Deliver high priority national projects through the Home Safe Plan based on thorough risk impact assessments.		
Action 2	Protect our track workers through modern technology delivering the Safer Trackside Worker programme.		
Action 3	Look out for our full workforce through fatigue and manual handling programmes.	News	
Action 4	Reduce level crossing risk using 'As Low As Reasonably Practical' approach and providing expertise and assurance.		
Action 5	Reduce train accident risk through monitoring of train accident risk reduction milestones and volumes across the business.		
Action 6	Drive leadership and culture change through training and awareness programmes.		

Health

Through delivery of key projects, the use of external health providers and collaboration with other business functions, the health and wellbeing programme aims to optimise the occupational health management and safety of our workforce by effectively mitigating, monitoring and diagnosing occupational health conditions. Our intention is to be more proactive than reactive by supporting improved health awareness and changing behaviours that influence long term health and safety, thereby achieving our vision of 'Everyone Fit for the Future'.

	Why	Outcome Vision		
Opportunity	To achieve a railway fit for the future we need a workforce "fit for the future". We aim to: • Enable, through pre-emptive measures a sustainable, health and productive workforce • Focus on protecting our workforce to reduce the impact of occupational health hazards • Form a culture of effective health and wellbeing management	Feels Like	A consistent management of occupational health and well- being across the organisation empowering staff to feel supported.	
Risk 1	We fail to manage, support and mitigate the health and wellbeing risks to our workforce leading to enforcement by Governing Bodies and a work force that is not fit and/or healthy to maintain and		at work and knowledgeable in the area of health and work.	
	How	Customers Say & Do	A workforce fit for the future	
Owner	Chief Medical Officer	Looks Like	boks Like Health and well-being of our workforce is recognised as a cornerstone to our organisation	
Action 1	Delivery of high priority Home Safe Plan projects, which includes the Mental Health and Resilience programme.		and becomes part of every-day life both inside and outside of work	
Action 2	To procure, optimise and appropriately link all required outsourced health services to ensure successful delivery of health programmes, thereby supporting an improved proactive and health prevention framework.	Behaviour	Taking an interest in your own health and the health of others	
Action 3	To ensure compliance to Occupational Health and Safety Legislation, with a strategic aim to prevent any new or worsening occupational health related health conditions	. 1		
Action 4	To share, monitor and effectively use available occupational health data as part of business scorecards and KPIs, to support the implementation and design of sustainable health and wellbeing programmes			
Action 5	To enhance the internal and external audit and assurance framework to drive forward continuous improvements in health and well-being			

Quality

Drive towards quality and process excellence through focus on the introduction of a modern Integrated Management system, compliance culture, clear and stretched quality KPIs and value based assurance achieving high quality performance across Network Rail.

	Why	Outcome Vision		
Opportunity	To drive better performance and assurance through continuous improvement to services in an efficient and user-friendly way whilst achieving compliance with global and standards for ways of working.	Feels Like	Delivering excellence through constant care	
Risk	Poor quality performance in Network Rail can lead to social, political and economic	Customers Say & Do	Network Rail delivers high Quality access and services	
	consequences with the risk of loss to customer and stakeholder confidence. Quality performance goes hand in hand with safety performance and poor quality can therefore lead to safety risks.	Looks Like	Network Rail performs for our stakeholders and is constantly pursuing excellence in the way we work.	
	How	Behaviour	Striving for excellence.	
Owner	Head of Corporate Quality		-	
Action 1	Develop, implement and maintain a modern Integrated Management System compliant with ISO 9001, ISO 14001, ISO 45001 and ISO 55000 as a minimum.	10 .		
Action 2	Drive Continuous Improvement, providing Lean expertise, training, awareness and toolbox including six sigma process optimization methodology and business support in process selection for application of this methodology.			
Action 3	Drive risk and value based audits and assurance of Quality including lessons learned processes. Expanding the scope of our assurance to cover the entire management system of Network Rail as opposed to our current reactive, technical standard based audit.	8		
Action 4	Focus on quality performance including cost of non-quality, non-conformances, re-work, corrective actions and customer complaints through prioritised improvement			
Action 5	Drive compliance culture through training and awareness programmes as well as enabling the business to clarify accountabilities within processes and procedures documented in the Integrated Management System.			

Environment & Sustainability

Improving sustainable business performance, delivering social value and maximizing opportunities for socio-economic growth, protecting and enhancing the natural environment, creating sustainable energy solutions, reducing emissions, and adapting the railway for improved resilience against future weather conditions as a result of climate change.

	Why	Outcome Vision		
Opportunity	Enabling sustainable business performance, including protecting and enhancing Network Rail's reputation, through attention to environmental, social and economic responsibilities.	Feels Like	We care about our impact on the environment and communities.	
Risk 1	Weather Resilience and Climate Change. The railway does not meet expected levels of performance during adverse and extreme weather events, today and in the future.			
Risk 2	Energy Management. Failure to manage energy and carbon effectively leading to a failure to meet regulatory, financial and carbon targets.	Customers Say & Do	We are seen as a responsible provider of rail access, infrastructure	
	How		and services.	
Owner	Head of Environment and Sustainability	Looks Like	We are actively working to improve our impact on the environment, enhancing resilience and creating social value for the communities we serve.	
Action 1	Deliver a weather resilience and climate change adaptation action plan – Enhance asset and infrastructure resilience to current and future weather conditions and streamline preparation for, response to, and recovery from extreme weather events.			
Action 2	Make environmental management part of the Integrated Management System compliant to ISO14001 and support the business to manage resource consumption, responsible sourcing and better management of lineside habitat to reduce ecological surprises.	Behaviour	Striving to have a positive impact on people and the environment.	
Action 3	Include social performance management in the Integrated Management System to improve reputation, manage our impact on lineside neighbours, maximize opportunities for socio-economic growth and invest in local communities through our employee volunteering programme.			
Action 4	Deliver energy & carbon strategies to enable business units to implement efficiency programmes to reduce energy costs, capital carbon, generate income and reduce carbon footprint and implement an energy management system.			
Action 5	Drive environment and sustainability awareness through leadership training, competence development and awareness campaigns.			

Security

To develop the management systems, policies, process and culture to protect people, railway infrastructure, cyber (technology and information), buildings and property, equipment and materials from hostile threats.

	Why	Outcome Vision			
Opportunity	Protecting the railway, our people and our business from many security threats including theft, vandalism, terrorist attack and violence .	Feels Like	Security is core to our culture and		
Risk 1	Many security threats are increasing, leading to impacts on rail and business performance, safety, cost and reputation.	Customers Sau			
Risk 2	There is an increasing regulatory requirement to manage all forms of security, including the risk of cyber attack. Failure to achieve compliance may result in unlimited fines.	& Do	continued capability to safely operate the railway in an increasing hostile environment with increasing reliance on digital systems. Customers take		
	How		responsibility for managing security.		
Owner	Chief Security Officer	Looks Like	A formal security management system proving clarity over roles		
Action 1	NRSP Implementation Plan to establish and maintain a railway security culture and achieve compliance with security regulations.		and responsibilities throughout the organisation.		
Action 2	Develop and introduce a formal security management system, to improve security performance, governance and mitigation of risks.	Behaviour	Security is everyone's responsibility - we will establish and maintain a safe and secure culture by ensuring our people know what is expected of them. Every new development		
Action 3	Deliver a Security Threats Management Programme to identify and limit the impact of increasing and emerging threats, which would otherwise result in uncontrolled		or change is considered an opportunity to review and improve railway security.		
	losses such as schedule 8 payments, asset repair or replacement costs and impacts on railway staff. Emergent threats may include new types of terrorist attack, changes to the capability of organised criminal gangs or significant increases in cyber security risk.				
Action 4	Develop and deliver a Vulnerability Reduction Programme to limit the impact of degrading assets and security measures, reducing their inflationary impact on security related losses. The programme will exploit information produced by the security management system, to identify areas of weakness that are creating the highest Security Attributed Losses, aiming to effect a net reduction of losses against the control period out-turn.				

Information Management

Assuring NR programmes meet regulatory requirements on information to reduce corporate risk and to equip employees with the skills and understanding to enable them to recognise the value of knowledge, information and data so that it is fully exploited, helping to drive innovation, productivity and competitiveness.

	Why	Outcome Vision	
Opportunity	To manage our knowledge, information and data more effectively by applying strong governance arrangements, including processes, roles, controls and metrics, to increase the trust and value that lays the foundations	Feels Like	Information and data risk is understood and managed for the enterprise. Sharing and exploiting knowledge, information and data is valued as highly as managing physical assets, with information professionals seen as key facilitators in unlocking its power.
Risk	Failing to manage our knowledge, information and data leads to duplication, reduced productivity, increased costs, sub-optimal decision-making and the stifling of innovation.	Customers Say & Do	Customers from many areas recognise the benefits that arise from the robust management of knowledge, information and data. Customers maintain information and understand its value as an asset.
	How	Looks Like	Knowledge, information and data is protected and secured
Owner	Head of Innovation and Information Management		operations of the railway.
Action 1	Deliver a refreshed and comprehensive suite of information governance standards with clear roles and accountabilities that assures the knowledge, information and data we create is of highest quality, appropriately protected and shared as necessary to help meet business objectives.	Behaviour	Sharing knowledge, information and data is the norm; restricting access without good reason is the exception.
Action 2	Deliver a programme to develop the skills and understanding needed to look after and manage our knowledge, information and data, including a competence framework that equips our people with the knowledge and skills to recognise and exploit the value of knowledge, information and data.	Q. ?	
Action 3	Deliver a programme to use and share our information to help ourselves and others that encourages innovation and increase productivity.		

Section 5: Expenditure and Efficiency

Expenditure (excluding EC4T)

Figure 15: Expenditure table

		CP6						
		FY20	FY21	FY22	FY23	FY24	TOTAL CP6	
	Controllable Opex	£45m	£44m	£43m	£43m	£42m	£217m	
	Engineering and Asset Management & Maintenance	£20.5m	£22.8m	£17.6m	£19.7m	£20.1m	£101m	
Core STE	Health and Safety, Sustainable Development and Quality	£12.7m	£17.2m	£15.0m	£15.2m	£13.2m	£74m*	
	Operations, Security and Information Management	£3.8m	£9.8m	£14.0m	£13m	£11.1m	£51m	
	RD&T	£25.0m	£47.0m	£52.0m	£58.0m	£63.0m	£245m**	
	ESD	£50.8m	£60m	£69.0m	£50.0m	£33.9m	£263m	
Targeted National	SCADA	£7.0m	£7.0m	£7.0m	£7.0m	£7.0m	£35m	
Targets	SCADA CP5	£21.0m	£16.0m	£0.0m	£0.0m	£0.0m	£37m	
	Intelligent Infrastructure	£31.4m	£45.2m	£51.0m	£51.0m	£11.5m	£190m***	
	ORBIS	£12.5m	£2.5m	£0.0m	£0.0m	£0.0m	£15m	
	TOTAL CAPEX	£184.7m	£207.6m	£205m	£203.1m	£209.7m	£1,010m	
	TOTAL CASH	£230m	£252m	£248m	£246m	£252m	£1,227m	

*Further budget provision is embedded in Route Plans for QHSE Initiatives

** Subject to a formal review of progress in 2021

*** A further £193m is held provisionally on the basis of the initial business case

Expenditure - Electricity Consumption for Traction (EC4T)

- Compared to CP5, the total EC4T cost for CP6 is forecast to increase by £0.84bn to £2.6bn. The reason for the in- crease in cost is due to expected electricity rate increases and increased consumption due to:
- East Midlands Trains: Electrification of the Midland Mainline (e.g. Bedford to Kettering / Corby)
- First Great Western: Expansion of the Great Western Mainline electrification westwards

- GTR: New Thameslink Timetable
- LNER: Hybrid trains introduced
- SWT: New stock and timetable
- Northern: New services Manchester to Blackpool
- Transpennine: Hybrid trains introduced
- Crossrail: New services on Western and Anglia

Figure 16 below shows the electricity consumption, year by year, for CP5 and CP6. Figure 17 shows how that consumption translates into expenditure. The cost of EC4T is almost entirely recovered through the track access charging arrangements and the recovery is also shown in Figure 17 (EC4T income) together with the net EC4T position, which is incurred in Network Rail..

Please note all estimates are made using the Track Access Billing System (TABS), which in turn uses volume/ consumption data from Passenger & Freight income.

		GWh consumption								
			CP5 year		CP6 year					
	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24
Passenger	3,197	303	3,325	3,403	3,851	4,993	4,334	4,469	4,519	4,623
Freight	84	65	57	58	60	61	63	64	66	69
Non-Traction*	68	76	79	86	87	87	87	87	87	87
Total	3,349	444	3,461	3,547	3,998	4,141	4,484	4,620	4,671	4,778

*Non-traction costs are passed to the Routes

Figure 17: EC4T income, expenditure and net position

Figure 16: Electricity consumption (GWh) for CP5 and CP6

	Cost (Pre Inflation)												
	CP5						CP6					CP7	
	2014/15	2015/16	2016/17	2017/18	2018/19	TOTAL	2019/20	2020/21	2021/22	2022/23	2023/24	TOTAL	2024/25
EC4T income (£m)	-273	-286	-292	-312	-405	-1,569	-443	-498	-530	-540	-556	-2,567	-556
EC4T expenditure (£m)	279	293	299	320	414	1,604	453	508	540	550	566	2,617	566
Net EC4T (£m)	6	7	7	8	9	36	10	10	10	10	10	50	10

Headwinds & efficiency - waterfall

Three types of impact on spend are shown using two formats: waterfall to focus on the build-up of the proposed CP6 budget: and fishbone to focus on the make-up of the efficiencies and headwinds by reason or intervention.

Three types of change are shown that change the cost of delivering the services under the Technical Authority, national programmes and expert services.

- Scope impact change in the level of ambition or breadth of impact such as capital investment for the RTS CDP to generate a step change in capability across the whole railway system
- Headwind (or tailwind) impact - external changes outside the direct control of Group STE such as market costs
- Efficiency (or inefficiency) impact - management actions such as the managed services programme



Figure 18 shows that Group STE is managing well over three times the volume of Capex works in CP6 compared to CP5. Figure 19 also shows the reduction in the Opex budget throughout CP6 for Group STE. Therefore more output is being delivered with less budget. Additional efficiencies will continue to be explored throughout CP6.

Figure 18: Scope change, headwinds and efficiencies waterfall for capex

Headwinds & efficiency - fishbone

The fishbone in figure 20 shows scope changes, efficiencies and headwinds across the key themes.

Figure 20: Headwinds and efficiency - fishbone



Section 5 - Expenditure and Efficiency

Financial uncertainty

The ranges for financial uncertainty, year by year, are created from a consideration of drivers for which there is limited ability to manage impact for the technical authority, national programmes and expert services. The low point in the range reflects the potential impact of slippage primarily to national programmes. The high point in the range reflects a potential increase in spend due to efficiency interventions not realising their forecast impact of £96M over CP6.

Figure 21: Uncertainty ranges for CP6



Total Funding	. Financial	Incertainty	Panaes	hv	Voor
Total Funding	- i munciui	Oncertainty	Runges,	D V	reur

Year	Low	Spot	High
2019/20	213	229	244
2020/21	222	252	270
2021/22	205	248	268
2022/23	193	246	269
2023/24	199	252	278
CP6	1,032	1,227	1,329

Sign Off

Jurathe

Jon Shaw - Group Safety, Technical & Engineering Director

Michael Mr

Mike Murphy - Financial Director

Andy Doherty - Chief Rail Technology Officer

Kamini Edgley - Chief Engineer

Lisbeth Norup Fromling - Chief of Quality, Health, Safety & Environment

Simon Warner - Chief of Operations, Security & Information

Tim Flower - Programme Director - ORBIS and Intelligent Infrastructure

Sinead Trudgill - HR Director

Appendix A – Funding – by year of CP6

Funding by year set out in Section 5 - Expenditure table

Appendix B – Assumptions

R&D portfolio

The following assumptions have been made in the benefits analysis of the R & D portfolio:

- 1. Observed improvements over the past 15 years (notably in track) are an appropriate basis on which to identify the form and impact of technology benefits.
- 2. The likelihood of success in future will be equivalent to the known industry norms for R & D and technology deployment.
- 3. The NR business will continue to support the work and will adopt the solutions into their activities to realise the benefits.
- 4. Cost forecasts of R & D and Intelligent Infrastructure projects are robust.
- 5. The costs included for deployment of the technology into the business are sufficient. (e.g. through II programme).
- 6. The forecast scale of benefits is realistic and can be realised.
- 7. The scale of the programme and the phasing of the projects is realistic. Thus the sequencing of benefits is realistic.

8. Major investments in pieces of plant / equipment will not require major capital outlay by NR as these will be manufactured and leased through external owners (e.g. Robotic equipment).

Appendix C – Risks

Summary of the risks managed by Group STE and the risks managed by the wider business. The figure below is a snapshot from our Enterprise Risk Model showing, from the top down:

- The 10 functional areas in Group STE that typically own level 0 and 1 risks;
- 14 risks that are owned by the 10 functional areas;
- 48 risks beyond the risks directly owned by the functional areas that benefit from Group STE's investment in managing the 14 risks; and
- 17 Network Rail businesses across which the 48 wider risks are owned.



Appendix D – Proposed additional investment

Requirements for any additional work and funding for Group STE during the course of CP6 will be developed with the appropriate business justification, delivery and funding mechanisms.

Currently this consists of the following items identified:

- £193m in relation to Driving Intelligent Infrastructure (II); phase 2 of the £393M total for the II programme
- Relevant for any security works that might emerge during the course of CP6.

Appendix E – Technical Authority Areas

The Technical Authority Areas

Group STE owns areas under the Technical Authority that support the Routes and other customers to manage and enhance their capability to deliver their plans and services. The Technical Authority areas build new capability through policies, standards, processes and tools and industry co-ordination. The Technical Authority ensures risks are managed through an assurance framework and frameworks to assess and develop the technical capability and competency of our people.

Each of the Technical Authority areas identify work plans against business cases that are driven by addressing the challenges, risks and opportunities of its strategy in close collaboration with customers and stakeholders. How Route and other customer needs are established and used to steer areas of the Technical Authority is summarised in update to section 2.

This ensures risks are mitigated across all areas under the Technical Authority which in turn mitigate risks owned by the wider business enabling the delivery of benefits to the railway. A summary of the risks managed by Group STE and the risks managed by the wider business is shown at Appendix C.

Technology

The R&D Technical Authority area supports the CRTO to lead technology strategy in NR and across the rail sector, managing R&D funds and securing third party investment. UK and European R&D, including Shift2Rail, is delivered through the R&D portfolio for which the CRTO is the Senior Responsible Owner.

Innovation

The Innovation Technical Authority area is critical to delivering value to the Rail industry from all the Research and Development programmes and technology transfer from other industries, supporting improvement across the business and playing a particularly important role enabling the rail industry Rail Technical Strategy Capability Delivery Plan (RTS CDP) with a planning horizon of 30 years.

Engineering and Asset Management

The Engineering and Asset Management Technical Authority area develops our people and improves process, technology and information to better manage infrastructure assets for a safe, reliable and sustainable railway at optimal whole life cost.

Maintenance

The Maintenance Technical Authority area drives efficient and effective maintenance through alignment of standards, business systems and maintenance reliability initiatives. It draws on expert services in Group STE including modelling, analysis and benchmarking and and the Intelligent Infrastructure Programme.

Operations principles

The Operations Principles Technical Authority area evolves operations principles in line with changing needs and opportunities for a safe and efficient railway by ensuring staff have the data, tools, equipment and systems to make informed decisions to manage the operational, safety and performance risks.

Health and safety

The Health and Safety Technical Authority area provides expert advice and business partner support to all areas of Network Rail and delivers prioritised Health and Safety projects with the highest health and safety impact. This area holds the safety authorisation for Network Rail and develops a business-wide competency framework for everyone discharging QHSE roles.

Quality

The Quality Technical Authority area develops and maintains an Integrated Management System compliant with key standards ISO9001, ISO14001, ISO45001, and ISO 55000 enabling better performance through standards and controls, assurance, risk and improvement.

Environment & Sustainability

The Environment & Sustainability technical authority area enables sustainable business performance, delivering social value and maximizing opportunities for socio- economic growth, protecting and enhancing the natural environment, creating sustainable energy solutions, emissions reductions and adapting the railway for improved resilience against future weather conditions as a result of climate change.

Security

The Security technical authority area develops the management systems, policies, process and culture to protect people, railway infrastructure, cyber (technology and information), buildings and property, equipment and materials from hostile threats. We have already made great progress in our cyber security arrangements, aligning to the 'National Cyber Security Centre 10 Steps', which protected us from highprofile attacks in 2017. However threats to the railway are increasing; trespass, theft, vandalism and cyber attacks are a daily challenge impacting our operations and costs.

We will continue to evolve our security measures to mitigate these risks and in doing so achieve compliance with revised security regulations. Working with our industry partners and the British Transport Police we aim to reverse the trend of security attributed losses, through the introduction of a formal security management system.

Information Management

The Information Management technical authority area equips employees with the skills and understanding to enable data assets to be recognised as such and the value from data to be fully exploited; supporting innovation, collaboration, productivity and competitiveness.

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