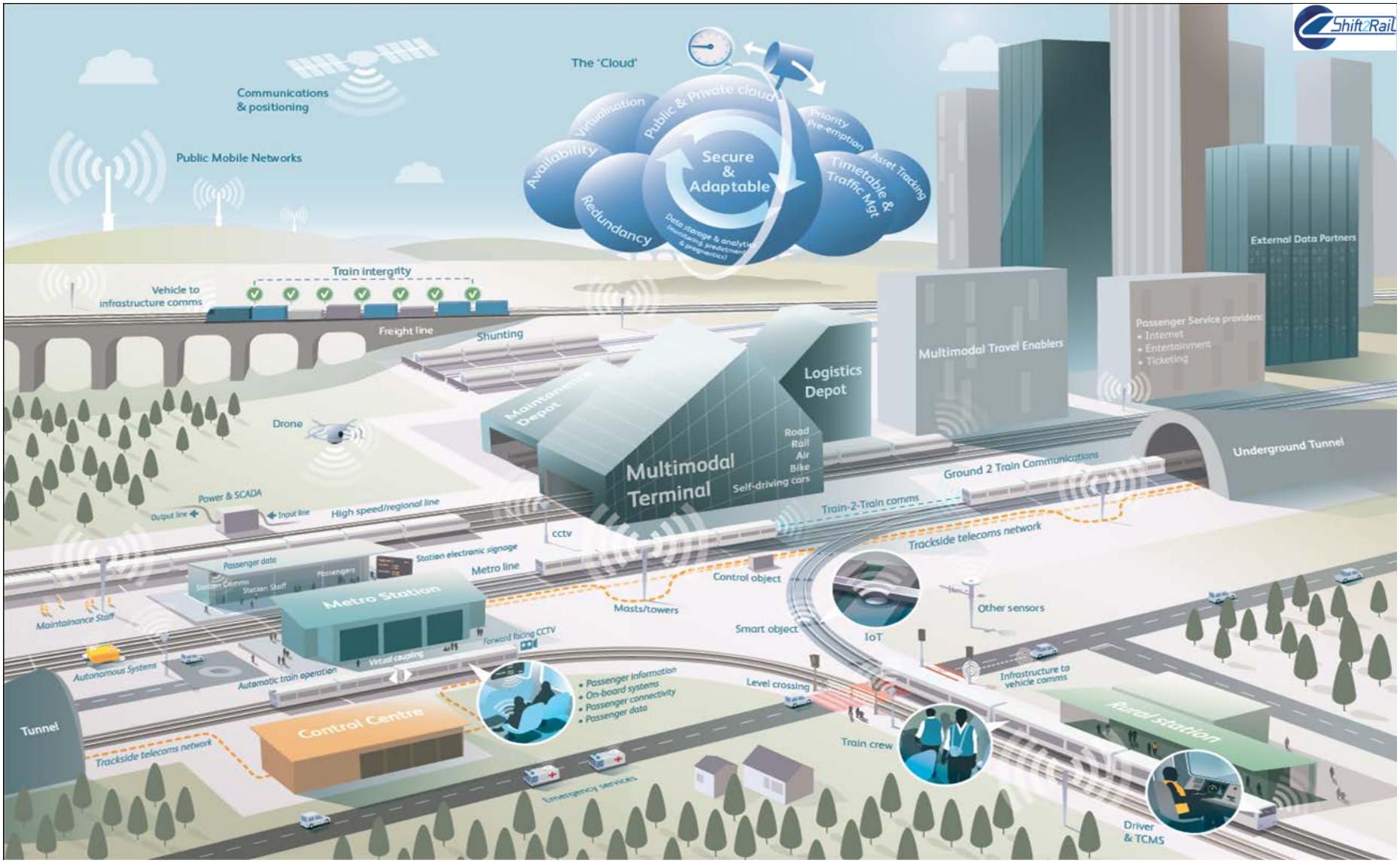
Network Rail Telecom Strategic Plan

Issue V9.0 – January 2018


Shift2Rail
The 'Cloud'
Communications & positioning
Public Mobile Networks
Secure & Adaptable
Virtualisation
Public & Private Cloud
Priority Pre-emption
Asset Tracking
Timetable & Traffic Mgt
Redundancy
Availability
Train intergrity
Vehicle to infrastructure comms
Freight line
Shunting
Drone
Maintenance Depot
Logistics Depot
Multimodal Terminal
Road
Rail
Air
Bike
Self-driving cars
Multimodal Travel Enablers
External Data Partners
Passenger Service providers:
• Internet
• Entertainment
• Ticketing
Underground Tunnel
Ground 2 Train Communications
Train-2-Train comms
Trackside telecoms network
Power & SCADA
Output line
Input line
High speed/regional line
cctv
Station electronic signage
Passenger data
Station Canvas
Station Staff
Passengers
Metro line
Metro Station
Maintainance Staff
Autonomous Systems
Automatic train operation
Forward facing CCTV
Virtual coupling
Masts/towers
Control object
Smart object
IoT
Other sensors
Infrastructure to vehicle comms
Level crossing
Train crew
Rural station
Driver & TCMS
Tunnel
Control Centre
Trackside telecoms network
Emergency services
• Passenger information
• On-board systems
• Passenger connectivity
• Passenger data

Contents

1. Purpose, role and vision

1.1. Purpose

Network Rail Telecom (NRT) provides the entire GB rail industry with a national telecommunications capability that is essential to its safe, reliable and efficient operation

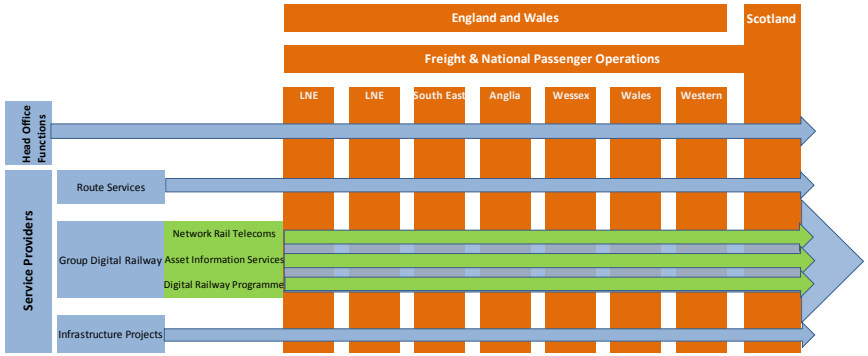
1.2. Role

We are responsible for delivering communications capability using Network Rail's telecommunication networks, systems and assets, which include our next generation IP telecoms network (called FTNx), the Global System for Mobile communications - Railway (GSM-R) system (which provides dedicated communications between drivers and signallers today and in the future, will provide the track-to-train communications necessary for the digital railway) and assets such as level crossing telephones, Closed Circuit Television (CCTV) cameras and customer information screens amongst others.

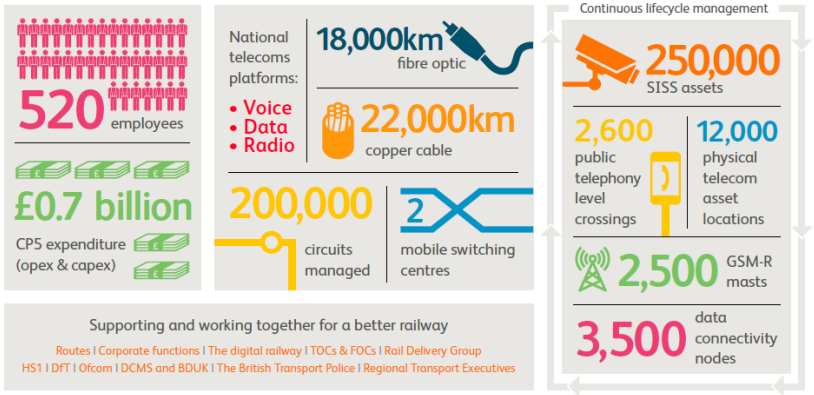
As a key part of the Group Digital Railway directorate, NRT is a central function providing the centre of excellence for expertise and national co-ordination of the telecommunications assets of the GB railway. NRT provides the links that unite the railway, as it is our telecommunications capability that enables the operational railway and the business to run. We support the routes in delivering the service requirements placed upon them by their key stakeholders.

The diagrams below illustrate our position (within Group Digital Railway) as a route support function within the overall Network Rail structure and, give an overview of the scale of the assets we currently manage on behalf of Network Rail:

Network Rail organisation



NRT at-a-glance



1.3. Vision

Our published vision is: **Placing our customers and stakeholders at the heart of our business, to deliver round the clock, safe, secure and reliable telecommunications infrastructure and connectivity across the GB rail network.**

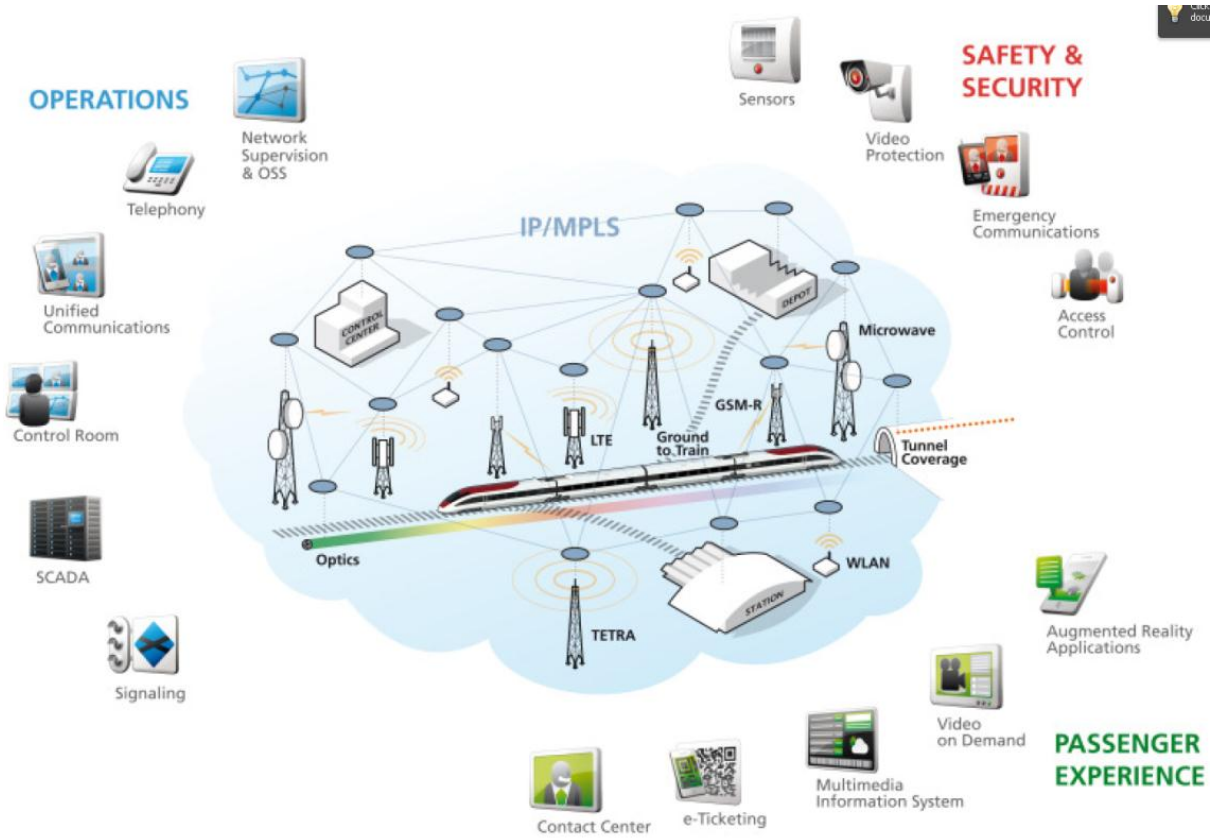
Introducing our strategy:
Our CP6 strategy continues to focus on providing the railway industry with telecoms capability, infrastructure and services which enable the safe, secure and efficient operation of the railway, and also increasingly focusses on the growing importance to deliver better passenger connectivity. It also supports Network Rail's strategic business plans such as delivering an always connected digital railway for customers, passengers and lineside neighbours. It is our intention to continue driving service-based outcomes rather than individual asset performance. We will support ETCS infrastructure schemes including ensuring enabling telecoms for FTN and GSM-R are delivered to meet enhanced ETCS requirements for Digital Railway.

Rationale
Significant numbers of our route based assets and infrastructure pre-date CP4 which, in telecoms technology lifecycle terms, means that they are operating beyond their designed life, are obsolete (no vendor support) and are becoming prone to increased risk of failure. We therefore need to refresh and upgrade these assets and take a smarter systems engineering approach. This will reduce complexity and cost whilst driving standardisation throughout the national network and support Network Rail's strategic plans. Externally to Network Rail, new train operating franchises are increasingly demanding new and better services for their passengers, staff and assets. Coupled with this, passenger numbers continue to grow rapidly. Our strategy has been designed to help our key customers (the routes) to provide more reliable and available services to their customers, the Train Operating Companies (TOCs), Freight Operating Companies (FOCs) and ultimately, passengers. Our strategy also caters for the unprecedented demand for communications connectivity along the rail corridor which needs to be managed consistently to ensure best value is achieved for everyone. To this end, NRT is working closely with DfT and DCMS to identify and establish suitable national solutions to mobile connectivity on the railways which is key to the delivery of the Conservative Party 2017 manifesto commitment that "By 2022…. Main line trains will enjoy full and uninterrupted mobile phone signal, alongside guaranteed wifi internet service on all such trains", and aligns well with a number of policies and priorities across Government. NRT is actively supporting and participating in the DCMS funded testbeds and trial programme (Trans-Pennine) to install new fibre networks, construction of new masts and upgrade the Rail Innovation and Development Centre (RIDC) such that it is able to support future 5G technology and user case trials. Additionally, NRT is exploring improved connectivity solutions with Industry for other main line routes and is funding an outline business case (Project Nimbus) using HMT five-case model in support of additional funding for network enhancements that could yield new wholesale commercial connectivity opportunities. – more detail on this is in section 9 of this document.

Our priorities over the planning horizon are focused on:

To deliver our strategy, our submission reflects the need to ensure the telecommunications network continues to underpin the three safety critical services that impact both safety and train performance namely; signalling, train detection and driver - signaller voice communications (GSM-R and lineside telephones). It also reflects the growth in nationally distributed asset volumes which, during the course of CP4 to date, have been handed over from project delivery to NRT for whole life management.

Our strategy will transform our legacy systems and capabilities into a simpler, resilient and affordable set of technologies. We will do this by consolidating services onto a ubiquitous modern IP telecommunications network. Our strategy will enable us to deliver a centrally managed highly available, secure next generation network (called FTNx) that will underpin the future needs of Network Rail, its customers and the industry whilst being more cost efficient to own and operate. This will also act as a platform to drive sustainable growth and new avenues to market for us, and our route customers whilst also providing the foundation for the future digital railway.


OPERATIONS
Network Supervision & OSS
Telephony
Unified Communications
Control Room
SCADA
Signaling
SAFETY & SECURITY
Sensors
Video Protection
Emergency Communications
Access Control
IP/MPLS
CONTROL CENTER
DEPOT
Microwave
GSM-R
LTE
Ground to Train
Tunnel Coverage
Optics
WLAN
STATION
TETRA
Augmented Reality Applications
Video on Demand
PASSENGER EXPERIENCE
Multimedia Information System
e-Ticketing
Contact Center

2. Stakeholder priorities

2.1. Stakeholders & priorities – Our Stakeholders are:

2.2 Customer and stakeholder engagement

In developing NRT's CP6 plans, our CP6 planning team has engaged with a wide range of stakeholders both within Network Rail and outside. This has been through a number of meetings and briefings and further meetings are planned throughout the CP6 planning process. Within NRT, all route stakeholder engagement has been undertaken through a dedicated account manager from within the Scope element of the team.

Ongoing customer and stakeholder engagement

We maintain relationships with each of our customers and stakeholders both formally and informally. The following table shows how we engage with our customers and stakeholders on an ongoing basis through key forums:

Forum	Frequency	Objectives and key subjects discussed
Route Level 1 meetings	Four-weekly	• Discussion of strategic priorities to address emerging risks, issues and opportunities • Alignment of Strategic Plans • Business critical decisions
TOCs	As requested	• To ensure the correct requirements are captured relating to re-franchising
Telecom periodic review	Four-weekly	• To ensure the programmes are prioritised and sequenced in line with business requirements and our capacity to deliver
DR Programme	Quarterly	• To ensure the programmes are prioritised and sequenced in line with business requirements and our capacity to deliver

In addition to the above there is regular engagement with stakeholders as part of normal business activities.

2.3 Addressing stakeholders' priorities

Our plan is built around our key stakeholders' requirements and through engagement, our plans are interlocked ensuring alignment. Our key stakeholders' needs, and the delivery of them, are paramount to NRT.

Stakeholder	Prioritised need	Short-term objectives	Long-term objectives
DFT	Delivery of performance levels for franchises	Support conversations at the earliest point to share core NRT imperatives - CP5 accelerated spend	Early engagement to drive forward the CP6 core scenario
Routes	Inability to upgrade GSM-R cab radios to ameliorate national interference (funded to focus on reactive infill only)	Deliver a reactive infill programme	We will make the case for the finance (to upgrade the cab radios, and improve the network) so as to agree funding before end of Year 4 of CP5. Also will develop other short term mitigation strategies
	Passenger and TOC concerns with amount of life-expired SISS assets (CIS & PA) due to delayed renewals	Significant increase in renewals - refer to the activity and expenditure table	Early engagement to drive forward the CP6 core scenario as stated in the investment section (scenario planning)
	TOC and Trade Union concerns with 40% DOO mirror renewals delayed	To be supported through a more cost effective solution for DOO	Early engagement to drive forward the CP6 core scenario
	Migration from legacy systems and operations to reduce the support costs from having dual networks in operation	Migration is a key imperative in realising reduced support costs achieved by use of an intelligent infrastructure.	Early engagement to drive forward the CP6 core scenario as stated in the section 6.2. Future capacity and growth
	Impact on route teams (reactive approach and increased	Migration is a key imperative in realising reduced	Early engagement to drive forward the

	maintenance inspections)	support costs	CP6 core scenario as stated in section 7.2 Maintenance delivery
	Sweating of large amount of assets – including LAN/WAN, cable renewals, GSM-R, systems hardware increases risk to business continuity, MTBF and MTTR performance	We have planned for LAN/WAN and cable renewals	Early engagement to drive forward the CP6 core scenario as stated in the investment section (scenario planning)
	On station Wi-Fi for passengers and operational communications	Need to deliver additional Wi-Fi capability for use by passengers and operational staff	Early engagement with Routes to ensure their requirements are captured and delivered upon.

Stakeholder	Prioritised need	Short-term objectives	Long-term objectives
TOCs	Customer Information Systems (CIS) at stations (particularly busy ones) should be reviewed	We will work with the TOCs to deliver improvements to station CIS wherever this is possible. Additional improvements in this area will be delivered as part of the plan for the next control period	Early engagement to drive forward the CP6 core scenario and delivery plans associated with it
	Improved performance data is required - will allow the root cause of issues to be identified and addressed	Our planned strategy of adopting a predict and prevent approach to maintenance puts data at the heart of decision making, with better management information being made available from a wider roll-out of condition monitoring equipment and use of enhanced analytics	Transition to a single IP telecommunications network will improve availability, performance, scalability and security of national connectivity and assets
	Communication technology between staff and organisations should be improved. In all other 'response' businesses (e.g. police, fire service), mobile phones are not relied upon. The railway would benefit from more specific and reliable technologies	We own the strategy for communications technology, and we are consulting on the most appropriate systems to use by staff involved in incidents and at times of disruption	A strategic crisis management proposal has been developed with a technology mix proposed. Of equal important are maintenance, the underpinning contracts, readiness practice and alignment to prevailing command structures and procedures
	Wi-Fi in depots	Where the assets are owned by the TOC, it is their responsibility to upgrade however we would be very happy to assist where required	Standardise assets and services - deliver open architecture enabling secure ‘plug and play’ capability
	Zonal based sound systems at busy stations	As part of putting passengers at the centre of what we do, we are exploring opportunities to enhance the passenger experience at both Network Rail and TOC managed stations. Zonal separation of public address systems is part of our vision for CP6 and we will work with the operators to deliver this at key locations	Early engagement to drive forward the CP6 core plan

	SISS equipment (e.g. help points, CCTV, CIS displays and PA equipment) that will become life-expired in CP6 (>10 years old) should be replaced. Some TOCs have expressed an opinion that like-for-like renewals will not be sufficient and replacements needs to account for the following: • Trains are longer • Trains stop in different positions along the platform • Passenger volumes are much higher and CIS can help manage station dwell times • What was suitable 15 years ago will not be suitable during the next 10 years • The need to future proof • We must maximise customer satisfaction Network Rail must engage with TOCs at a very early stage as they have significant experience in this area	CIS renewals are planned in CP6 and we are working with the operators to deliver improvements to the station CIS wherever this is possible. Additional improvements in this area will be delivered as part of the plan for the next control period. Enhanced CCTV is also required to counteract the increased risks from terrorism.	The old orange LED screens will move to new LED panels that allow for a much greater use of colour and graphics. They will be IP enabled (which future proofs for a period of time) and proactively monitored. We need to understand the approach to providing travel information on personal devices and how important this is considered to be in order to provide the most appropriate capability. We are also looking at Wi-Fi enabled touch screens but further discussion on screen capability requirements is needed
	Mobile to train and on train data offload	We will work with the TOC's to enable them to deliver their franchise commitments in delivering improved mobile connectivity for passengers. We will also use our infrastructure to improve real time data offloading from trains (e.g. for on train CCTV offloading)	Early engagement to drive forward the CP6 core scenario and delivery plans associated with it

2.4 How these priorities link to our strategic plan for CP6

Whilst section 2.3 demonstrates alignment with our customer and stakeholder needs, we have also undertaken further activities with the routes such as supporting them with the writing of the telecoms section within their strategic plans to ensure alignment.

In summary

What will we do?	How we will do it
✓ Place our customers at the heart of everything we do	✓ Continue to deploy our highly available, secure and scalable, national next generation network coverage and capacity
✓ Continue to focus on delivering the telecoms capability, infrastructure and services that enable a safe and efficient railway	✓ Embed our operating model and develop our processes and systems to deliver an exceptional customer experience
✓ Extend the use of our assets to support Network Rail's strategic business plans, the digital railway, our customers, passengers and lineside neighbours' requirements	✓ Invest in and create an integrated plan to ensure our colleagues are skilled and competent
✓ Develop a sustainable business model	✓ Identify and secure non-disruptive inward investment and funding

Increasingly demanding and passenger numbers continue to grow rapidly. Our strategy has been designed to help our key customers (the Routes) to provide additional and improved services to their customers (the TOCs & FOCs) and ultimately, improve passenger experience.

3. NRT objectives

This plan is predicated on the key assumptions laid out in Appendix B and will be impacted as these assumptions change.

Scorecard for 17/18

Safety	17/18		
	MINIMUM	TARGET	MAXIMUM
Lost Time Injury Frequency rate	0.442	0.402	0.362
Close Calls % closed within 90 days	77%	85%	94%
Milestones to reduce information security risk, improve safety culture and employee wellbeing	8	9	10
Financial performance	**17/18**		
	MINIMUM	TARGET	MAXIMUM
Financial Performance Measure – excl. enhancements (£m)	tbc	0	Tbc
Cash Compliance	tbc	£137.4m	Tbc
Investment	**17/18**		
	MINIMUM	TARGET	MAXIMUM
Top Investment Milestones	tbc	8	tbc
Asset Management	**17/18**		
	MINIMUM	TARGET	MAXIMUM
Reduction in Telecoms service affecting failures	3120	2836	2552
Telecoms Renewals Volumes	5883	6537	7191
Train Performance	**17/18**		
	MINIMUM	TARGET	MAXIMUM
Reduction in train delay minutes	127271	115701	104131
FTNx Capacity	80%	90%	100%
Locally Driven Customer Measures	**17/18**		
	MINIMUM	TARGET	MAXIMUM
Service Availability – % performance of key NRT services	82.01%	90.99%	99.97%
Your Voice Pulse Survey - employee engagement	72%	77%	82%
Your Voice Pulse Survey – improvement on lowest scoring question	63%	65%	68%

Long term scorecard

Safety		18/19	19/20	20/21	21/22	22/23	23/24	24/25	Achievability
Close Calls % closed within 90 days	MINIMUM	85%	85.4%	87.6%	90.0%	91.2%	92.4%	93.6%	Increasing faults on troughing difficult to resolve within 20 days
	TARGET	91%	91.2%	92.3%	93.5%	94.1%	94.7%	95.3%	
	MAXIMUM	97%	97%	97%	97%	97%	97%	97%	
Milestones to reduce information security risk, improve safety culture and employee wellbeing	MINIMUM	80%	80%	80%	80%	80%	80%	80%	Milestones set each year
	TARGET	90%	90%	90%	90%	90%	90%	90%	
	MAXIMUM	100%	100%	100%	100%	100%	100%	100%	
Financial Performance		**18/19**	**19/20**	**20/21**	**21/22**	**22/23**	**23/24**	**24/25**	**Achievability**
Financial Performance Measure – excl. enhancements (£m)	MINIMUM								Based on efficient delivery of volumes and financials to deliver train performance
	TARGET	0	0	0	0	0	0	0	
	MAXIMUM								
Cash compliance	MINIMUM	Tbc							Post efficient cash funding
	TARGET	130.2	225.4	246.2	223.0	207.8	170.4	215.0	
	MAXIMUM	Tbc							
Investment		**18/19**	**19/20**	**20/21**	**21/22**	**22/23**	**23/24**	**24/25**	**Achievability**
Top Investment Milestones (Set each year)	MINIMUM	80%	80%	80%	80%	80%	80%	80%	Milestones set each year
	TARGET	90%	90%	90%	90%	90%	90%	90%	
	MAXIMUM	100%	100%	100%	100%	100%	100%	100%	
Asset Management		**18/19**	**19/20**	**20/21**	**21/22**	**22/23**	**23/24**	**24/25**	**Achievability**
Service Availability – % performance of key NRT services	MINIMUM	83.8%	85.4%	86.8%	88.2%	89.4%	90.4%	91.4%	10% reduction in failures YOY
	TARGET	91.9%	92.7%	93.4%	94.1%	94.7%	95.2%	95.7%	
	MAXIMUM	99.97%	99.97%	99.97%	99.97%	99.97%	99.97%	99.97%	
Telecoms Renewals Volumes (per plan)	MINIMUM	4277	10444	9166	7641	3176	2175	7824	Per budget set each year
	TARGET	4753	11605	10185	8490	3529	2417	8694	
	MAXIMUM	5228	12765	11203	9339	3882	2659	9563	

Train Performance		18/19	19/20	20/21	21/22	22/23	23/24	24/25	Achievability
Reduction in train delay minutes	MINIMUM	+10%	+10%	+10%	+10%	+10%	+10%	+10%	Routes will request significant improvements each year which will be very challenging
	TARGET	Agreed with Routes	Agreed with Routes	Agreed with Routes	Agreed with Routes	Agreed with Routes	Agreed with Routes	Agreed with Routes	
	MAXIMUM	-10%	-10%	-10%	-10%	-10%	-10%	-10%	
FTNx Reach	MINIMUM	80%	80%	80%	80%	80%	80%	80%	Based upon rollout programme
	TARGET	90%	90%	90%	90%	90%	90%	90%	
	MAXIMUM	100%	100%	100%	100%	100%	100%	100%	
Locally Driven Customer Measures			19/20	20/21	21/22	22/23	23/24	24/25	Achievability
Service Level Availability (Telecoms)	MINIMUM	90.99%	92.8%	92.6%	93.3%	93.8%	94.4%	95%	Will require deployment of new network topologies
	TARGET	92.80%	92.6%	93.3%	93.8%	94.4%	95.0%	95.4%	
	MAXIMUM	99.97%	99.97%	99.97%	99.97%	99.97%	99.97%	99.97%	
Your Voice Pulse Survey – employee engagement	MINIMUM	77%	79.3%	81.4%	83.2%	84.9%	86.4%	87.8%	Improving scores will require moderate cultural change
	TARGET	79.3%	81.4%	83.2%	84.9%	86.4%	87.8%	89.0%	
	MAXIMUM	81.4%	83.2%	84.9%	86.4%	87.8%	89.0%	91.1%	
Your Voice Pulse Survey – improvement on lowest scoring question	MINIMUM	65%	66.5%	68%	69.5%	71%	72.5%	74%	Improving scores will require moderate cultural change
	TARGET	66.5%	68%	69.5%	71%	72.5%	74%	75.5%	
	MAXIMUM	68%	69.5%	71%	72.5%	74%	75.5%	77%	

Achievability definitions (applies to "target" value)	
RED	Very challenging, likely to require substantial organisational and cultural change to achieve and/or highly dependent on third party involvement
AMBER	Challenging, likely to require moderate organisational and cultural change to achieve and/or dependent on third party involvement
GREEN	Achievable, builds on existing organisational and cultural capabilities and little or no dependency on third parties for delivery

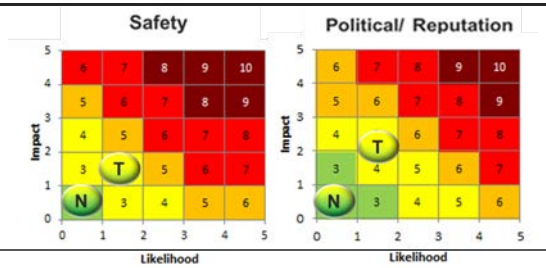
NRT scorecard definitions

Category	Measure	Weighting	Definition of measure
Safety	Close Calls % closed within 90 days	15%	A national safety measure which captures the number of close calls that are closed within 90 days
	Safety Milestones		The health, safety, security and wellbeing milestones which are available in NRT's Periodic Update newsletter
Train Performance	Train Delay Minutes	10%	Train delay minutes attributed to telecoms failures
	FTNx Reach		The extent to which our FTNx distribution layer has been deployed
Finance	Finance Performance Measure	15%	The variance between our budgeted and actual Opex, capex and income performance
	Cash Compliance		The ability to remain within our funding envelope
Investment	NRT Milestones	25%	The NRT milestones completed which are available in NRT's Periodic Update newsletter
Asset Management	Service Affecting Failures	15%	The number of incidents where telecoms equipment has impacted train performance
	Renewal Volumes		The number of telecoms renewals activities completed
Satisfaction	Service Availability	20%	A combination of four KPIs which indicate the availability of telecoms services (Expected delivery dates on projects, Service Level Agreements, Enquiry to quote deadlines and journeys not impacted by Telecoms failures).
	Your Voice 'Pulse' Survey Employee Engagement		The employee engagement index result of the six monthly Your Voice pulse survey
	Your Voice 'Pulse' Survey Improvement on lowest scoring question		Improvement in previous Your Voice pulse survey lowest scoring question

4. Safety (activity prioritisation on a page)

Summary of objectives	To maintain safety performance at the highest level affordable and within appetite within cash constraint scenarios for CP6. To further improve our safety culture and identify opportunities to improve safety performance throughout the telecoms estate.

No.	Key constraints, risks and opportunities	What we plan to do	Owner	Timescale (start/ finish)
1	C: The plan assumes minimum [financial] constraints on the achievement of safety objectives.	We will monitor changes in financial requirements and manage the asset portfolio in accordance with established safety risk management principles.	NRT Head of Operate	Initiate in Yea r5 of CP5, and sustain through CP6
2	C; The plan assumes no increase in risk of failure to meet LTIFR.	We will monitor accident and injury rates, and further improve our safety culture. See also item 6 below.	Professional Head - Telecom	Continued effort throughout CP5 and CP6
3	R: Wholesale renewal of 'cable trough' is not being undertaken by NRT (it has been removed from the minor works budget). There is a risk of increased (1) Close Calls for potential slips, trips and falls related to cable trough condition and exposed cable, and (2) they will exceed the 90-day target.	Work continuously with industry to engage with workers and improve awareness of this issue. Work with major programmes to reduce the likelihood of further damage to troughs and cables, and to reduce the likelihood of related accidents.	NRT Head of Operate	Initiate in Year 5 of CP5 and sustain through CP6
4	R: Railway Operational Safety: There is increasing risk that a GSM-R emergency call will not be fulfilled to prevent a collision/accident. This is because of three factors: (1) Government and industry plans to address radio interference affecting GSM-R are not yet agreed and we believe that there will be increasing occurrences of radio interference; (2) our ability to monitor radio quality is limited, and; (3) we are deferring renewals of signal boxes' GSM-R signaller terminals, effectively delaying risk reduction.	1 and 2: We will make the case for the finance (to upgrade the cab radios, and improve the network) so as to agree funding before end of Year 4 of CP5. Also will develop other short term mitigation strategies. 3.a: We will optimise the asset management regime for GSM-R signaller's terminals. 3.b: Site inspections will help enable better understanding of site and asset condition, and better fault prevention.	1 and 2: NRT Director 3.a: NRT Head of Operate 3.b: Professional Head - Telecom	1 and 2 to be completed before end CP5 3 a and b commence before end CP5 and sustain through CP6
5	O: An opportunity is taken in the plan to defer some level crossing telephone renewals so as to introduce a better performing product.	Align telecom asset renewals with Network Rail level crossing initiatives to introduce better performing products.	NRT Head of Scope	Continued effort throughout CP5 and CP6
6	O: Opportunities may arise to reduce the risk of lineside accidents by moving assets to a safer location, or reducing worker exposure to higher risk maintenance and repair activities.	Site assets in safer locations where practical to do so.	NRT Head of Scope	Managed throughout CP6

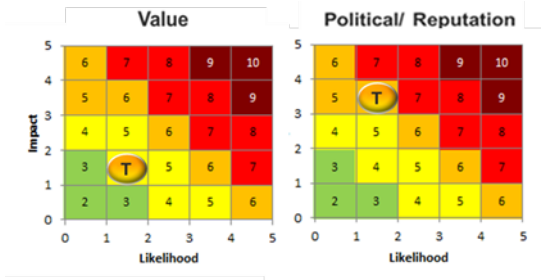


Summary of risk outcome:
We plan to continue to manage safety risk within risk appetite throughout CP6. However GSM-R, level crossing or cable trough issues may affect both safety and related reputation adversely if they manifest in CP6.

Financial performance (activity prioritisation on a page)

Summary of objectives	To acquire funding for CP6 activities and exercise control over NRT finances and monitoring and responding to financial performance issues.

No.	Key constraints, risks and opportunities	What we plan to do	Owner	Customers impacted	Timescale (start/ finish)
1	C: NRT has a working assumption that the total budget of £1.1 bn is not to be exceeded within CP6.	Prioritise asset renewals and drive efficiencies within Opex to ensure deliverability against targets	NRT Director	Routes, NRT and GDR	Managed throughout CP6
2	R: Financial Performance Measure and Cash Compliance – Capex Unit Rates: There is a risk that the assumed unit rate reductions will not be realised, impacting the ability to deliver the volumes in the plan.	Monitor and respond through periodic reporting against the plan.	NRT Director	Routes, NRT and GDR	Managed throughout CP6
3	R: FPM and Cash Compliance – Capex Supplier Prices: There is a risk that external market prices will increase the cost of products or services, impacting the ability to deliver the plan.	Monitor and respond through periodic reporting against the plan.	NRT Director	NRT and GDR	Managed throughout CP6
4	R: Cash Compliance - Opex: There is a risk that operational support contracts and third party service contracts will increase in cost due to deferral of work or retention of obsolete assets remaining in service longer than planned.	Monitor and respond through periodic reporting against the plan.	NRT Director	NRT and GDR	Managed throughout CP6
5	R: There is a risk that efficiency targets will be set that are not within the plan.	Review areas of key costs and identify opportunities to achieve efficiency targets.	NRT Director	NRT and GDR	Managed throughout CP6
6	O: There may be an incremental opportunity to raise further external investment/funding by extending the use of telecoms assets and infrastructure.	Write the business cases to extend the use of telecoms assets and infrastructure beyond NR and DR for passenger connectivity and lineside neighbours.	NRT Commercial Director	All routes, TOCs and other external stakeholders	Late 2017 to December 2018



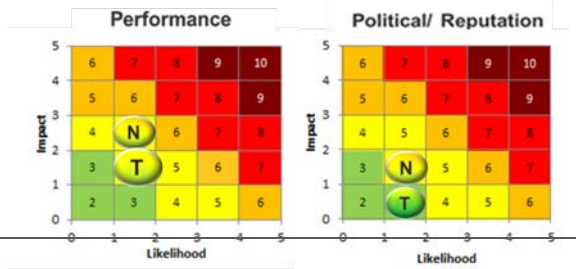
Summary of risk outcome:
Financial risk will be monitored to ensure that NRT remains within its funding envelope. The plan intends to remain within risk appetite throughout CP6.

Please note Net and Target scores are identical within both Political/Reputation and Vale assessments for financial performance.

Investment: capacity & growth (activity prioritisation on a page)

Summary of objectives	To build the capability, capacity and reach of our next generation network to ensure it meets the needs of the business and of our customers. Exploit opportunities to reduce the cost and complexity of our asset base through consolidation and rationalisation.

No.	Key constraints, risks and opportunities	What we plan to do	Owner	Customers impacted	Timescale (start/ finish)
1	**C:** NRT does not have a 'capacity' target or plan to be achieved.	Work proactively with our key stakeholders to understand their future demands of the telecoms network. These will inform our capacity planning processes and projects will plan for such.	NRT Head of Scope NRT Head of Build	Internal Network Rail, rail industry and government customers	Managed throughout CP5 and CP6.
2	**C:** Enhancements or investments arising from the Digital Railway Programme or other rail infrastructure projects are not budgeted within this plan.	Strengthen our presence in their Investment Panel meetings and ensure that customers are aware of the provision that must be made in their project and operating budgets to support their telecoms need.	NRT Head of Scope NRT Head of Build	Internal Network Rail, rail industry and government customers	Managed throughout CP5 and CP6.
3	**R:** There is a risk that railway programmes and projects will place orders with milestones that NRT cannot meet. [This will be due to them engaging NRT insufficiently early (1) to check their assumptions and jointly agree milestones or (2) for NRT to prioritise support to complete the work to the project schedule.]	Strengthen our customer account management capability, and engage earlier with our customers to understand their requirement early in the project lifecycle and ensure that our plans are aligned.	NRT Head of Scope	Internal Network Rail, rail industry and government customers	Managed throughout CP5 and CP6.
4	**R:** There is a risk that NRT will not gain additional funding to meet delivery milestones for railway programmes and projects that are not explicitly funded already in this plan. [This will be due to them failing to engage with NRT to (1) check their assumptions or (2) jointly agree the budget and expenditure to meet project scope.]	Strengthen our customer account management capability, and engage earlier with our customers to understand their requirement early in the project lifecycle and ensure that our plans are aligned.	NRT Head of Scope	Internal Network Rail, rail industry and government customers	Managed throughout CP5 and CP6.
5	**R:** There is a risk that NRT will not have the organisational or network capacity to meet new customer demands, the assumptions of operational users and customers or projects that are not explicitly funded already in this plan.	Strengthen our customer account management capability and engage earlier with our customers and our supply chain. Ensure that funding for organisational and network capacity is included in customer proposals.	NRT Head of Scope NRT Head of Build	Internal Network Rail, rail industry and government customers	Managed throughout CP5 and CP6.
6	Opportunities may arise in future plans to identify minor efficiencies or to identify how to use capacity more effectively [for example, in station upgrades or system renewals] that are not part of NRT's present plan for capacity and growth.	Work with our customers to identify and to exploit opportunities to reduce cost by leveraging next generation technologies, available capacity and by delivering integrated programmes of work such that cost can be shared.	NRT Head of Build	Internal Network Rail, rail industry and government customers	Managed throughout CP5 and CP6.



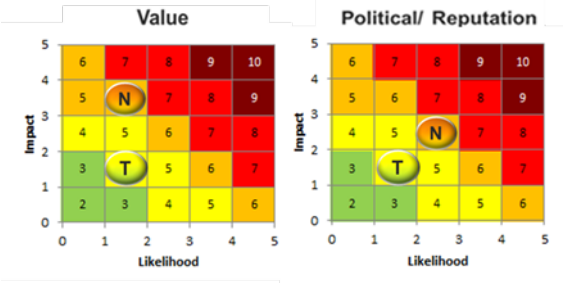
Summary of risk outcome:

The investment element of performance is within appetite for both performance and reputation. Measures to improve customer and supply chain engagement and to ensure better alignment of plans are intended to develop us as a service provider and reduce the impact in both performance and reputation over CP6.

Sustainability & asset management capability (activity prioritisation on a page)

Summary of objectives	Achieve sustainability targets by delivering against the target investment plan in keeping with targets set by ORR, and avoiding overspend to stay within budget. Strive to achieve optimal whole life costs in asset management regimes.

No.	Key constraints, risks and opportunities	What we plan to do	Owner	Timescale (start/ finish)
1	C: There is a bow wave of renewals work due to a lack of funding in CP4 and CP5 that needs to be addressed in CP6. Some renewals scheduled for CP6 have been deferred because they cannot be afforded in CP6 will be addressed in CP7.	Design, develop and execute a delivery/transformation plan that is underpinned by stable investment, resource and product development and cyclic maintenance to deliver the requirements of the core scenario of CP6. Stability and development of efficiencies in CP6 will support further investment planning in CP7.	NRT Head of Scope	Develop CP6 readiness plan by October 2017. Continued effort throughout CP5 and CP6
2	R: There is a risk that the budget for the CP6 readiness plan will not address sufficient volumes to stabilise the decline of the asset sustainability figure.	We will identify the core cost in the delivery of telecoms assets with particular attention to station information and surveillance systems. We will target efficiencies in technology and delivery, and drive lower unit rates and whole life cost reductions to deliver increased volumes within a sustainable budget for CP7.	NRT Head of Operate	Develop plan by March 2018. Continued effort throughout CP5 and CP6
3	O: Opportunities may arise to align, coordinate or merge projects together so as to drive efficiency and derive benefit from products, services and organisational capabilities.	We will use the NRT decision support tool to identify opportunities and package complimentary works together. Also we will engage route stakeholders to identify opportunities to include our packages within their overall work plans and realise efficiencies that way.	NRT Head of Operate	Develop plan by March 2018. Continued effort throughout CP5 and CP6
4	O: Opportunities may arise to deliver national ubiquitous connectivity earlier than planned. This may be offered as an alternative for some renewals projects to utilise and hence gain greater efficiency.	We will monitor progress with delivery of the national network capability, and identify opportunities to affect the design or utilise the final network to avoid the costs of using legacy or third party networks.	NRT Head of Build	Assess reliance on legacy/third party infrastructure by July 2018. Continued effort throughout CP5 and CP6
5	O: Opportunities may arise to develop a more intelligent asset or asset management regime that will derive greater efficiency from the renewals schedule with reduced resource requirements.	We will support internal research and development of intelligent service based infrastructure and reliability centred maintenance which may offer opportunities to influence projects in CP7 and beyond.	NRT Head of Scope	Continuous review in CP5 and CP6.
6	O: Opportunities may arise to develop or acquire new decision support tool(s) that will assist asset managers to derive greater efficiency from the renewals schedule.	Dependent upon funding becoming available, we will develop or acquire a better decision support tool to support whole life cost modelling and identify downstream opportunities to realise efficiencies.	NRT Head of Build	An emergent opportunity to be identified in CP5 and CP6.
7	O: Opportunities may arise to optimise the frequency of asset maintenance and renewals activities and therefore to drive efficiency in the resource plan.	Dependent upon items 5 and 6 above potential improvements in whole life costs may be realised and changes to the resource plan proposed.	Professional Head - Telecom	An emergent opportunity to be identified in CP5 and CP6.

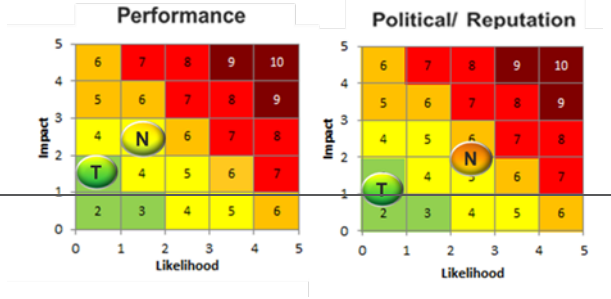


Summary of risk outcome:
Our present risk position for sustainability and asset management is within appetite. However our plan for CP6 is dependent upon our ability to identify and reduce the core cost of the delivery of telecoms assets, and dependent upon as yet unrealised unit cost reductions. We perceive greater risk is being taken in the plan, and therefore the target scores for value and reputation are each ambitious at 2:2.

Train performance (activity prioritisation on a page)

Summary of objectives	We will change the approach to on-going management and maintenance of telecoms services, networks and assets across Network Rail. This is because telecoms technology improves efficiency by concentrating high volumes of critical services onto a high capacity, high availability and secure platform. Reliability is improved by building resilience and using technology to predict and prevent failures. Train delays thus become more infrequent, however higher impacting.

No.	Key constraints, risks and opportunities	What we plan to do	Owner	Customers impacted	Timescale (start/ finish)
1	O: Current telecoms management and maintenance processes are aligned to an asset management model. There is an opportunity taken in the plan to develop NRT as service provider, using service level agreements to define and deliver services to the digital railway, wider Network Rail, TOCs, FOCs and third party suppliers.	Design, develop and implement a national service level agreement with the customer/supplier/ maintainer community for telecoms services delivered across the rail corridor.	NRT Head of Operate	Routes, RS-IT, TOCs, FOCs, Level 3.	Start: Year 1 CP6 End: Year 2 CP6
2	R: NRT fails to attract the right kind of new talent into the organisation and tend to promote from within. New technologies will require the development of new capabilities and ways of working to support the digital railway. NRT will need to become more attractive to new talent and technology experts whilst retaining scarce legacy technology skill sets.	Establish attractive external NRT brand identity and ensure that strategic roles are benchmarked against telecommunications industry.	Director NRT	All	Start: October 2017 End: September 2018
3	O: There is an opportunity taken in the plan to exploit centrally managed telecoms systems and to gather data about real-time asset and service condition. This in turn presents opportunities for 'predict and prevent analyses' and 'proactive maintenance'.	Implement data farming and harvesting policy combined with a service architecture that delivers benefits to NRT and its customers.	NRT Head of Operate	All	Start: now End: Year 2 CP6
4	O: There is an opportunity taken in the plan to develop intelligent system integration combining processes, data and system information. This will deliver real-time automation that builds intelligence and analytics into a simplified user interface, combining processes, data and system information.	Develop a network element intelligence strategy that delivers real-time automation that leverages standard service models to deliver a world-class service to our customers.	NRT Head of Operate	All	Start: November 2017 End: Year 2 CP6
5	C: Current NRT telecoms services delivered across Network Rail do not benefit from service management. The introduction of service management as part of an ITIL framework would make efficient use of resources and improve the quality and reliability of services NRT delivers to our customers.	Become service-led and adjust the organisation to ensure we put the customer experience at the heart of what we do. This will be reflected with the application of a more formal ITIL framework across NRT.	NRT Head of Operate	All	Start: November 2017 End: November 2019
6	R: NRT currently operates legacy, end of support, end of life and obsolete assets. These assets/services cannot sustain service levels required to build the digital railway, and take up space, power, resource which could be more effectively purposed for ubiquitous national telecoms network.	Develop a complete migration strategy that sunsets the frame-based technologies that reside within our network	NRT Head of Scope	All	Start: March 2017 End: into CP7

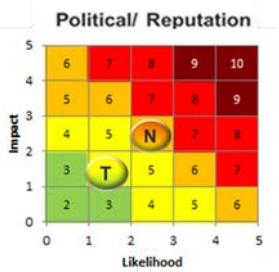


Summary of risk outcome:
We are managing train performance risk within appetite however keeping reputation within appetite is more challenging. Increased dependency on telecoms in CP6 will drive greater risk to both measures but, by exploiting the identified opportunities, we will address this and drive towards our target position by the end of CP6.

Locally driven customer measures (activity prioritisation on a page)

Summary of objectives	NRT will move from a transactional to partnership relationship with its customers by engaging earlier in the planning cycle. We will achieve this by transitioning from asset to service based outcomes through enhancing our standard product portfolio.

No.	Key constraints, risks and opportunities	What we plan to do	Owner	Customers impacted	Timescale (start/ finish)
1	R: There is a risk that we continue to deliver bespoke, expensive non-repeatable services to the railway	Implement a single front door for customer requests underpinned by a service catalogue with standard and repeatable products and services	Head of Scope	All Routes, TOC's	June 2017 to March 2019
2	R: NRT engages internal customers too late in projects to steer customers to standard telecoms services	Build account management capability to engage and align with customers earlier in the planning lifecycle	Head of Scope	All Routes, TOC's	June 2017 onwards
3	R: There is a risk that Network Rail is targeted as part of a local/national cyber/security breach resulting in reputational damage	Develop products and services to support and protect our customers	Head of Scope	All Routes, TOC's	July 2017 onwards
4	R: There is a risk of increased cyber-attack as we move to open IP architectures.	Build the services and operating models to better protect our customers	Head of Operate	All Routes, TOC's	January 2018 onwards
5	R: There is a risk of multiple third parties accessing safety critical track side assets in an uncontrolled manner	Deliver commercial products and services in a way that protects and leverages those critical assets (assuming mandate and funding secured)	Head of Scope	All routes, TOCs and external stakeholders	Late 2015 onwards
6	O: In support of our route based customers (i.e. TOC's),to Improve the passenger journey experience by enabling wireless and mobile connectivity to trains through improved intelligent trackside infrastructure.	Deliver commercial products and services in a way that protects and leverages those critical assets (assuming mandate and funding secured)	Head of Scope	Routes, TOC's, Passengers	Late 2015 to onwards



Summary of risk outcome:
Through management of the risks and opportunities identified we will move to become a more commercial and service orientated telecoms provider whilst maintaining telecom support for the railway and improving passenger journeys.

5. Activities & expenditure

5.1. Cost and volume summary

This plan is predicated on the key assumptions laid out in Appendix B and will be impacted as these assumptions change.

Renewal costs (post headwinds and efficiencies in 17/18 prices)

	Unit of Measure	CP5 (£m)						CP6 (£m)						CP7 (£m)
		14/15	15/16	16/17	17/18	18/19	CP5	19/20	20/21	21/22	22/23	23/24	CP6	24/25
Route Operational Communications	**£m**	3.6	9.8	8.4	15.1	7.5	**44.4**	25.0	24.1	15.1	7.4	12.9	**84.5**	21.3
Route Network	**£m**	5.5	8.9	7.8	8.0	7.4	**37.6**	10.0	10.0	7.4	8.6	7.2	**43.1**	10.9
Station Information and Surveillance Systems	**£m**	5.1	6.1	8.9	£9.5	26.8	**66.4**	44.3	48.5	33.9	24.0	13.0	**163.8**	41.2
Route Projects and other	**£m**	10.1	7.4	5.6	4.1	6.3	**33.5**	3.8	3.4	8.0	13.0	13.3	**41.5**	10.6
Non Route Central capital	**£m**	60.2	23.1	38.7	35.6	15.3	**172.9**	72.2	88.1	83.9	78.0	45.3	**367.5**	75.9
Total Telecoms Capital	**£m**	***84.4***	***55.3***	***69.4***	***82.3***	***63.4***	***354.8***	***155.4***	***174.1***	***148.3***	***131.0***	***91.7***	***700.5***	***136.3***
Non PR-FTN*	**£m**	0	13.3	10.8	2.0	0	**26.1**	0	0	0	0	0	**0**	0
Telecoms including FTN	**£m**	***84.4***	***68.6***	***80.2***	***84.3***	***63.4***	***380.9***	***155.4***	***174.1***	***148.3***	***131.0***	***91.7***	***700.5***	***136.3***

*Non PR-FTN funding relates to FTN GSMR expenditure undertaken by units other than Network Rail Telecom for which we were not funded for in CP5 but which were subsequently transferred across to NRT, they have been included here for comparison purposes.

KEY VOLUMES

	CP5 (£m)						CP6 (£m)						CP7 (£m)
Unit of Measure	14/15	15/16	16/17	17/18	18/19	CP5	19/20	20/21	21/22	22/23	23/24	CP6	24/25
Transmission Node	0	62	36	33	71	202	150	56	115	191	249	761	183
Radio		76		2		78	1	12	34	88	91	226	54
Concentrators	21	1,088	5,591	3,634	2,128	12,462	3,105	1,570	2,469	228	472	7,844	1,883
SISS	1,132	474	1,006	2,204	2,530	7,346	8,068	8,040	5,710	2,738	1,327	25,863	6,212
DOO CCTV and mirrors	9	74	36	21	2	142	83	277	56	95	68	579	139
Human Machine Interfaces		11	60	46	16	133	11	36	7	14	40	108	26
PETS	22	13	11	8		53	51	78	2	21	44	196	47
Power	7	46	2	82	6	143	136	116	97	154	126	629	151

Note on significant volumes in CP6:

- **Concentrators:** Reduced volumes compared to CP5 due to rollout of centralised fixed voice platform, enabling capability delivery with fewer assets.
- **SISS:** Increased volumes in early years of CP6 as a result of CP4/5 deferrals of assets which are now life expired, decrease in year 4/5 due to some deferrals into CP7.

OPEX COSTS (post headwinds and efficiencies in 17/18 prices)

	CP5 (£m)						CP6 (£m)						CP7 (£m)
	14/15	15/16	16/17	17/18	18/19	CP5	19/20	20/21	21/22	22/23	23/24	CP6	24/25
Maintenance													
Operations													
Support	73.5	72.6	53.3	53.1	66.8	**319.3**	70.0	72.1	74.7	76.8	78.6	**372.2**	78.7
Total Controllable Costs	73.5	72.6	53.3	53.1	66.8	**319.3**	70.0	72.1	74.7	76.8	78.6	**372.2**	78.7
Non-Controllable Costs													
Headcount													
Permanent	477	514	517	522	523	**523**	523	523	523	523	523	**523**	523
Agency	46	28	18	13	12	**12**	12	12	12	12	12	**12**	12

**Accommodation, training and GDR leadership costs are held separately within GDR Support.

5.2. Route Business Scotland details

	CP5 Year			CP6 Year					CP6 total
	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	
National Cost (£m)	133.5	137.4	130.2	225.4	246.2	223.0	207.8	170.4	**1072.7**
Scotland Renewals Cost	*11.1*	*8.9*	*4.6*	*16.6*	*18.4*	*15.6*	*13.8*	*9.6*	***74.0***
Scotland Operational Costs	*5.6*	*5.6*	*7.0*	*7.5*	*7.6*	*7.9*	*8.1*	*8.3*	***39.3***
Scotland Cost (£m)	**16.7**	**14.5**	**11.6**	**24.0**	**26.1**	**23.5**	**21.9**	**17.9**	**113.3**
Scotland (%)	12.5%	10.6%	8.9%	10.7%	10.6%	10.5%	10.5%	10.5%	**10.6%**
National Cost	The CP6 national cost represents, Route based renewals of £333.0, Central asset renewals of £367.5m and Operational costs of £372.2m								
Basis for allocation to Route Business Scotland	Route assets renewal expenditure Central capital and operational cost expenditure has been apportioned from a National fund on the basis of Train km on an annual basis, giving a CP6 cost of £74.0m for Capital expenditure Operational costs have been apportioned, in line with group guidance, on the basis of Train km on an annual basis, giving a CP6 cost of £39.3m								
Activity	Route Asset replacement will cover the replacement of specifically identified route assets within the area controlled by the Scotland route and is based upon the Network Rail Telecoms Decision Support Tool which lists each asset, its age, condition and replacement cycle. Central capex will provide for the National telecommunications network capability required to keep the railway running across GB, which Scotland benefits from. The Operational costs represent the apportioned costs of running the national telecoms service and networks (excluding maintenance which is budgeted for within the Route directly). The plan for Scotland has been prepared in light of the requirements outlined in the High Level Output Specification issued by Transport for Scotland in July 2017 and has been designed to meet the aspirations for improved customer benefits outlined within it.								

5.3. Asset intervention strategy

Asset area	Intervention strategy
Telecoms	The Telecoms Asset Management Policy provides clarity of direction on the Asset Intervention Strategy, a summary of this is contained below. Asset Intervention Types Four key intervention types are used to provide service to our customers, mitigating the effects of the asset's degradation and failures: • Monitor • Inspect (predict) and maintain (prevent) • Replacement and renewal Monitor - Check that equipment meets the defined performance thresholds by checking the asset by automated management systems or direct observation. If the performance threshold is breached or failures are detected, secondary intervention or remedial action such as rectify or periodic service is required to restore service. Inspect (predict) and maintain (prevent) - Check that equipment meets the defined performance thresholds by periodic visual and physical activities including tests and measurements, restoring (service) performance to defined thresholds if within expected levels. Maintenance can be at hardware or software level. Replacement and renewal - Replacing or renewing components or systems with serviced or repaired spares or new purchase. Three types of renewal or replacement are available: 1) Full system renewal generally comprises the system itself and the supporting equipment, containment and structures. Project management, design, testing and commissioning are included in the package. 2) Targeted renewal is the renewal/replacement of a component part of a system such as a monitor/display or camera where there is a little or no requirement for design work and minimal testing and project management. 3) Maintainer swap-out is replacement of equipment as part of the normal service/system rectification activity, generally using the Telecommunications Maintenance Testing & Failure Investigation (TMT&FIP) Process.

5.3.1. Weather resilience

Within the CP6 investment scenario there is funding identified for the development of improved environmental management equipment and processes. The allocation of funds will be used to develop environmental solutions that mitigate against hot weather conditions and deliver a sustainable solution that reduces the reliance on operational cost funding associated with maintenance and faulting of traditional environmental systems e.g. air conditioning.

Our networks and systems are, and will continue to be, designed and implemented to provide physical and logical diversity, up to the point the application connects to the telecoms infrastructure. Significant weather or external infrastructure events do cause issues to the telecoms infrastructure locally, but data passing across our core systems can be rerouted (usually automatically) to avoid problem areas and giving inbuilt resilience.

We are working with our stakeholders to develop a suite of telecoms services to support remote condition monitoring of our infrastructure, to assist in the early warning and management of weather related incidents.

5.4. Operational plan

5.4.1. Train performance strategy

The investment identified within the core scenario is designed to maintain the CP5 exit figures for train performance. There are opportunities to drive minimal performance improvements however the investment is primarily targeted at maintaining systems' stability utilising an efficient level of investment. The key imperatives are to deliver simplicity through a single network environment that supports commercial off the shelf (COTS) plug and play solutions. This will be a key enabler in driving down cost through increased system reliability and supporting train performance requirements/improvements.

5.4.2. Route operations strategy

The core investment scenario has been created in consultation with the information provided by the route asset management teams. Renewals are supportive of known operational changes and implement technologies that will form enablers to many of the requirements for the route projects delivering operational change. A summary of the key operational asset groups are summarised as follows:

- Transmission will be provided by a single supportable network (FTNx) by the close of CP6. Legacy transmission systems will be migrated to the FTNx system over the duration of the control period and where operational efficiencies can be identified, third party supplier provisions will also be migrated to the single network
- GSM-R will continue to be the single operational radio network in England and Wales. Scotland will continue to utilise a mix of GSM-R and RETB for track-to-train communications
- Driver Only Operation (DOO) despatch systems will be renewed to support the operational requirements of the routes and associated TOCs. The introduction of new rolling stock with on-board systems is a key consideration in the creation of the core investment scenario
- Level crossing telephony forms a key part of the core scenario with a plan to maintain asset renewals and support the development of product/technology improvements.
- Enabling telecoms for ETCS infrastructure schemes for FTN and GSM-R will be delivered to meet enhanced ETCS requirements.

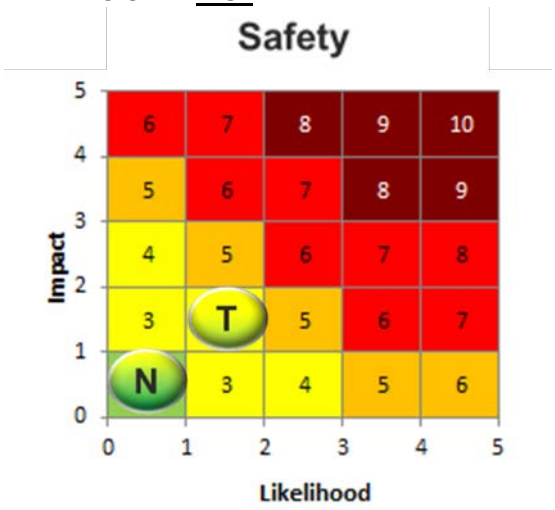
5.4.3. Approach to resilience

The Telecom Asset Management Policy provides guidance on the approach to asset resilience and associated criticality. This guidance has been reflected into the Telecoms Decision Support Tool (DST) and the tool has been utilised to drive the renewals work bank. The key elements that have been prioritised within the plan are summarised below:

- Power support systems have been prioritised to maintain operational continuity in the times of national operator failure. A battery strategy is in the process of being developed to drive power support in line with system and geographical needs. This will drive a sustainable position for this asset base
- Operational telephony will progress with a combination of site renewals in line with the development of a central core that will facilitate flexibility, efficiency and resilience
- Sustained investment into lineside infrastructure and level crossing telephony will deliver improvements to availability of the service and hence support resilience. Known hotspots will be targeted alongside the evaluation of the complete system and support at level crossings
- The migration from third party services to our own telecoms infrastructure will be undertaken to deliver greater resilience at level crossing locations
- Further network build is planned to facilitate the completion of the FTNx infrastructure to enable the single network environment
- The migration from legacy services to our own telecoms infrastructure will be undertaken to drive to a single supportable, scalable and sustainable FTNx network environment.

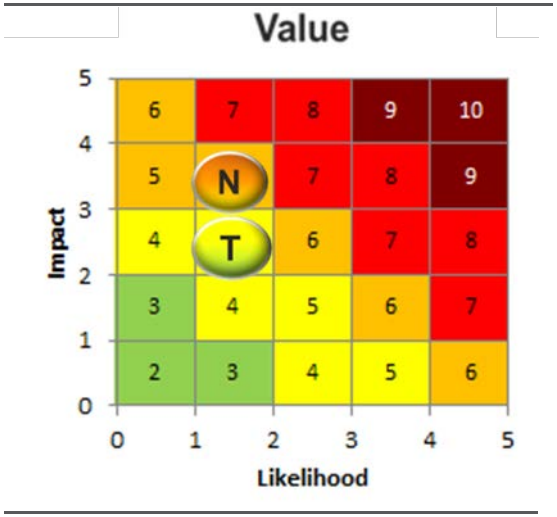
5.5. Output summary

5.5.1. Risk



Summary of risk outcome: Safety

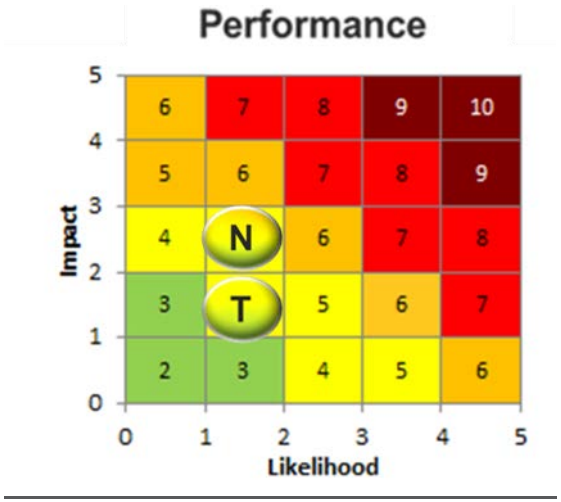
We plan to continue to manage safety risk within risk appetite throughout CP6. However GSM-R, level crossing or cable trough issues may affect safety adversely if they manifest in CP6.



Summary of risk outcome: Value

The target risk position reflects a combination of value (finance) and planned efficiencies for whole life costing in the asset management regime.

Financial risk will be monitored to ensure that NRT remains within its funding envelope. The plan intends to remain within financial risk appetite throughout CP6.

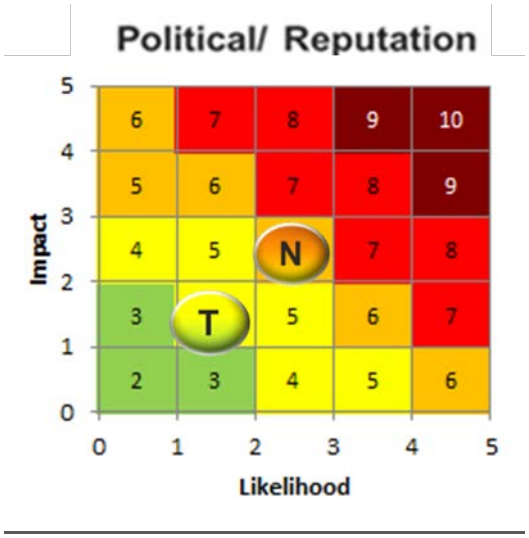


Summary of risk outcome: Performance

The target risk position reflects a combination of train performance and investment capacity and growth.

We are managing train performance risk within appetite. By exploiting the identified opportunities we will drive towards our target position by the end of CP6.

Similarly, the investment element of performance is within appetite. Measures to develop us as a service provider over CP6 (improve customer and supply chain engagement and to ensure better alignment of plans) will enhance our performance in delivery.

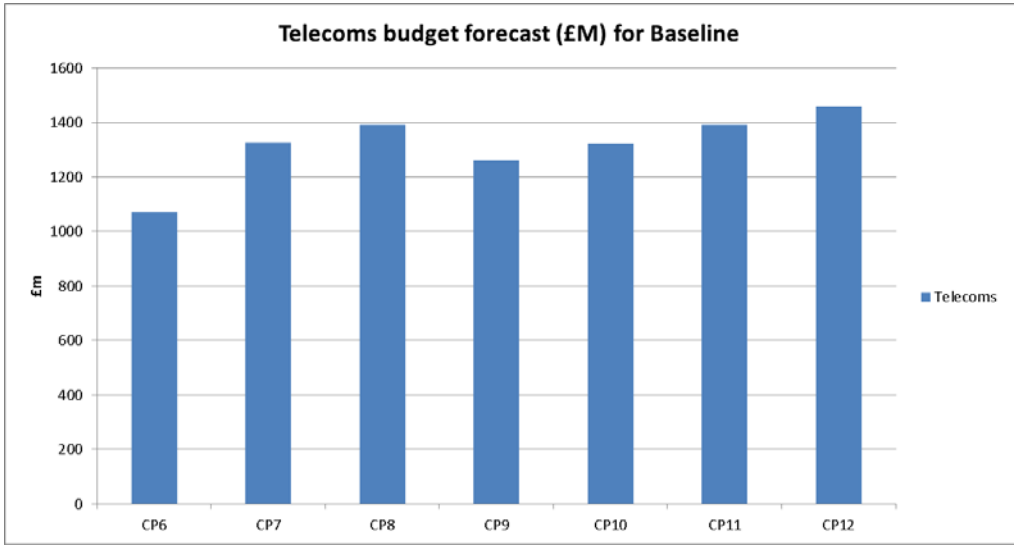


Summary of risk outcome: Political/Reputation

The target risk position strikes a balance between diverse impacts in all six activity areas.

Overall we expect that delivery of all elements of the plan will cause a reduction in both frequency and impact related to political and reputational issues.

Long run forecast



- This graph describes the long term expenditure forecast to control period 12, assuming expenditure levels for CP6 are consistent with the levels outlined in this plan.
- Beyond the end of CP6, the assumed level of expenditure is that required to meet the increasing demand for telecommunications services by the GB rail industry.
- The increase in demand is partly offset by assumed technological advances, capacity and cost improvements driven by these advances.

Given the speed of technological advancement over recent years and the ever increasing demands for new and innovative services: Forecasting of demand, and costs, within the field of telecommunications over more than the 8 years contained in this plan, is considered to be highly speculative. *The increasing underlying trend (5% per CP) is predicated on data growth from intelligent infrastructure use, digital asset and sensor information, remote condition monitoring, digital train control systems and out payments for spectrum and licence upgrades. There is also investment spike in CP8 for technology refresh of £200m to address Software defined networking in the core and uplifts to OSS and BSS systems for orchestration and network management, and a further £200m within CP7 to migrate GSM-R to FRMCS (Future Railway Mobile Communication System)*	**Some costs could be offset partially or fully, contingent on externalisation of the network to drive income and private investment.* *To give some context on the speed of technological change within the telecommunications industry* • *1985 – First ever mobile telephone call made in the UK.* • *1985 – BT installs first 204km of fibre cable in UK* • *1992 – UK's first dial up internet introduced by Pipex* • *1992 – First portable mobile handset introduced* • *2000 - UK's first ADSL broadband line providing a maximum of 2Mb/s.* • *2007 – First Apple IPhone introduced* • *2012 – IPhone 5 launched with 2.7 times the processing power than the 1985 Cray-2 supercomputer (which cost £8 million)*

6. Customer focus & business development

6.1. Operating model and business development

During 2016/17 we reviewed and updated our operating model. This was done to take account of the changing environment in which we operate and the requirements that were placed upon us by the outputs of the Shaw review. Route devolution has also impacted the design of our operating model.

This review led to the creation of three major elements within NRT namely; Scope Build and Operate. Each element's responsibilities are outlined in the diagram adjacent.

We are part of the Group Digital Railway directorate and are a central support function within Network Rail. We provide routes with a national telecommunications capability specifically aimed at the railway. We support the routes by providing a national centre of excellence and ensuring that telecommunications are installed to a common set of interoperable standards across our network.

We are investigating the feasibility of extending the use of our assets and infrastructure with a view to supporting NR the Digital railway our passenger and lineside neighbour communities. To do this, it is anticipated that a degree of investment is required to enhance our existing infrastructure which in turn could yield incremental income. Further details on this can be found in section 9 of this document.

6.2. Future capacity & growth

Whilst the foundation of our CP6 strategic plan is based on asset renewals, we plan to take a service capability based approach linked to a system of systems methodology, developing newer technology and business operating models in order to reduce our operating costs and deliver our services more effectively.

We recognise the ever increasing demands made for our services, and the ever increasing technological change within the commercial telecoms market. Therefore within this strategic plan we are proposing to retire the various legacy networks, which are now costly to maintain, and deliver equivalent capability via a ubiquitous IP telecommunications network. Our aim is to migrate services from legacy core networks by the end of CP6.

We also propose to centralise some of the functionality currently at the edge of the network into two/three data centres, to provide a lower cost, more reliable and more agile service offering to our customers.

6.3. Digital railway

We are a key enabler for the digital railway providing the communications backbone over which capability such as in-cab signalling will operate. We are working closely with the Digital Railway programme to develop a detailed set of requirements that will ultimately define our service offerings for this pivotal programme.

Our strategic plan and the financials within it specifically exclude direct expenditure required to facilitate the requirements of the Digital Railway programme. However, the strategy adopted has been cognisant to ensure that no options have been taken that would run counter to the current identified potential requirements for the programme.

6.4. Communications

The role of our Communications team is to support the business through the delivery of timely, accurate and compelling communications to our stakeholders, enabling us to achieve our vision, mission and objectives as well as develop a more mature culture.

We will continue our focus on increasing levels of employee and customer engagement as well as reputation management and enhancement. This focus will be achieved through following corporate guidelines, collaborative working, effective stakeholder management and benchmarking activities.

All activities will be delivered using a structured continuous improvement approach to ensure that all our communications activities are better every day.

7. Cost competiveness & delivery strategy

7.1. Summary telecoms deliverability statement

The volumes proposed in this strategic plan are considered to be challenging, as they represent a step change in expenditure from those committed in CP5. To this end we will continue to use our industry supplier partners to provide both industry best practice and flexible, scalable and sustainable delivery capability. Route based assets have been subject to a local deliverability assessment between the National Telecoms Asset Performance Managers and their route based Senior Renewal and Enhancement Engineering teams.

For centrally delivered assets, the majority will be delivered by third party specialist telecoms companies with rail expertise, who will be able to resource adequately in line with requirements rather than via internal delivery mechanisms.

7.2. Access

Access to the railway to undertake both renewals and maintenance will be more complex given the ever increasing level of services being operated by the routes, coupled with the increasing challenge of securing possessions to allow safe working. We will therefore develop a strategy to where possible, integrate our works with other projects across the network.

We will actively look to use the work bank visualisation and Schedule 4 decision making tools being developed elsewhere within Group Digital Railway and elsewhere within the business.

Access restrictions will also require new methods of working for both maintenance and renewals. We will look to analyse our working practices, processes and utilise new technologies as they become available, in order to minimise, as much as possible, possessions and electrical isolations during operational running times of the network.

7.3. Maintenance delivery

We are experiencing unprecedented change in terms of requirements, access restrictions and technology development within the telecoms industry which subsequently pose significant maintenance challenges.

These challenges require the adoption of new maintenance approaches, changes within processes, organisational alignment, tools and training. We will use lean based techniques to develop new maintenance delivery methods based upon lowest whole life cost for each asset type.

The maintenance and renewal strategy will be based on a predict and prevent regime with effective team working with all stakeholders.

Our overall aim is to provide safe, reliable and high performing services to our customers and minimise delays attributed to the telecoms.

At the heart of this strategy is our people and those within the route maintenance teams - it is our people's skills and passion that will enable delivery of our maintenance strategy.

Similar to other assets, we have a four-strand approach to delivering our maintenance strategy:

- Task standardisation and improved collaborative working
- Reliability centred maintenance and renewal regimes based on improved asset knowledge and intelligence

- An effective and responsive organisation founded on a multi-discipline approach with highly trained and skilled workforce
- Use of technology to predict faults and to ensure deployment of the right solution for each task.
-

7.4. Project delivery

We will continue to develop a diverse contracting strategy with Infrastructure Projects and with our external suppliers. We will seek to introduce new contractors with the requisite skills in order to deliver our highly technical requirements whilst also driving further competition and efficiency, with a view to driving down whole life cost.

We will also continue to act as a delivery agent for the telecoms components of large internal customer projects e.g. resignalling workbank. Our delivery will utilise our project management and technical expertise and be fully in-line with the appropriate financial, project management governance (GRIP and MSP4NR) and with our ISO9001 Quality Management System.

7.5. Supply chain

Our Commercial team will add significant value to pre and post contract management through effective supplier selection and management, innovative procurement strategies and whole life cost analysis. An example of an innovative procurement strategy is Early Contractor Involvement which has already resulted in the development of new ideas and potential solutions which could bring significant benefits of both time and cost.

We will engage further with our suppliers to ensure that we have an appropriate supply chain for our future requirements and have the potential for different delivery options such as service contracts to ensure we have the right level of flexibility required. We will continue to work with our suppliers to ensure we have the right mix of industry best practice in our supply chain and to ensure we have flexible, scalable and sustainable delivery capability to meet our delivery requirements.

We will work in partnership with our supply chain to keep them informed of our work bank to enable them to support our delivery strategy from a resource, time and cost perspective.

We will continue to focus on contract management ensuring we understand the risks and opportunities within our contracts, such as cost avoidance and cost mitigation post contract. There will be a continued review of suppliers and supplier contracts to ensure overall value for money.

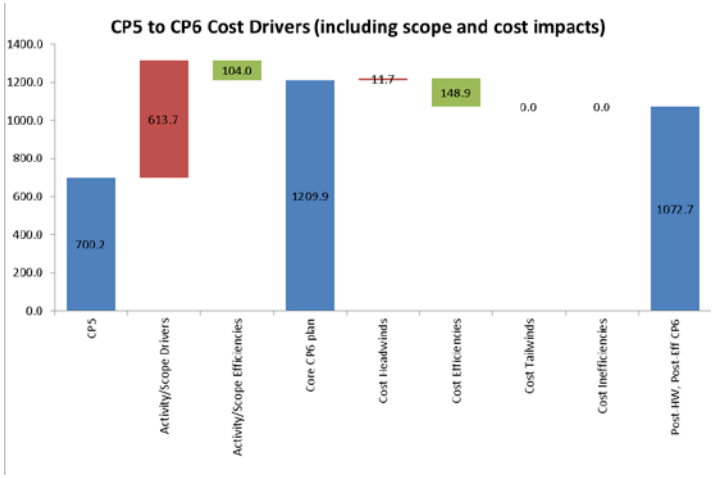
Through our approach to procurement and the use where appropriate of framework solutions we will ensure that we are achieving value for money.

7.6. Costing approach

Asset	Supplier of cost	Basis of cost	% of asset covered
Route assets (£333m)	Head of Asset Management – Network Rail Telecom	Costs are based upon our decision support tool which shows asset life, remaining life and asset condition data for all route based assets. This consists of over 100,000 individual assets by type. Each asset has a condition and useful remaining life calculation which in turn, with the asset policy requirements, generates a replacement schedule by asset which is then multiplied by a unit cost to get the total renewals policy compliant requirement of £868m in CP6. The unit costs are based upon current CP5 unit costs. Based upon allowable derogations from the asset policy and affordability, certain assets type renewals have been deferred into subsequent control periods this deferral is c. £330m in CP6. Efficiencies in both unit cost and new ways of working are expected to be delivered during CP6. This has been modelled by asset type and is captured within identifiable asset plans. These total £190.6m. The resulting route asset cost of £350m has then had a further 5% efficiency applied to it over CP6.	48%
Central assets (£367.5m)	Head of Product Strategy - Network Rail Telecom	Cost profiling and assessment of the central asset proposal, has been generated using actual figures from projects implemented during CP5, whilst using forward looking external market data and vendor roadmaps in order to arrive at predicted costs. An efficiency of 5% has been applied to the current market costs as we drive down supplier and framework costs going forwards.	52%

7.7. Cost drivers, headwinds and efficiency

Summary of cost changes between CP5 and CP6



Summary of efficiency

	Year			Year					
Totex (O,M,R)	**16/17**	**17/18**	**18/19**	**19/20**	**20/21**	**21/22**	**22/23**	**23/24**	**CP6 total**
Pre-efficient plan[1] (£m)	**149.5**	**158.7**	**151.6**	**273.73**	**297.02**	**265.29**	**260.00**	**217.82**	**1313.87**
Activity/scope efficiencies (%)				-10.5%	-7.6%	-5.6%	-8.0%	-7.8%	-7.9%
Core plan (£m)	**149.5**	**158.7**	**151.6**	**244.95**	**274.52**	**250.41**	**239.22**	**200.79**	**1209.89**
Head winds (%)	3.3%	3.0%	4.5%	0.0%	1.0%	2.1%	1.6%	0	1.0%
Efficiency (%)	-14.0%	-16.3%	-18.6%	-8.0%	-11.3%	-13.0%	-14.8%	-15.1%	-12.3%
Tailwinds (%)									
Inefficiency (%)									
Post-HW, post-Eff spend (£m)	**133.5**	**137.4**	**130.2**	**225.37**	**246.17**	**222.98**	**207.76**	**170.37**	**1072.67**

[1] Note that pre-efficient plan is equivalent to core CP6 plan + 2a (activity/scope efficiencies) in the waterfall

Headwinds and efficiency by theme

Theme	Area	Description	Net % change
Access (3)	Efficiency (3a)		
	Tailwind (3b)		
	Inefficiency (3c)		
	Headwind (3d)		
Workbank planning (4)	Efficiency (4a)		
	Tailwind (4b)		
	Inefficiency (4c)		
	Headwind (4d)		
Technology (5)	Efficiency (5a)	***Surveillance CCTV*** – investigate potential for using Commercial off the Shelf Product **10.57m**	(0.9%)
	Tailwind (5b)		
	Inefficiency (5c)		
	Headwind (5d)		
Delivery (6)	Efficiency (6a)	***PAVA speakers*** – drive lower unit cost by implementation of enhanced renewal strategy **£7.00m** ***Route commercial framework review*** - renegotiation with suppliers to achieve reductions **£17.49m**	(2.0%)
	Tailwind (6b)		
	Inefficiency (6c)		
	Headwind (6d)		
Design (7)	Efficiency (7a)	***Battery app dev.-*** reducing strings, capacity and REB solution **£7.40m** ***Station management Systems*** - review and develop new solution using COTs elements **£1.90m**,	(0.8%)
	Tailwind (7b)		
	Inefficiency (7c)		
	Headwind (7d)		
Commercial (8)	Efficiency (8a)	***CCTV -*** Unit costs framework reduction using standardised COTs products **£30.92m** ***CIS small*** - rate renegotiation with suppliers based on new technology **£11.90m** ***SISS small speakers -*** renegotiation with suppliers for new solution using COTs elements **£16.97m** ***Central asset framework agreements*** –reduced costs based on standardised solutions **£25.12m** ***Operational support contracts -*** Negotiate discounts for ongoing contracts **£19.59m**	(8.34%)
	Tailwind (8b)		
	Inefficiency (8c)		
	Headwind (8d)	***Increased Licence costs –*** driven by obsolescence of equipment and restricted supplier base **£3.50m**	
Other (9)	Efficiency (9a)		0.7%
	Tailwind (9b)		
	Inefficiency (9c)		
	Headwind (9d)	***GSMR core –*** potential renewals requirement above funding level **£5.49m**, ***GSMR Interference -*** Increased potential for GSMR Interference issues caused by MNO rollout **£2.50m**	

7.8. Risk and uncertainty in the CP6 plan

Pre-efficient costs in our plan are based on ‘current rates’ but include any additional scope needed to deliver the outputs in the plan. We have used 2016/17 unit rates to develop our capital expenditure forecasts and CP5 exit rates for support, operations and maintenance expenditure forecasts. Drivers of rate increases (headwinds/inefficiencies), or rate reductions (efficiencies/tailwinds), where there is a reasonable expectation they will occur, have been identified separately from the core CP6 plan.

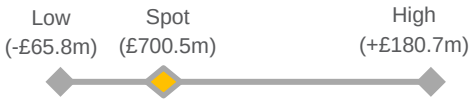
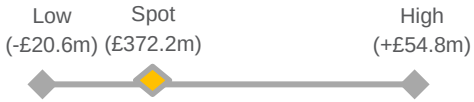
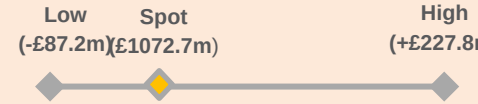
The combination of our core CP6 plan, headwinds/tailwinds and efficiencies/inefficiencies is our ‘submission’ and represents the ‘most likely outcome’ for CP6. The content of our plans reflect the funding that we understand to be available in CP6. We consider this plan to be realistic and, therefore, deliverable in CP6.

Current unit rates are likely to include some risks that were not originally included in CP5 plans but that have materialised during the current control period. As a result of this approach, it is likely that some risk and uncertainty is already be included in our core CP6 plan, as we have not sought to remove the impact of these unplanned events from our unit rate estimates.

Whilst it is difficult to precisely estimate the likelihood of delivering our plan in CP6, it seems reasonable to suggest that, overall, there is a 45% to 55% likelihood of the outputs in the plan being delivered for the forecast cost in our CP6 plan. This means that approximately half of the time, we will be able to deliver our plan for the forecast cost. However, this uncertainty varies between expenditure categories. For example, we consider that there is significantly more uncertainty in our renewals plan than in the support, operations and maintenance plans in CP6. The main drivers of uncertainty in our plan are identified in the table below.

Uncertainty ranges for CP6

The information in the table, below, presents our estimate of the overall range of uncertainty across our expenditure and income for CP6. We have also identified the main drivers of the uncertainty ranges. The information in this table is based on the detailed inputs provided in our Opex, and renewals submissions. Headwinds/tailwinds and efficiencies/inefficiencies are included in the spot estimates.

Area (S, O, M, R, Income)	Potential range (low – spot – high)	Summary of key drivers of the uncertainty range	
		Driver of range	**% of range**
Renewals		Central Assets – Asset by Asset analysis of predicted costs	42%
		Route network – Asset by asset review	4%
		Route - Station Information and surveillance Systems analysis by asset	21%
		Route – Operational Assets review	6%
		Efficiency programme analysis and uncertainty around deliverability	27%
Operational costs		Staff costs (net Recoveries) vary by +15% to -5% = +13.5 to – 4,5m (Range £18.0m)	24%
		Operational support contract costs vary by +20% to – 5% = +33.2mto – 8.3m (Range 41.5m)	55%
		Other costs +5% to – 5% = +5.9m to – 5.9m (Range £11.8m)	16%
		Efficiencies uncertainty -9% to +11% = -1.8m to +2.2m range £(4.0m)	5%
Total expenditure			

8. Culture strategy

8.1. Safety

Our strategic aim, in line with Network Rail's overall strategy, is to maintain delivery of an injury-free (workforce, passenger and public) operations so everyone who interacts with our railway returns home safe every day.

Our strategy to deliver this is based around the following:

- Improving workforce safety, reducing injuries by road driving, train strikes for people working on the railway, slips, trips falls and manual handling injuries
- Monitoring of sickness, excess working hours and stress and putting in place strategies to monitor address these
- Ensuring compliance with and implementing improvements to our Safety Management system.

Progress against these key measures will be tracked and managed on a periodic basis and will be widely communicated.

8.2. Change

Safety, performance, value for money and modernisation are key drivers of business change within NRT during CP6.

We have no further plans for significant organisational change but will continue to monitor and review our performance and make small changes as required.

Our project management office is focused on transforming our processes in order for us to be more flexible and adaptable to change as and when it occurs.

We recognise that the introduction of new technology alongside existing railway technology may cause short term issues as the solutions are installed. We will adapt our organisational capability and manage change to minimise initial impact on services and to provide longer term benefits.

8.3. Organisational capability

We are developing an integrated people strategy that encompasses organisational capability, change management and diversity and inclusion, aligning with the national themes of great people, a great place to work and a high performing organisation. One area of focus is to make NRT an employer of choice within what is a competitive job marketplace and to attract the right calibre of applicants.

We actively encourage our people to gain and maintain appropriate professional qualifications and memberships of appropriate professional institutions. For example, we provide Finance colleagues with sponsorship and appropriate time off in order to gain professional status and pay appropriate examination and membership fees.

8.4. Social & environmental performance

We believe that good management of our economic, social and environmental impacts is key to maintaining a strong and responsible business. We will drive efficiency, build trust and create long-term value for our stakeholders within this area.

To achieve this, we have set the following strategic objectives:

- Deliver outstanding value for money to taxpayers, customers and funders
- Make efficient use of natural resources, innovate with sustainable materials, and reduce, reuse or recycle any waste
- Be energy efficient across our infrastructure, operations, and contribute to this across the rail industry as a whole
- Use low carbon energy sources to minimise our carbon footprint
- Make our network and our operations resilient to future changes in

the climate
- Manage our ecological diversity, and increase its economic and social value where identified
- Protect land, air and water from pollution and other negative impacts
- Improve the accessibility and inclusivity of our assets and services, enabling more people to enjoy our services where practical and ethical
- Make a lasting positive contribution to our lineside neighbours and the communities we serve
- Respect the rights of our employees and those working in our supply chain.

8.5. Diversity & Inclusion

Our objective is to be a more open, diverse and inclusive organisation. To realise this we are committed to providing a great working environment which recognises that people from different backgrounds, experiences and abilities can bring fresh ideas and innovation to improve our business and practices.

We want to ensure that equality, diversity and inclusion is embedded in our culture, and reflected in our people and behaviours, all of which will help us to better serve our customers. We will endeavour to:
- Provide fair and open access to development opportunities in order to fully utilise the talents of all employees
- Improve the recruitment and retention of people from diverse backgrounds
- Ensure that employment decisions are objective, and reflect the collective agreements that have been established where appropriate
- Enhance decision-making and innovation, by encouraging positive interactions and involvement throughout the business
- Increase our ability to relate to existing and potential customers wherever they exist
- Build effective and productive relationships in the wider community through partnerships with community-based groups and stakeholders
- Ensure that people are treated fairly and protected from discrimination, bullying or harassment and to take appropriate steps when complaints arise
- Be committed to reviewing all existing policies within Network Rail to ensure they demonstrate our equality, diversity and inclusion values
- Be committed to exceeding the minimum legal requirements.

8.6. Quality

Our assurance and quality strategy encompasses our business requirements and supports the management of our quality assured governance to ISO9001 standard. The core deliverables of our assurance systems encompass our Scope, Build and Operate structure to maintain clear working standards and create efficient and cost effective management of our business.

Our Quality Management System extends to both internal governance and external supplier engagement to allow compatibility and a safer working environment including efficiencies and continued improvement in short and long term engagement.

Our assured elements will further extend and compliment other areas of our business and key stakeholders as opportunities arise and efficiencies are gained.

9. Strategy for commercial focus – 3rd party cash funded contributions

9.1. Current and planned third party funding

Network Rail's telecoms asset and infrastructure is very valuable asset due to its reach and the services it supports today to Network Rail. Today Network Rail operates a largely closed private network which underpins many vital rail services such as signalling, train detection, operational voice (GSM-R and level crossing communications) and Supervisory Control and Data Acquisition. Network Rail has the opportunity to also provide connectivity services for passenger connectivity and lineside neighbours and raise further external investment/funding by extending the use of telecoms assets and infrastructure. These activities will be undertaken subject to appropriate legal, regulatory and licence considerations being understood and addressed

In CP6 we believe that we could extend use of telecoms assets and infrastructure to the UK telecoms (external) wholesale connectivity market and extend Network Rail telecommunications infrastructure to one that:

- Delivers sustainable benefits to Network Rail, its stakeholders and passengers
- Retains safe and secure control of telecoms assets and of the rail corridor
- Is designed to deliver modern telecommunication services
- Exploits public assets (including fibre, optical networks and geographic reach)
- Potentially attracts external investment and income for Network Rail
- Helps deliver on Government manifesto and policy commitments including actively supporting the developing Government Digital Agenda

The primary focus of any future telecommunications infrastructure will be to support NRTs key purpose; to provide a national telecommunications capability that enables the safe, reliable and efficient operation of the GB railway.

9.2. Capability and business development

Due to the national reach of Network Rail's telecommunications infrastructure and the nature of the services that could be provided on the network, there is a strong level of demand particularly from the mobile network operators for connectivity services along the rail corridor, which will enable services to be provided to rail customers as well as to the surrounding urban population. The UK telecoms (external) wholesale connectivity market which is currently valued at c. £4-5bn per annum.

There is also growing political demand, as evidenced in the manifestos of the major political parties for the June 2017 election, for provision of improved broadband and mobile communications:

Conservative party manifesto (May 2017)

- *"We will ensure that consumers and businesses have access to the digital infrastructure they need to succeed. By the end of this year, 19 out of 20 premises will have access to superfast broadband.*
- *"By the same date (2022), all major roads and main line trains will enjoy full and uninterrupted mobile phone signal, alongside guaranteed Wi-Fi internet service on all such trains."*

NRT will continue work with its key stakeholders to explore areas where our assets can further support passenger services and provide digital capability to customers, passengers and lineside neighbours. This will include areas where digital connectivity is limited and where the assets can support digital coverage for remote and rural communities.

9.3. Focus for third party involvement

NRT are continuing to investigate the different commercial options of third party funding to help develop the capability needed to extend the use of the telecoms assets and infrastructure. In particular the investment required in core next generation IP telecommunications network, telecommunications estate and fibre optic cables required to provide connectivity services for passenger connectivity and lineside neighbours.

Initial discussions have revealed a positive level of interest in this potential opportunity and we continue to evaluate the options.

10. Sign-off

This document and accompanying templates are owned by the Telecoms Director.
Submission of this document indicates confirmation that:

- **all appropriate level 1 assurance activities have been undertaken (see separate advice on definition of level 1 assurance);**
- **the Telecoms Director is satisfied with the quality, currency and appropriateness of the content of this document as well as the cost, volume and activity projections to which it refers;**
- **the signatories are satisfied that the plan has been assessed as deliverable, subject to the assumptions articulated in Appendix B.**

Authorised by:

David Waboso
Group Digital Railway Managing Director

19th January 2018

Simon Atterwell
Director Network Rail Telecom

19th January 2018

Michael Reynolds
Group Digital Railway Finance Director

19th January 2018

Appendix A N/A

Appendix B Key assumptions

[It is vital that the assumptions provide a clear description of what costs or activity are assumed to be in route or other central functions' plans, and therefore excluded from the plan of this central function.]

Ref no.	Topic (e.g. access, deliverability, climate etc.)	Assumption	Areas of spend impacted (e.g. all Opex, track renewals, all spend etc.)	Is this a change of assumption for CP6?
NRT 1	Digital railway	All expenditure related to the Digital Railway programme has been excluded from this plan. Telecoms costs for central elements of the Digital Railway programme are contained within the separate Digital Railway programme submission	All spend	No
NRT2	Supervisory Control and Data Acquisition (SCADA)	All SCADA expenditure has been excluded from this plan as it has been agreed that the Safety, Technical & Engineering directorate would budget for it	All spend	No
NRT3	Unit costs	Unit cost reductions have been assumed within route based assets in line with expectations based on market analysis	Efficiencies	Yes
NRT4	Network configuration	This plan has been built on the basis of NRT transforming and migrating from several legacy systems and networks to a ubiquitous IP based network by the end of CP6	Renewals	Yes
NRT 5	Capability and products	This is a renewals based plan with capabilities offered at the end of CP5 being maintained throughout CP6 and at least maintaining asset reliability	Renewals	No

Ref no.	Topic (e.g. access, deliverability, climate etc.)	Assumption	Areas of spend impacted (e.g. all Opex, track renewals, all spend etc.)	Is this a change of assumption for CP6?
NRT 6	Refranchising	Customers' requirements after any refranchise will be the same as at the time of submission	All spend	No
NRT 7	Routes	The current route model and touch points will still be the same as at the time of submission	All spend	No
NRT 8	NRT organisation	We will move to a capability based delivery model with no increase in resource headcount above our CP5 exit position	All spend	Yes
NRT 9	Technology	We will deliver a capability based on our end-state architectures. This will be based on a system of systems approach rather than like for like renewals	Renewals	Yes
NRT 10	Migration	We will retire our legacy systems whilst rolling out a multi-service platform	All spend	Yes
NRT 11	Organisation	We will shape our organisation to deliver capability with the lowest practical whole life cost	All spend	Yes
NRT 12	Value for money	We will commission, build and operate capability that delivers best value to GB rail	Renewals	No
NRT 13	Dual running	We will need to support some legacy systems and applications throughout CP6	All spend	No
NRT 14	GSM-R	GSM-R service performance will remain at least consistent throughout CP6 as per CP5 exit	All spend	No
NRT 15	Technology	We will consolidate our multi-service platform around IP/MPLS technology	Renewals	Yes

Ref no.	Topic (e.g. access, deliverability, climate etc.)	Assumption	Areas of spend impacted (e.g. all Opex, track renewals, all spend etc.)	Is this a change of assumption for CP6?
NRT 16	Future proof	Our multi-service platform will support the railway and will be scalable to support other government/commercial services	Renewals	Yes
NRT 17	Value for money	We will partner with industry to consolidate our technology systems and reduce our unit rates	Renewals	No
NRT 18	Asset demarcation	Demarcation of assets will remain consistent throughout the control period in line with current agreed demarcation	All spend	No
NRT 19	Extended use of telecoms infrastructure	Any costs or income associated with the extended use of telecoms infrastructure has been excluded from this plan.	All spend	No

Appendix C Telecoms context

We provide Network Rail (routes and functions) and the rail industry with a national telecommunications capability that enables the safe, reliable and efficient operation of the GB railway. We are responsible for all Network Rail's telecommunications networks, systems and assets such as our fixed and wireless networks, GSM-R system and CCTV, Public Address and Customer Information Screens.

Our mission is to deliver an outstanding operational service today whilst developing a connected digital railway infrastructure for the future. By using the power of telecommunications, the best technologies and its people's expertise, we will create an agile and powerful, digitally-enabled business which is best placed to serve the growing needs of the railway and its passengers.

There are over 520 colleagues in NRT who between them design, build and operate telecom solutions and services using assets which include:

- 18,000km fibre optic cable
- 22,000km copper cable
- 2,500 GSM-R masts
- 2,600 level crossing telephones for use by the public
- 250,000 Station Information and Surveillance Systems

For today's railway, we manage the ongoing maintenance, enhancement and renewal of telecommunications assets to keep the railway running. We deliver improved train performance by increasing system availability and enhancing the performance of our telecommunications networks and assets. We also support telecom works for projects such as; Thameslink, Crossrail and other re-signalling schemes.

For tomorrow's railway, we support the development of the digital railway where reliable communications between trains and infrastructure will be essential to address the railway's current capacity challenge.

We are also focused on the effective stewardship of Network Rail's telecoms networks and assets which are of strategic importance to the future of the railway. We are working with industry partners, financial institutions and government departments to explore how inward (external) investment can be generated to provide benefits to passengers, lineside neighbours and additional funding to invest in the development of the digital railway.

Appendix D Scenario planning

Part 1: Tactical scenario planning for CP5

Provide information on the impacts on CP5 of each of the following scenarios:

- Scenario 1: 20% increase in total remaining expenditure

Asset	Yr 4-5 outstanding spend	Potential investment increase	Benefits of increased expenditure			Comment on benefits
			Performance	Sustainability	Reputation	
Govia Thameslink (GTR) Driver Operation Only (DOO) Mirror		£2m	G+	G	G+	Finance to mitigate an existing issue with GTR over the use of DOO Mirrors for despatch. This would enable the initial deployment
CP6 Development		£2.5m	G	G+	A	The early development of CP6 Projects to achieve a more stable introduction to CP6 and support required spend profile in years 1 and 2.
Decision Support Tool (DST) development		£0.25m	A	A	G+	Development of a new DST tool to replace existing inefficient Spreadsheet based version
Station Information and security Systems (SISS) Managed Stations	£6.6m	£3m	G	G	G	Development of core network backbone to deliver efficiencies in the delivery of future managed stations SISS.
SISS Route	£32.9m	£3m	G	G+	G	Spend to address the current renewals slippage and promote a more sustainable position
DOO Structures	£4.2m	£2m	G	G	G	Mitigation for current risks to DOO Structures
Battery renewals	£4.4m	£2m	G	G	A	Mitigate some of the existing power support risk.
Other projects	£99.5m	£14.75m				Unidentified requirement – This has not been addressed as given project timescales we do not believe the organisation has the delivery capacity to deliver further projects in CP5
Total	**£147.7m**	**£29.5m**				
Opex	**£119.9m**	**£23.9m**				
Total	**267.6m**	**£53.4m**				Of the potential £53.7m identified as potential additional funding due to constraints within the business only £14.8m of Capex has been identified as potential expenditure that could be utilised in CP5

Key to risk colours

A: no additional benefit
G: some additional benefit
G+: considerable additional benefit

- Scenario 2: 20% decrease in total remaining expenditure

Asset	Yr 4-5 outstanding spend	Maximum potential saving	Risk of curtailing expenditure			Comment on impacts/issues
			Performance	Sustainability	Reputation	
Route and Managed Stations SISS	£39.5m	£12.5m	A	R	R	The asset spend that was originally targeted renewals has already been significantly reduced in the CP. Serious reputational risk that would undoubtedly result in TOC claims against breach of licence. The compounded reduction of SISS spend would push this asset base into a sustainability position that would be unrecoverable within CP6 and CP7 combined.
Operational Power (inc Batteries)	£2.2m	£1.5m	R	R	R	The current spend on Operational power is behind the sustainability curve and this reduction would be directly from assets that have known issues with supportability and reliability. This is highly likely to manifest itself as a performance issue.
Transmission (West Coast Main Line)	£6.6m	£2m	R	R	R	The spend on WCML Transmission has already been significantly reduced within the CP and this would put the asset at direct risk.
Driver Operation Only (DOO) CCTV	£1.1m	£1m	R	R	R	There are currently issues with the supporting structures associated with DOO CCTV as a number have fallen over in public areas (Platforms). The funding would be making a large assumption that these asset could last a further 2 years however recent inspections and incidents point to this not being viable
Recoveries	£1.3m	£1.2m	A	A	R	The ceasing of recoveries associated with this committed scheme would directly impact the Western Electrification Project and force these cost into that project. The works associated are required to complete Western Electrification activities and commitments have been agreed
Other projects	£97.0m	£11.3m				NRT have been unable to identify further savings in Capex across the final 2 years of CP5 as the majority of schemes are already committed, any further savings would need to come out of unremitted projects

Capex Total	**£147.7m**	**£29.5m**				
Opex	**£119.9m**	**£23.9m**				Given the current efficiency targets inherent within NRT's Opex numbers (£5m) and the semi fixed cost nature of its cost base, it is not possible to identify any significant savings within its Operational cost base that are deliverable in CP5
Overall Total	**£267.6m**	**53.4m**				**Of the total requirement of £53.4 NRT can only see potential to reduce expenditure by £18.2m, but even these come with significant potential additional risk.**
			R	A	G	
Total						

Key to risk colours

G: no additional risk
A: some additional risk
R: considerable additional risk

Part 2: CP6 strategic investment options

This section describes the benefits of additional investment in the route, over an appraisal period of up to 30 years.

[Business case 1]	CP6 total: (£m)		CP6 capex: (£m)	37	CP6 Opex: (£m)	8	Total BCR	1.2	Appraisal period	10 years
Description	**Qualitative benefits**						**Quantitative benefits**			
Enhanced national access network deployment: Delivers connectivity regionally to support route and DR intelligent infrastructure requirements i.e. a full 'plug and play' telecoms connectivity solution that delivers secure, highly available on demand connectivity to customers.	• Common national architecture, scoped and scaled to meet current and emerging demands • Lower cost of implementation overall, as current scheme by scheme approach inefficient due to multiple project management costs and lack of intra route dependencies • Delivers a common single platform sooner, and will allow wholesale retirement of legacy technology, reducing operational costs and complexity, whilst increasing telecoms availability, reducing delay minutes						• Reduction in project management implementation costs through CP6 of up to 30% by running a larger national roll-out programme • Potential to drive better deals with vendor community with better forecast of requirements • Reductions in time to deliver services and connectivity, months > days • Significant operational flexibility and agility, delivering the capability to dynamically reconfigure the network at lower cost, essential in order to meet our Rail Operating Centre (ROC) and ETCS based digital railway future			

[Business case 2]	CP6 total: (£m)		CP6 capex: (£m)	30	CP6 Opex: (£m)	8	Total BCR	1.26	Appraisal period	10 years
Description	**Qualitative benefits**						**Quantitative benefits**			
Full national centralised operational voice platform	Our plan to deliver an initial centralised voice platform during CP6 would be enhanced by developing it into a full national solution. This would leverage the IP network to deliver voice capability, and in theory allow for the retirement of over 600 individual signal box concentrators. This will have great impact in reducing asset numbers and associated support and maintenance costs, whist also allowing for a reduced set of appropriate competencies						Early retirement of existing assets and cessation of associated support contracts. If implemented along with business case 1 above (full national IP network) we can reduce 3-4 assets into 1 consistent solution, whilst improving resilience. Current concentrator support contracts are running at c. £13m in CP6, this would reduce by more than half if integrated with the national IP network and other data centre based works in CP6			

[Business case 3]	CP6 total: (£m)		CP6 capex: (£m)	15	CP6 Opex: (£m)	8.7	Total BCR	1.72	Appraisal period	25 years
Description	**Qualitative benefits**						**Quantitative benefits**			
Additional trackside fibre capability	During the deployment of the FTN programme, cost based engineering decisions were taken which led to certain areas not being fibre enabled. Additional funding could be used to improve the resilience of the network where this was the case. Many of these areas are rural and would also open up other commercial opportunities that are being explored with external stakeholders and government. Additional fibre deployment would also ease capacity issues in some areas and could also facilitate the national IP network roll-out						By delivering this as a central programme we would; • Reduce/remove project management costs associated with individual schemes • Increase in system availability leading to a reduction in train delay • Improvements to GSM-R availability due to removal of single points of failure			

Appendix E N/A

Appendix F N/A

Appendix G Glossary of terms

Term	Definition
BSS	Business support systems - are the components that a telecommunications service provider uses to run its business operations towards customers. Together with operations support systems (OSS), they are used to support various end-to-end telecommunication services
Capex	Capital expenditure
CCTV	Closed Circuit Television
Central assets	Assets that are within the telecommunications national network and which serve more than one route
CIS	Customer Information Systems
COTS	Commercial Off The Shelf – A solution that is generally available and is not specifically designed for Network Rail
CP4	Control Period 4 – The Railway Control Period lasting from 1 April 2009 – 31 March 2014
CP5	Control Period 5 – The Railway Control Period lasting from 1 April 2014 – 31 March 2019
CP6	Control Period 6 – The Railway Control Period lasting from 1 April 2019 – 31 March 2024
DOO	Driver Only Operation
DRP	Digital Railway programme – A programme being undertaken with Group Digital Railway that aims to deliver the benefits of digital signalling and train control more quickly than current plans, deploying proven technology in a way that maximises economic benefit to the UK
ERTMS	European Rail Traffic Management System - The system of standards for management and interoperation of signaling for railways within the European Union
ETCS	European Train Control System – the signalling and control component of the European Rail Traffic Management System (ERTMS)
FOC	Freight Operating Company – A freight carrying company operating trains over Network Rail's infrastructure
FRMCS	Future Railway Mobile Communication System – An international wireless communications standard for railway communication and applications which is currently being developed with a view to replacing GSM-R
FTN-X	The next generation telecoms network operated by Network Rail Telecom
GDR	Group Digital Railway – A directorate within Network Rail responsible for telecommunications, asset information and the Digital Railway programme
GRIP	Governance for Railway Investment Projects – Network Rail's lifecycle management methodology which details the project deliverables and the stage in the project at which they need to be .delivered

GSM-R	Global System for Mobile communications – Railway – An international wireless communications standard for railway communication and applications
HMI	Human machine interface
IP	Internet Protocol – The principal set (or communications protocol) of digital message formats and rules for exchanging messages between computers across a single network or a series of interconnected networks
KPI	Key performance indicator
LAN	Local Area Network
MPLS	Multiprotocol Label Switching – A type of data-carrying technique for high-performance telecommunications networks
MSP4NR	MSP4NR is Network Rail's mandated programme management methodology to be used for all business change programmes
MTBF	Mean time between failure
MTTR	Mean time to repair
NRT	Network Rail Telecom – An operating unit within the Group Digital Railway directorate of Network Rail with responsibility for providing the telecommunications infrastructure for the railway within Great Britain
Opex	Operational expenditure
OSS	Operations Support Systems - computers used by telecommunications service providers to administer and maintain network systems
PABX	Private automatic branch exchange
PETS	Public Emergency Telephone System
RETB	Radio Electronic Token Block – A system for signalling trains on single lines by a combination of computer control and radio messages. There is no physical token but the software issues messages allowing trains to proceed on the single line
ROC	Rail Operating Centre
Route assets	Assets specifically installed for the use of one particular operating route
Route(s)	There are nine routes businesses within Network Rail, eight geographical areas and a national freight and passenger operator's route. Each of these routes is run locally so that we can work more closely with the relevant train and freight operating companies to better meet the needs of passengers and businesses.
Schedule 4	The schedule within the track access contract operating licence that describes and defines the compensation payments to third parties for disruptive possessions.
SISS	Station Information and Surveillance Systems
TMT&FIP	Telecommunications Maintenance Testing & Failure Investigation (TMT&FIP) Process

TOC	Train Operating Company – A passenger carrying company operating trains over Network Rail's infrastructure
WAN	Wide Area Network
Wi-Fi	Wi-Fi – a technology for wireless local area networking with devices based on the IEEE 802.11 standards.