

HS1 Ltd

Five Year Asset Management Statement for Control Period 3

Draft for Consultation

28 February 2019

Foreword

HS1 is the UK's only high speed railway and provides a direct rail link to Europe. Our success requires our customers to perform well in their businesses and we know we have a significant role to play supporting their ongoing growth and development.

Central to our customers' success is maintaining our outstanding performance and safety record, ensuring we deliver asset renewals effectively and efficiently and working with customers to grow their own businesses on our network.

Our approach is to **develop strategic partnerships** and be an **intelligent client** – thus ensuring we continually add value to the concession we hand back to Government in 2040. We are not complacent and will always seek to challenge our suppliers and deliver efficiently for our customers.

Throughout CP1 and CP2 we have consistently provided the best infrastructure performance in Europe and maintained one of the UK's highest customer satisfaction levels at our stations as measured through the National Rail Passenger Survey.

Our train operator customers have told us that they want us to maintain this performance in CP3 at a lower cost while providing them with the opportunity and incentive to grow their businesses. As a strategic partner and intelligent client we will:

- Continue to work with Network Rail (High Speed) who operate and maintain HS1 on our behalf in CP3, challenging them to outperform their current plans for efficiencies over the next five years and further develop their asset management capability;
- Continue to prepare for the step change in renewals that will be required as the HS1 asset ages, taking the recommendations of the deliverability study conducted in CP2 though to implementation;
- Explore all opportunities to improve cost efficiency – challenging our suppliers, such as the British Transport Police Authority (BTPA), to make sure they can demonstrate they are delivering value for money and reviewing our approach to energy purchasing and consumption over the life of the concession. We have already achieved significant savings on insurance costs; and
- Enhance our engagement with operators, fully involving them in big decisions around renewals, supply chain opportunities, and how we treat risk.

During this periodic review we have worked closely with stakeholders as an honest broker. We have clearly identified the risks and opportunities we collectively face and adopted a 'no surprises' approach. Stakeholders have told us that they value our proactive and collaborative approach.

This document sets out the work undertaken including:

- The input we have received from stakeholders over the last 18 months and the work we have done (or will do) to address that feedback;
- Our outputs for CP3, based on stakeholder aspirations;
- The detailed work needed to deliver these outputs and the resulting costs; and
- Our views on our asset stewardship obligations and our plans to fund them over the next 40 years.

We look forward to working with customers, suppliers and stakeholders throughout 2019 as the ORR makes its determination.

Dyan Crowther

Chief Executive Officer

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1. Executive Summary

HS1 is a major success story for the UK. It has dramatically reduced journey times to and from our landmark terminus at St Pancras International. Passengers now benefit from time savings of over 30 minutes on international services, and more than 40 minutes for domestic services travelling from Ashford or beyond.

As a result, the travelling public has embraced high-speed rail travel. Since our Concession started in 2010, passenger journeys on HS1 to and from Kent have more than doubled and there has been 15% growth in Eurostar travel between the UK and continental Europe.

HS1 has also driven a substantial transformation of economic opportunities along the route; it is expected to provide at least £10bn of regeneration benefits over the next 50 years.

Critically, we have achieved this success while continuing to operate a safe and reliable railway. Passenger accidents at stations are down 38% since 2012 and workforce accidents are down 26% over the same period. We have continued to deliver excellent operational performance with an average of 7 seconds delay per train in CP2 to date and improved recovery from major incidents.

Delivering for our train and freight operator customers is at the heart of what we do as HS1 infrastructure manager – we can only succeed where operators can maximise the benefits of using our assets. Over the past two years we have worked collaboratively with train operators, the Office of Rail and Road (ORR), the Department for Transport (DfT) and other interested parties in developing our proposals for CP3, which are set out in detail in this draft Five Year Asset Management Statement (5YAMS).

We are required to have a long-term view. We have a unique opportunity to do the right thing first time and be sustainable in our approach. We can avoid the legacy issues that have afflicted other infrastructure companies when assets age, and in doing so deliver a more efficient, whole life cost, lower disruption, and better and more consistent performance for both the passengers of today and tomorrow. This is what our customers and stakeholders say they want.

We are proud of our record in CP2. We have delivered significant savings for our customers and a step-change in asset management capability. We have faced some operational challenges, but we have delivered what we said we would, addressed risks as they materialised and changed our processes where needed to improve our outputs. We have made changes in the HS1 organisation during CP2 to ensure that we continue to comply with our long-term obligations under the Concession Agreement as the business has matured. We led the GSM-R upgrade and are working on the 4G network upgrade. We established ambitious targets for O&M cost reductions in CP2 and we have worked hard to keep outturn costs within the efficient budget.

We recognised at the start of CP2 that there was a gap in our approach to renewals planning and project management. We have improved our ability to plan and introduced project processes and a project governance framework that have delivered major benefits in terms the scope, nature and cost of renewal projects in CP2.

In CP3 we will set the basis for the future. Our proposals are ambitious, respond to operators' needs so that they can most effectively serve passengers, and deliver on our obligations to act as the long-term asset steward of HS1 infrastructure, ensuring it remains a world-class asset long into the future.

The HS1 assets are ageing and will require progressive renewal over the coming decades. We have had substantial growth and need to facilitate more. We cannot take performance for granted and will need to work hard and be focused to deliver to the same level.

Delivering world-class high-speed rail services requires close cooperation between all parties in the supply chain. In recognition that more can and should be done to join up the operation of track and train, we will continue to act as a strategic partner with our operators and an intelligent client of our supply chain, in particular Network Rail (High Speed), Mitie and UKPNS as delivery partners, in order to deliver on the full potential of HS1 for passengers and freight users.

Our plans for CP3

At the start of the PR19 process, we identified the key outputs that operators seek from HS1 infrastructure. These include world-leading operational performance, with average delay per train service below 10 seconds. Operator outputs have guided the approach we have taken to CP3 and form the basis of our proposals. Reflecting on these outputs, and the challenges ahead, we have identified the following key priorities for CP3:

1. Continuing to drive cost efficiency, while recognising the railway is maturing and requires significant future investment to maintain current outstanding performance levels.
2. Moving towards a greater emphasis on delivering renewals projects, in additional to the vital operations and maintenance activities we and our delivery partners carry out each day.
3. Working closely with our operators, to ensure they can continue to succeed in delivering excellent services to passengers and freight users.

Our CP3 plans are informed by detailed analysis and cost assessments, supported by expert advice. To ensure they are delivered, we will change the way we do business over the next five years.

In CP3, we plan to:

- **Reduce operating and maintenance costs by 3% by the end of CP3**. Our benchmarking analysis has developed significantly since PR14 and all costs have been subject to a robust process of internal review and challenge.
- Realise the benefits of our investment during CP2 in an increasingly **mature asset management system**, ensuring we make the right whole life cost decisions on operations, maintenance and renewals activity that respond to operators' requirements and deliver our asset stewardship obligations in a sustainable way.
- Continue to build our **renewals** planning and **delivery capability**, and implement **governance improvements** that increase transparency and operator involvement in decision-making.
- Support growth in the **long-term capability of the supply chain**, so that it is sustainable, innovative and high-performing. This will be informed by Bechtel's renewals deliverability study and be a key consideration in the market-test decision.
- Pursue a suite of **investments** that will **deliver benefits for our customers into the future**, such as a structured approach to the market-test decision, collecting the condition data necessary to underpin future cost trade-off decisions, and working with adjacent infrastructure managers to identify a future signalling control solution.
- Make targeted **improvements to the regulatory regime** under which HS1 operates, for example by introducing a specific performance regime for UKPNS power supply, calibrating the main performance regime with more recent data, and suspending the Capacity Reservation Charge. We propose to undertake a Structure of Charges Review during CP3.
- Ensure operators get value for money for their renewals annuity payments by implementing a **more proactive escrow investment strateg**y.
- Enhance **engagement with operators** through CEO strategic partnership meetings that fully involve operators in big decisions around renewals, supply chain opportunities, and how we treat risk generally.

Based on our detailed engineering analysis, we forecast that renewals required over the next 40 years will cost £1,524 million, which in turn will flow through to the proposed charges faced by operators. Charges for passenger services are shown in Table 1 and freight charges are proposed to increase by 78% from the current level of £7.54 per train-km to £13.43 per train-km.

Table 1: CP2 and CP3 OMRC (£ per minute, February 2018 prices)

	International passenger services	Domestic passenger services
CP2 OMRC	£54.07	£40.79
CP3 OMRC forecast at PR14	£58.36	£43.44
Proposed CP3 OMRC	£78.95	£49.91

Clearly, this proposed increase in charges will be challenging for operators. We recognise that short- to medium-term financial sustainability is important, and the first step towards the long-term success of the HS1 railway. Hence, we want to have an open dialogue with operators and stakeholders on risk and reward and the choices possible as we prepare our formal submission to the ORR in May 2019. Further detail is provided in Part 2 of this document.

Ultimately, we want to continue to deliver outstanding levels of asset performance and support our operators in delivering excellent services to passengers, while planning for and investing in the future success of HS1.

About this consultation

This consultation is an extremely important part of our regulatory process. We aim to:

- Make sure stakeholders understand the work that we have done and the engineering logic that we have applied.
- Reassure parties that we are motivated to achieve efficiencies and that we have the workstreams in place to deliver them.
- Check that we are best meeting the trade-offs between long-term asset availability and condition, performance delivery for customers, and value for money.

We have engaged stakeholders in a structured way over a two-year period. We have endeavoured to adopt a 'no surprises' approach but this does not mean there will universal agreement on all our proposals. This consultation is an extremely important milestone ahead of our submission to ORR at the end of May 2019. We welcome feedback on any aspect of our proposals and have included a series of consultation questions to stimulate debate and draw attention to the areas we see as important.

We look forward to working with our customers and stakeholders to test and improve our plans, and then to get on and make the most of the available opportunities. We know that our continued success relies on our customers. Maintaining a safe and efficient railway is core to what we do.

Navigating this document

The remainder of this document is structured as follows:

Part 1: Context and Approach

We outline our vision for HS1 and our journey to respond to the challenges of an ageing asset. We describe how we work as strategic partner and intelligent client with suppliers, customers, regulators and other infrastructure managers and how we have put together our plans for CP3 and beyond in consultation with stakeholders.

Part 2: CP3 Proposals

In this section we set out the key outputs we plan to deliver in CP3, based on consultation with our stakeholders.

We outline our safety and security plans for CP3 demonstrating a clear division between our responsibilities for our own organisation and the assurance process for the management of our industry partners.

We describe how we have delivered on our commitment to improve our asset management maturity, and that of our supply chain, building capability to ensure we meet our long-term asset stewardship obligations, and how this has informed our plans for CP3 and beyond.

We outline our approach to identifying efficient costs and set out our forecast expenditure for CP3 and beyond, and the corresponding charges for operators.

Part 3: Regulatory & Incentive Framework

This section outlines our proposals for changes to the regulatory and incentive framework. The framework is generally working well and we propose a limited number of changes.

Part 4: Conclusions

In this section we set out the conclusions of our review and the next steps in the PR19 process.

Next steps

This draft 5YAMS launches our formal public consultation. We will hold a **Stakeholder Briefing Session** to discuss our proposals on **Tuesday 12 March 2019**.

We are seeking responses to the questions raised in our 5YAMS by **Wednesday 10 April 2019**.

Part 1: Context & Approach

2. HS1

2.1. Our vision and our journey

Our vision is for HS1 ***"to deliver the world's leading high speed rail experience"***. The seven supporting workstreams to deliver the vision – continuous improvement, operational expertise, asset management, customer experience, value for money, reputation and safety – are shown in Figure 1.

Figure 1: Workstreams to deliver our world leading vision

HS1 has evolved over time, from a concept to a construction project to a railway with world class performance. In CP2 we have delivered excellent performance and significant improvements in cost efficiency. To deliver our vision, we will continue to evolve in CP3 and beyond to respond to the challenges of an ageing asset and a changing environment. At each stage in the HS1 journey, we will ensure that we have the right skills and knowledge to achieve the right outcomes. Our journey is summarised in Figure 2.

Figure 2: The HS1 journey

2.2. How HS1 works

HS1 is governed by a Concession Agreement and property leases with the UK Government. We operate primarily through an outsourced model, notably through Network Rail (High Speed) (NR(HS)) and UK Power Networks Services (UKPNS). Key contracts and relationships with industry partners are discussed below.

2.2.1. Strategic Partner – Intelligent Client

To deliver our vision of HS1 providing the world's leading high speed rail experience, we work with a number of organisations – acting as both a supplier and a client. These organisations are our strategic partners and are essential in enabling us to meet our ambitions.

Our customers provide domestic passenger services and international passenger and freight services between the UK and Europe. Our major strategic partners (customers) are:

- London & South Eastern Railway Limited (LSER);
- Eurostar International Limited (EIL);
- East Midlands Trains (EMT);
- DB Cargo; and
- GB Railfreight.

Our suppliers are essential in supporting us to operate, maintain and renew the infrastructure our customers rely on. Our major strategic partners (suppliers) are:

- NR(HS) – operates, maintains and renews the HS1 route assets and St Pancras International, Stratford International and Ebbsfleet International stations;
- UKPNS – operates, maintains and renews the HS1 electricity substations and high voltage distribution network;
- NRIL – has physical interfaces with our assets and operates and maintains Ripple Lane exchange sidings on our behalf;
- Mitie –operates, maintains and renews Ashford International Station;
- npower – supplies electricity for the HS1 assets; and
- British Transport Police Authority (BTPA) – provides policing services at stations and along the HS1 route.

In order to work effectively with our suppliers, we act as an intelligent client. This means we have been developing our in-house capability during CP2 to engage, oversee, direct and challenge our supply chain to deliver more efficiently and effectively.

2.2.2. Regulation

2.2.2.1. Concession Agreement

We hold the concession from the UK government to operate, maintain, renew and replace the HS1 assets until 31 December 2040. Among other things the Concession Agreement sets out the charging framework for HS1 (Schedule 4) and specifies the asset stewardship obligations and periodic review requirements (Schedule 10).

The track assets are overseen by the ORR in accordance with The Railways (Access, Management and Licensing of Railway Undertakings) Regulations 2016 (the Regulations) and on behalf of the Secretary of State for Transport (SoS). The ORR's functions in relation to the Concession Agreement relate principally to the stewardship of HS1 (other than stations) and to the review of operations, maintenance and renewal costs and charges.

Our General Duty under the Concession Agreement is to achieve the Asset Stewardship Purpose – to secure the operation and maintenance, renewal and replacement, and the planning and carrying out of any upgrades of the HS1 railway infrastructure:

- In accordance with best practice;
- In a timely, efficient and economical manner; and
- Save in the case of the UKPNS assets, as if we were responsible for the stewardship of the HS1 railway infrastructure for 40 years following the date that any such activities are planned or carried out.

In September 2017, HS1 was purchased by a consortium comprising funds advised and managed by InfraRed Capital Partners Limited and Equitix Investment Management Limited. The consortium is committed to ensuring HS1 continues to serve all stakeholders well. Each of the consortium members has a proven track record of owning and managing UK infrastructure businesses and collectively they bring significant financial and operational expertise to HS1.

2.2.3. Supply chain

We operate through an outsourced model, in which we lead the supply chain as an intelligent client. We have a good understanding of our asset and our requirements, including or long-term asset stewardship obligations, and we challenge our suppliers to improve their practices and deliver efficiently. We have collaborative working relationships with our suppliers and these have been strengthened during CP2.

The key suppliers in the outsourced model are NR(HS), UKPNS and NRIL.

2.2.3.1. Operator Agreement with NR(HS)

We subcontract with NR(HS), a wholly-owned subsidiary of NRIL, to operate, maintain, renew and replace the HS1 route assets on our behalf. NR(HS) holds the Safety Authorisation for the HS1 railway infrastructure. Our relationship with NR(HS) is governed by an Operator Agreement. The original Operator Agreement was agreed before the sale of HS1 and ran from 2003 to 2047. In 2012, we renegotiated the Operator Agreement. For CP3, the renegotiated Operator Agreement has a fixed price for operations and maintenance which will be determined through the PR19 process. NR(HS) is involved in, and bound by, the PR19 process. The Operator Agreement contains separate provisions for renewal and replacement activities and specific additional services.

The renegotiated Operator Agreement has a break clause in 2025 and includes obligations for NR(HS) to provide operational and maintenance standards and procedures which can be used to conduct a market test and information on NR(HS)'s contractual arrangements with NRIL.

During CP2, we have driven improvements in NR(HS), particularly in terms of asset management and long term planning. We developed our joint vision for HS1 and clearly defined NR(HS)'s role in delivering the vision, setting out our requirements and what NR(HS) needs to do to deliver them. Our joint vision drove a transformation in NR(HS); during CP2, NR(HS) has made a number of fundamental changes to the way it operates and has benefitted from closer integration with NRIL and wider European stakeholders. We also identified capability gaps in NR(HS) and worked with NR(HS) to develop its capability, particularly in asset management. This is discussed further in Section 9.3.

To date, performance of the HS1 asset has been excellent. As the asset ages, the capability of our supply chain needs to adapt to maintain excellent performance at the same time as delivering significant asset renewals. The benchmarking work we commissioned for PR19 suggests that there are opportunities to improve efficiency. Also as part of PR19, we have developed an efficient delivery model for long term route renewals.

NR(HS) has made commitments to improve its capability in line with our changing requirements and we will continue to work with NR(HS) and the wider rail community to continuously improve the planning and delivery of operations, maintenance and renewals.

The Operator Direct Agreement includes provisions for **market testing** for all or part of the services provided under the Operator Agreement. The decision on whether to market test and the approach to market testing will be made by HS1 shareholders in consultation with our stakeholders. The formal notice period to NR(HS) is between 1 April 2020 and 31 March 2022, with any new contractual arrangements as a result of market test being effective from the start of CP4 (1 April 2025). It should be noted that, as a decision on whether to market test has not yet been made, we have not included the cost of a potential market test in our CP3 cost forecast.

2.2.3.2. UKPNS agreements

UKPNS financed, designed, built and now operates, maintains and renews the electricity substations and high voltage distribution network under the UKPNS suite of agreements. The suite of four agreements was signed in 2002, restated in 2017, and expires in 2057, with no break points. There is a fixed price for operations, maintenance and renewal.

Our relationship with UKPNS has evolved since the start of the concession. During CP2, we worked with UKPNS and DfT to improve and clarify the contractual documentation governing this relationship. The outcome was a clearer contract with a more sensitive performance regime and better information sharing. Key improvements were:

- A single contract for the whole distribution system with Sections 1 and 2 being treated as one;
- A revised performance regime with incentives based on the impact of outages on HS1 and with greater clarity on the measurement of outages;
- Improved information sharing, which facilitates:
    - Joint planning aligned to our regulatory review timetable and planning process;
    - Better integration of maintenance and renewals work with the rest of our supply chain, in particular, NR(HS);
- Asset management commitments:
    - A stronger emphasis on asset stewardship;
    - Asset Knowledge Reviews, five and 40-year plans for operating, maintaining and renewing the assets;
    - Commitment to achieving ISO 55001 Asset Management accreditation.

During CP2, we have also leveraged wider UKPNS experience, for example, in developing an Energy Strategy for HS1 (see Section 11.6).

2.2.3.3. Operations and Maintenance Agreement with NRIL

The interface assets between the NRIL network and HS1 are governed by the Operations and Maintenance Agreement (OMA). The OMA is an agreement between HS1 Ltd, NRIL and the SoS and was agreed before the sale of HS1.

The OMA defines the interface assets, setting out ownership, maintenance and renewal responsibilities and cost contributions for each party. Interface assets include the Waterloo connection, Dollands Moor freight chords, Ashford chords, Ripple Lane exchange sidings and Orient Way sidings. There is a fixed price for maintenance. Renewals are treated on a case by case basis.

We have commissioned Vertex to undertake a technical review of the OMA, to determine if it is fit for purpose and if NRIL is carrying out its obligations in line with the OMA. In Stage 1, Vertex will review the obligations in place, review maintenance records and costs and provide recommendations. In Stage 2, Vertex will validate Stage 1 findings and determine areas of potential improvement and efficiency.

2.2.4. Customers

We enter into Track Access Agreements (TAAs) with train operators, which set out the terms and conditions for access to the HS1 track. Framework Track Access Agreements (TAAs with a duration of more than one year) require ORR approval. The track access agreements incorporate the HS1 Passenger Access Terms (PAT) or HS1 Freight Access Terms (FAT) as appropriate and include track charges, the performance regime, the possessions regime and periodic review provisions.

We currently have:

- A Framework Track Access Agreement with EIL, which expires on 16 August 2019;
- A Framework Track Access Agreement with LSER, which expires on 31 December 2024. Boxing Day services are excluded from the Framework Track Access Agreement; we negotiate a TAA for these services on an annual basis;
- A Track Access Agreement with DB Cargo; and
- A Track Access Agreement with GB Railfreight.

2.2.5. Other infrastructure managers

All passenger and freight services operating on HS1 also operate on the networks of other infrastructure managers. NR(HS) carries out the day to day planning and operation of services in cooperation with other infrastructure managers on our behalf. Some specific examples of where we have worked with other infrastructure managers to improve services to our customers are:

- By taking overall system performance into account in our timetabling we have reduced train planning delays significantly;

- Participation in NRIL's PR18 consultation to ensure HS1 needs are taken into account in plans for the NRIL SE Route; and
- A high level trespass strategy working group with SNCF Réseau, EIL and Getlink to coordinate strategies and transfer best practice between organisations.

We also collaborate with other infrastructure managers at a strategic level, current examples are:

- A collaboration agreement with Getlink, SNCF Réseau and Infrabel to coordinate the deployment of ERTMS on our respective networks by sharing information and expertise, selecting a uniform technical system and working to a common deployment schedule;
- Working with Lisea[1], Getlink and SNCF Réseau on a joint initiative to create a 'turn-key' open access route between London and Bordeaux, allowing a rail operator a faster start-up than on previous international routes. A joint feasibility study is scoping the border control and security facilities needed at Bordeaux St Jean station to allow passengers to travel directly to London St Pancras without changing trains; and
- We are aiming to create a similar 'turn-key' open access route between London and Frankfurt/Cologne/Dusseldorf. This work is at a preliminary stage; we are currently inviting other infrastructure managers to partner with us in this project.

[1] Lisea has the concession for the Sud Europe Atlantique LGV between Tours and Bordeaux (LGV SEA) from 2011 to 2061

3. Periodic review process

Under the Concession Agreement the ORR has a role in relation to the periodic review of costs and charges. The Concession Agreement sets out the purpose of and the process for conducting periodic reviews. Each periodic review covers a five year control period; the 2019 Periodic Review (PR19) covers the period from 1 April 2020 to 31 March 2025, Control Period 3 (CP3).

ORR has been in discussion with HS1 Ltd and train operators throughout CP2 and consulted formally on the PR19 process in 2017. Following this consultation, ORR published its approach to PR19 in January 2018.

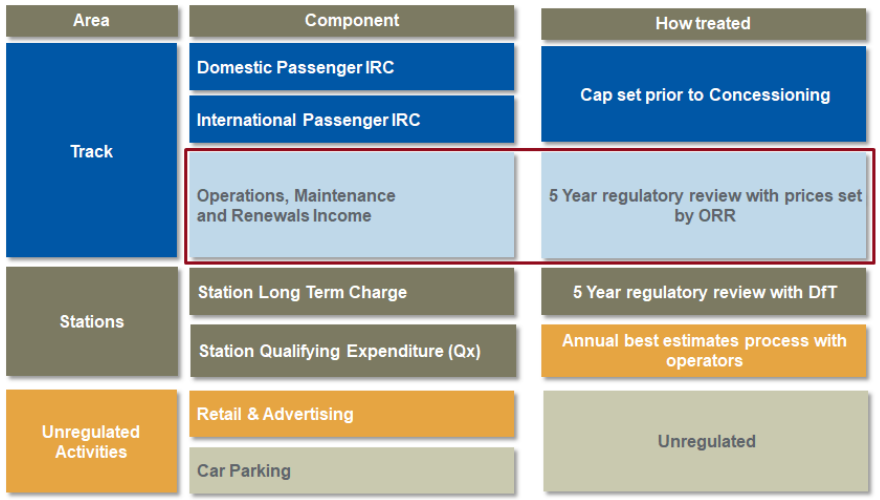
3.1. Scope of PR19

Under the terms of the Concession Agreement, the periodic review covers the efficient costs for the operation, maintenance and renewal of the HS1 route infrastructure, and how these costs are recovered via charges to train operators. It **excludes**:

- Investment Recovery Charge (IRC) revenue. The purpose of this charge is to part recover the construction costs of HS1; the IRC is capped at a rate set out in the Concession Agreement subject to semi-annual indexation by RPI.
- Stations operation, maintenance, repair and renewal activities, which are covered by separate review procedures. Station assets are overseen by the SoS and there is a parallel review process with DfT on the station long term charge.
- Other unregulated commercial activities such as the letting of retail space and car parking facilities.

This is summarised in Figure 3.

Figure 3: Our income streams and their regulatory treatment



For each periodic review, we are required to propose an efficient level of cost for the operations, maintenance and renewal of the route infrastructure and the corresponding operations, maintenance and renewal charges (OMRC) for the control period. The ORR will either approve or determine the costs and level of OMRC. Appendix 2 shows the specific Concession Agreement requirements for periodic review and where each is addressed in this Five Year Asset Management Statement (5YAMS). This 5YAMS is the principal input into the periodic review; supporting documentation is listed in Appendix 3.

Although IRC is excluded from the periodic review, there may be an Additional IRC to recover the efficient spend associated with upgrades. This Additional IRC is subject to approval by ORR. Upgrades follow a separate approval process but are summarised in this 5YAMS.

As route, stations and unregulated activities have different regulatory treatments, our costs must be split between these three areas. Some of our cost categories are clearly related to one of the three areas, for example, NR(HS) charges under the Operator Agreement are all related to

route. We have reviewed the allocation methodology agreed for CP2; as the HS1 business has not changed we have continued to use the same methodology to allocate CP3 costs.

The cost categories which have been split and the way in which the split has been determined for each category are summarised in Table 2. Apart from staff costs, there have been only small changes in the CP3 allocation percentages compared with CP2.

Table 2: Split of costs between route, stations, unregulated activities

Cost	Route / Stations / Unregulated allocation	Explanation
BTPA	22% / 70% / 8%	Based on staff cost and location of duties provided by BTPA.
Staff	71% / 11% / 18%	Based on person by person allocation of HS1 staff to route, stations or unregulated.
Technical/ legal support	Built up on a line by line basis	Costs are built up on a line by line basis and allocated directly to route, stations or unregulated. There is no apportionment involved. Legal and contractor costs directly attributable to route renewal projects are allocated to renewals costs.
Office running	100% / 0% / 0%	100% allocated to route
Other: managing the concession	Built up on a line by line basis	Costs are built up on a line by line basis and allocated directly to route, stations or unregulated. There is no apportionment involved.
Other: running the railway	Built up on a line by line basis	Costs are built up on a line by line basis and allocated directly to route, stations or unregulated. There is no apportionment involved.
Rates (*see Note*)	77% / 20% / 3%	The split is calculated on the basis of rates as at the 2017 revaluation. Apportionment is on a receipts basis, using historic allocation for further sub-division.
Insurance (*see Note*)	76% / 22% / 2%	Different classes are split in different ways, for example, by asset value or historic broker advice. The methodology is unchanged from CP2.
Non-traction electricity	Built up on a line by line basis	Non-traction electricity is sub-metered and is allocated to route, stations or unregulated based on actual readings

Note: For rates and insurance the allocations relate to the charges to HS1 Ltd. There are also rates and insurance charges charged directly to retailers which are not included in this table.

3.2. How we put this plan together

3.2.1. Stakeholder consultation

In our approach to this periodic review our intention has been to be:

- Genuinely engaged with stakeholders;
- Open and transparent;
- Committed to long-term success; and
- Dynamic and innovative.

We have undertaken a very significant amount of work for PR19. The aim of our informal stakeholder consultation during this process has been to ensure that our key stakeholders (passenger and freight train operators, ORR and DfT) are informed of and involved in this work such that there are no surprises in this PR19 consultation document. We have regularly updated stakeholders on progress and key issues; asked about their requirements and taken them into account in our developing plans; and given them the opportunity to provide feedback on a wide range of issues.

We commenced with a series of bilateral meetings with stakeholders in spring 2017 to better understand their key focus areas and aspirations.

Our initial stakeholder workshop in June 2017:

- Provided an update on performance during CP2;
- Set our vision for CP3 and the role of PR19;
- Summarised the key messages we heard during the bilateral meetings to test that we had properly understood stakeholder views. We used these to develop a set of outputs for CP3 which are discussed in further detail in Section 6; and
- Proposed an 'issues based' approach to PR19 consultation, structured around six themes. Our view was that by setting out the workstreams in advance we could achieve transparency and focus on the key issues.

Based on feedback at the June 2017 workshop we finalised the six consultation themes in July 2017 – 40-year renewals plan, asset management, value for money, regulatory framework, Future Railway and operational and safety excellence. For each of the themes we set out the specific agenda items we would cover at each of the quarterly stakeholder events planned between September 2017 and December 2018. We evolved this over time to reflect the nature of discussions and stakeholder interest. Themes such as Future Railway also turned out to be less relevant than we initially expected and were covered relatively quickly.

The key issues arising throughout the process include:

- Identifying efficient costs for HS1 Ltd, NR(HS) and other suppliers. This included a significant benchmarking exercise undertaken by RebelGroup;
- Our asset management approach, both how we have developed our capabilities and how we are applying this to make better decisions;
- Our approach to the 40 year renewals plan. This incorporated a major piece of work undertaken by Bechtel looking at how to best deliver the NR(HS) forecast volumes, including opportunities for productivity improvements;
- Related to the 40-year renewals plan, the methodology for translating the renewal costs into an annuity which forms part of the charges to operators; and
- Initiatives to improve safety and operational performance.

Discussion around some of these themes continues, in particular, the approach to the renewals annuity. This consultation document also covers issues within the regulatory framework which were not a priority for the stakeholder workshops but nonetheless form part of PR19.

We have worked in partnership with ORR during PR19 with a structured programme of engagement to ensure there are no surprises for ORR and that we understand and take into account ORR views in developing our plans for CP3. We have driven an efficient process, for example, we designed the scope of the independent assurance of NR(HS) Specific Asset Strategies to satisfy both our own and ORR assurance requirements.

Our informal programme of engagement with ORR during PR19 has covered the treatment of risk, calculation of the renewals annuity, updates on benchmarking and progressive asset management assurance. Asset management sessions to engage with ORR on the technical content of our submission are summarised in Table 3.

Table 3: Asset management progressive assurance

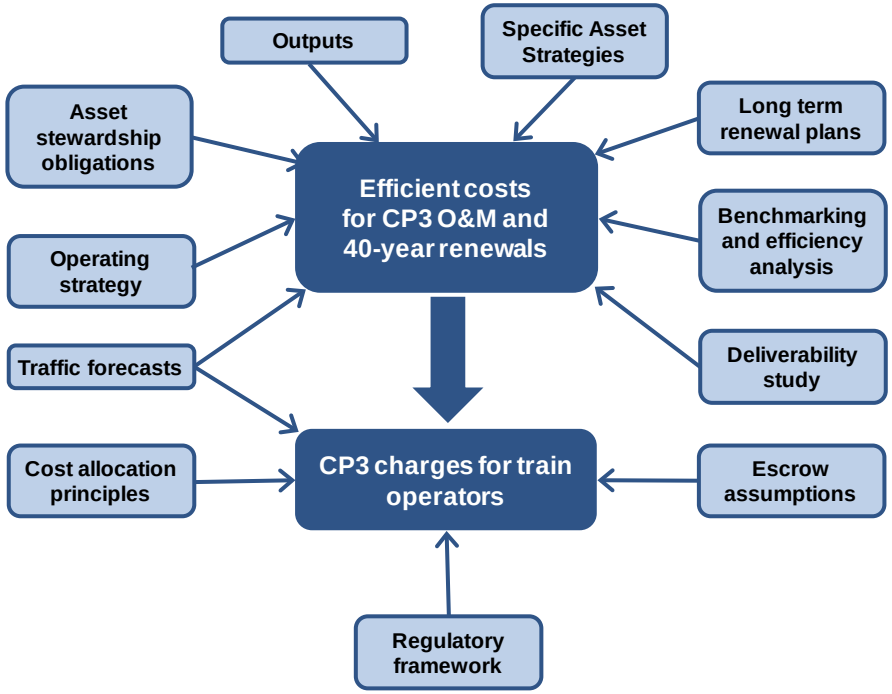
Month	Theme
Jul-18	Engineering assurance meetings with NR(HS)
Aug-18	Asset Management strategic context
Sep-18	Engineering and strategic decision making
Oct-18	Intervention volumes
Nov-18	CP3 costing
Dec-18	Long term cost and deliverability
Jan-19	Meeting customer expectations

As part of our formal consultation process, this draft 5YAMS is being circulated to a wider range of stakeholders with an interest in HS1. We are keen to engage with this wider group of stakeholders and will arrange bilateral meetings with stakeholders who wish to discuss our proposals in more detail.

3.2.2. PR19 workstreams

Figure 4 summarises how we have developed costs and charges for CP3 in the context of a 40-year view of the HS1 route assets.

Figure 4: Components of the review – how we get to charges



The production of our PR19 submission has been a collaborative effort with NR(HS). We have a joint vision with NR(HS) and have worked together on developing our plans for operating, maintaining and renewing the HS1 route; we have performed a review and challenge role to NR(HS). The NR(HS) Five Year Asset Management Statement (NR(HS) 5YAMS) is a key supporting document for our 5YAMS.

We have commissioned supporting work by consultants in areas including benchmarking, renewals deliverability and costing and the track access performance regime.

Table 4 summarises the workstreams and key activities that have informed the development of this 5YAMS.

Table 4: Workstreams and key activities for PR19

Workstream	Main activities
Input assumptions	Demand forecasts Asset condition Cost forecast to the end of CP2 Financial assumptions
Asset management capability	Alignment of Asset Management System with ISO 55000 ISO 55001 accreditation for NR(HS) and UKPNS Capability improvements to underpin better decision-making and supporting the other workstreams
Proposed asset interventions	Specific Asset Strategies (SASs) Independent assurance of the SASs 40-year renewal plans Deliverability study (Bechtel) Asset Decision Support Tool (ADST)

Workstream	Main activities
Costing the interventions	Internal costing / resource models Rightsizing organisations Deliverability study Treatment of risk
Value for money / efficiency	Benchmarking and case study analysis Deliverability study Energy Review Project governance review
Charges	Updating the charging model with new costs Reviewing the assumptions and methodology in calculating the renewals annuity element of the charge
Delivering outputs for stakeholders	Checking stakeholder alignment with the 'aspirations' and that proposals deliver these. For example, how reflected in the Asset Management Objectives
Operations and safety strategy	How to make operations more resilient, including recovering from big incidents such as trespass Building on safety work to date
Stakeholder engagement	Quarterly meetings and other bilateral discussions as required throughout the process How to better engage stakeholders in strategic decision-making (e.g. renewals) in CP3 and beyond
Regulatory framework	Performance regime Possessions regime Structure of charges review Volume reopener provisions

As noted above, we have performed a review and challenge role to NR(HS)'s plans; the following section outlines the assurance activities we have undertaken.

Assurance of NR(HS) plans

Our role is to assure ourselves that the obligations in the Concession Agreement are passed through to our supply chain effectively and that our responsibilities are discharged. For PR19, our objective has been to assure ourselves that the plans put forward by NR(HS) are appropriate. We have not duplicated effort but we have sought assurance where it is required. We implemented a progressive assurance process, in which we involved the ORR, and systematically reviewed the output from NR(HS).

In PR14 we made a commitment to improve our asset management maturity and that of our supply chain. During CP2 we have led a programme of joint working with NR(HS) driving improvements in NR(HS), particularly in terms of asset management and long term planning.

- We developed our 2020 joint vision for HS1 through which we monitor capabilities and how they are developing.
- We identified capability gaps in NR(HS) and worked with NR(HS) to develop its capability, particularly in asset management, and instigated a joint asset management training programme.
- We worked with NR(HS) to improve the HS1 Asset Management System, aligning it with ISO 55000. As evidence of improved capability, NR(HS) obtained certification to ISO 55001:2014 (Asset Management) in March 2018.
- We commissioned an independent assessment of NR(HS) and HS1 Ltd competency in asset management using the Asset Management Excellence Model (AMEM) framework to identify focus areas for improvement.

We have worked with NR(HS) throughout the development of NR(HS)'s PR19 submission. NR(HS) has been through an iterative process to develop the Strategic Asset Management Plan (SAMP) and Specific Asset Strategies (SASs) and we have been involved in this process through asset management working groups, reviewing the structure and content of the documents and providing feedback on drafts.

We commissioned Vertex-SE to undertake an independent review of the engineering elements of the SASs and we undertook site visits (Vertex, HS1 Ltd and ORR) to check asset condition and the validity of proposed renewals projects. We reviewed NR(HS)'s whole life cost justifications for the proposed interventions, using our Asset Decision Support Tool where appropriate.

We held regular working sessions to review the NR(HS) 5YAMS, Operations Strategy, Possessions Strategy and Safety Strategy. The Safety Strategy is also reviewed through our board safety subcommittee for general direction and NR(HS). NR(HS) holds the Safety Authorisation for the HS1 route and is

regulated by ORR as safety regulator but we are taking an active role as a responsible client.

We have engaged with ORR through a programme of progressive asset management assurance and presented proposals and obtained feedback from stakeholders at the quarterly stakeholder workshops.

We have challenged NR(HS) to improve cost efficiency, using our relationship and influence with NRIL to push efficiency, and commissioned the OMR Effectiveness Study from RebelGroup to identify potential areas of efficiency. We reviewed the Oxera report on the NR(HS) management fee and evidence of the NR(HS) contract risk calculation.

For CP3 renewals:

- We have reviewed and challenged NR(HS)'s proposed CP3 renewals projects, requiring evidence to support the scope of work, challenging the level of contingency and challenging NR(HS) to make better use of experience from CP2 renewals projects. These meetings resulted in successive reductions in CP3 renewals costs.
- We have challenged the level of risk applied to the CP3 renewals portfolio and are still in discussion with NR(HS) on this point.
- We recognise that NR(HS) is building its project delivery capability, and we are supportive of its approach. We have formally requested a plan which shows how NR(HS) will develop its project capability over the next six months against which we can measure them.

For 40 year renewals, the Bechtel deliverability study confirmed that the long term renewals are deliverable with limited disruptive access and developed a high-level master plan for the renewals workbank with an estimated cost.

4. CP2 outturn

4.1. Overview

We are very proud of our record in CP2. We have faced some operational challenges but we have delivered what we said we would, addressed risks as they materialised and changed our processes where needed to improve our outputs.

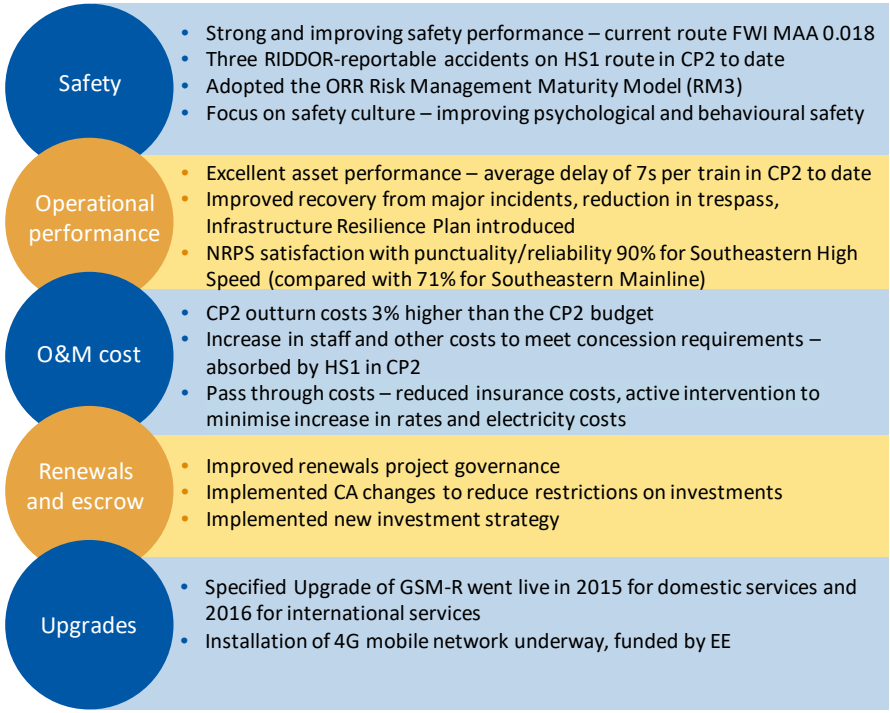
We have continued to deliver excellent operational and safety performance. We have focused on safety culture during CP2 and adopted the ORR Risk Management Maturity Model (RM3) to benchmark and evaluate improvement activities. Operational challenges in CP2 have related mainly to trespass and infrastructure incidents. To improve operational resilience, we have reviewed and enhanced our trespass strategy, resulting in a significant reduction in the number and impact of trespass incidents, and developed an Infrastructure Resilience Plan.

In PR14, we established ambitious targets for operating and maintenance cost reductions and have worked hard to keep outturn costs within the CP2 efficient budget. While still providing significant savings to train operators compared with CP1, overall O&M costs have increased by 3% compared with the budget. The single biggest increase was for rates, where we worked with train operators and DfT to secure the best possible outcome from the 2017 rates revaluation. We have made changes in the HS1 organisation during CP2 to ensure that we continue to comply with our long term obligations under the Concession Agreement as the business has matured, which has marginally increased staff costs and other HS1 internal costs in CP2.

We commenced route renewals, drove improvements in NR(HS) project capability to plan and deliver renewals, and improved project governance to ensure efficient renewals spend. We also implemented our new investment strategy to maximise the return on the route escrow account.

We led the efficient delivery of the Specified Upgrade of GSM-R; outturn costs are expected to be lower than forecast and the saving will be passed on to train operators. We are also planning the 4G upgrade project to improve mobile network coverage.

Figure 5: Summary of CP2 performance



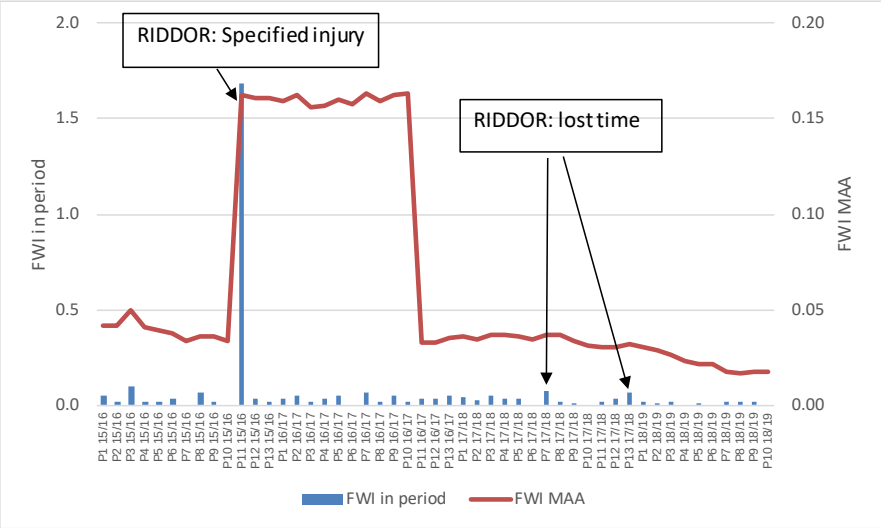
4.2. Safety performance

Our safety performance is good but we strive for continuous improvement.

NR(HS) monitors route and stations safety performance against 20 proactive and reactive safety KPIs. Reactive indicators cover RIDDOR-reportable and lost time accidents for staff and contractors and passenger accidents. Proactive indicators cover the number of safety tours and T3 checks and close out of resulting actions, safety briefings, audits, voice communications and dissemination of recommendations from accident and incident investigations.

The top level safety measure for the HS1 route is the Fatalities and Weighted Injuries rate (FWI) for staff and contractors. To calculate FWI, incidents on the route are weighted by severity and normalised per million hours worked. Figure 6 shows the FWI for the HS1 route for CP2 to date.

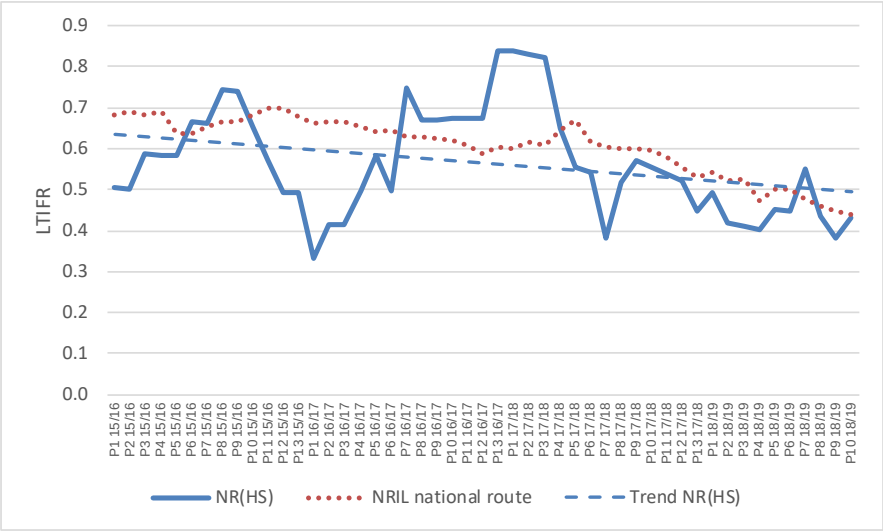
Figure 6: Fatalities and Weighted Injuries (HS1 route)



The small number of incidents on HS1 means that a single RIDDOR-reportable incident can have a significant impact on FWI. This was the case in P11 2015/16, where an employee sustained a specified injury travelling from a training course off site. Figure 6 shows the improvement in FWI for the HS1 route during CP2; the current (to P10 2018/19) FWI Moving Annual Average (MAA) is 0.018.

NR(HS) workforce and contractor safety performance is recognised as good within the industry. Lost Time Injury Frequency Rates (LTIFR)[1] for NR(HS), which are compared with the NRIL national route average, have shown an improving trend in CP2 as shown in Figure 7.

Figure 7: LTIFR MAA for HS1 and NRIL national route average



In CP1, HS1 Ltd and NR(HS) focused mainly on the delivery of situational safety (what the organisation does for safety) through the development and implementation of procedures, standards and competencies. In CP2 we broadened our scope to focus on safety culture – changing the psychological and behavioural approach taken to safety by staff – through proactive and positive leadership, benchmarking, sustained planned and coordinated activities (safety workshops, employee engagement, and weekly conversations). The ORR Risk Management Maturity Model (RM3) has been used as a tool to assess NR(HS) safety culture and identify areas for improvement.

[1] The Lost Time Injury Frequency Rate (LTIFR) measures the number of personal injuries which have resulted in lost time. It is not weighted by injury severity.

In CP2 we also undertook a fundamental review of the NR(HS) Safety Risk Model and its contributing precursors in order to embed risk management further into the organisation. The identification and monitoring of hazardous event precursors is used to manage risk proactively through effective risk control measures. This includes investigation of and learning from 'near miss' incidents – events where, under slightly different circumstances, harm could have resulted. NR(HS) has weekly reviews of 'near miss' incidents and shares learning throughout the workforce, including contractors.

We believe in the importance of providing proactive support to safety management on the HS1 route and stations. Wherever possible, joint problem-solving exercises with affected parties are held.

We play a key role in assuring NR(HS)'s safety responsibilities are being executed properly. In CP2, we enhanced our existing assurance activities by introducing quarterly HS1 Assurance Meetings with NR(HS) to provide additional longer term safety assurance.

During CP2, ORR has undertaken a number of proactive inspections and supervision activities with NR(HS). In ORR's approach to PR19 document, ORR noted that these "*revealed a proactive attitude towards predicting defects and anticipating potential problems. As a result, we have no current concerns over the safety of the network.*"

Section 8 sets out our safety strategy for the remainder of CP2 and CP3.

4.3. Operational performance

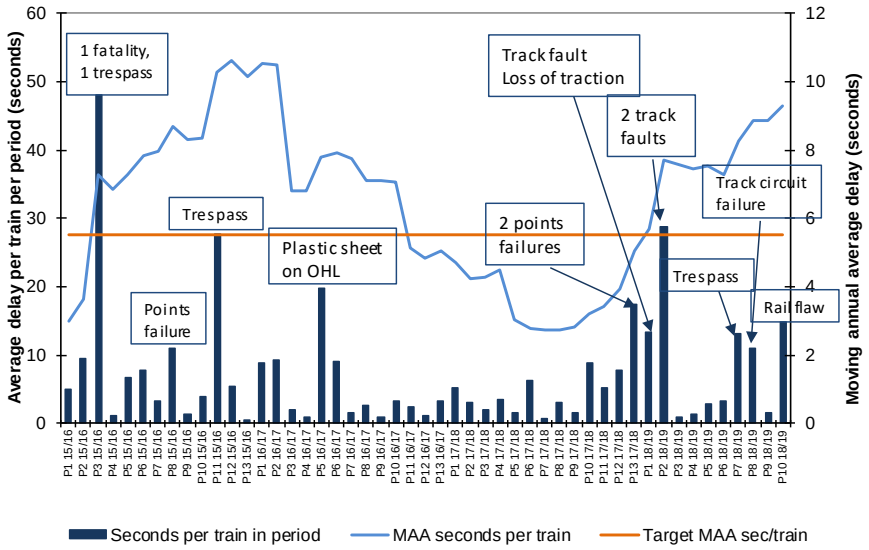
4.3.1. Delay minutes

HS1 has continued to operate at excellent levels of reliability throughout CP2. The top level service requirement for HS1 is average seconds delay per train for all incidents attributed to HS1[1]. The measure is reported on both a period and MAA basis.

We agree internal stretch targets with NR(HS). The target set in the Initial Asset Management Statement was 15 seconds delay per train (MAA) and this was reduced in stages over CP1 to drive further improvements in performance. For CP2, we have set a stretch target of 5.5 seconds delay per train (MAA). NR(HS) also reports against a Significant Delays KPI, which includes all incidents with a performance impact of over 200 minutes.

Figure 8 shows average seconds delay per train and MAA during CP2 and Table 5 summarises total delays and significant delays for each of the three full years of CP2 to date and for P1 to P10 2018/19.

Figure 8: Average seconds delay per train attributed to HS1



[1] In general, only delays above a threshold of 3 minutes are attributed although there are circumstances in which sub-threshold delays are attributed

Table 5: Delay metrics for CP2

Metric	15/16	16/17	17/18	18/19 P1-P10
All incidents attributed to HS1				
Seconds delay per train	10.2	5.0	5.1	9.3
Total minutes delay	12,711	6,209	5,620	7,730
Number of incidents	248	270	205	167
Average delay per incident (minutes)	51	23	27	46
Significant incidents (>200 minutes delay)				
Total minutes delay	9,581	3,076	2,437	6,294
Number of incidents	10	4	6	7
All other incidents (<200 minutes delay)				
Total minutes delay	3,130	3,133	3,183	1,436
Number of incidents	238	266	199	160

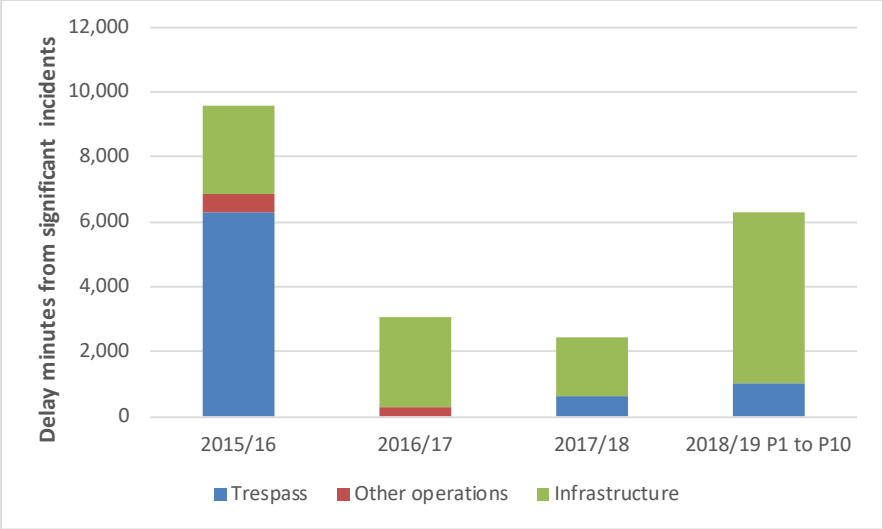
In 2015/16, there was a total of 10.2 seconds delay per train compared with the internal stretch target of 5.5 seconds. 50% of delay minutes for the year were attributed to four major trespass incidents; excluding these incidents, the average delay per train would have been 5.1 seconds.

Operational performance improved to 5.0 seconds delay per train in 2016/17 and was maintained at 5.1 seconds delay per train in 2017/18.

Overall performance has remained good in 2018/19 but there has been an increase in delay minutes compared with the previous two years as a result of six significant infrastructure incidents (and one trespass incident) between P1 and P10 2018/19. The forecast of delay minutes for the full year is 8,423, which equates to 8.1 seconds per train.

Underlying asset reliability has been very good. Major incidents are infrequent but have a significant impact on average performance. In P1 to P10 2018/19, 81% of total delay minutes were caused by only seven significant incidents. The main causes of significant incidents in CP2 are shown in Figure 9.

Figure 9: Delay minutes by cause for significant incidents



We review all significant incidents and use learning to improve our operational and maintenance regimes. Following the significant trespass incidents in 2015/16 we undertook a major review and enhancement of the HS1 trespass strategy, systems and processes including:

- A high level working group with SNCF Réseau, EIL and Getlink to coordinate strategies and transfer best practice between organisations;
- Improvements to route security including modification or removal of gates, height extensions to fencing and removal of stepping aids, enhancement of bridge security and addition of motion detectors at tunnel entrances;
- System renewals to be in line with the trespass strategy when replacing security systems (fencing/CCTV/data transmission);

- A programme of fatality and operational exercises, working in conjunction with stakeholders; and
- Enhanced engagement with BTP crime reduction officers.

This led to a reduction in the number and impact of trespass incidents.

In 2017/18 the HS1 trespass strategy was revised with additional emphasis on prevention. We assessed the HS1 boundaries and increased security at high risk locations. We also developed and implemented a 'multi-agency standard operating procedure' between HS1 Ltd, NR(HS), NRIL, BTP and our security supply chain which has enabled improved information sharing. We hold regular multi-agency exercises (both desktop and practical) to ensure a joint response approach.

In response to the decline in operational performance in late 2017/18 and early 2018/19, NR(HS) introduced an Infrastructure Resilience Containment Plan. The initial workstreams of Engineering Verification, Performance Risk Containment, Standards Review and Prioritisation, Spares and Materials have been completed. The following priority areas have been identified for additional work.

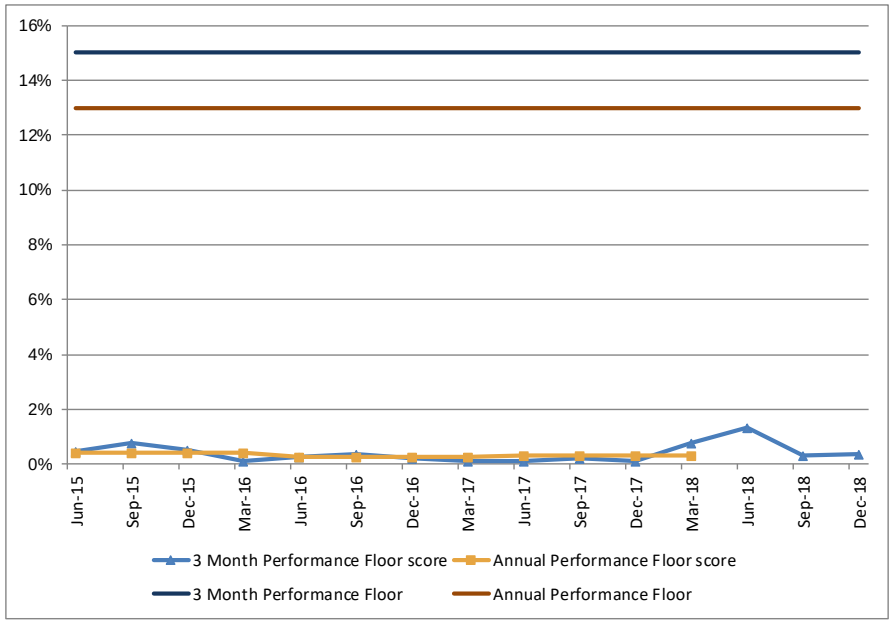
NR(HS) has developed plans for delivery against these themes by September 2019.

The excellent operational performance on HS1 is reflected in passenger satisfaction. In the Spring 2018 National Rail Passenger Survey, satisfaction with punctuality/reliability was 90% for Southeastern High Speed services compared with the 71% for Southeastern Mainline services.

4.3.2. Concession Agreement Performance Floors

Under the Concession Agreement, performance is measured against three month and annual performance floors which measure the percentage of trains delayed by five or more minutes or cancelled due mainly to incidents attributable to HS1 Ltd. The three month threshold is 15% and the annual threshold is 13%. The performance floors do not represent a target level of performance; they are triggers for enforcement procedures under the Concession Agreement. Performance has been significantly better than the performance floors throughout CP2 as shown in Figure 10.

Figure 10: Actual performance against performance floors



4.4. CP2 outturn costs

This section covers costs for the whole of CP2. We present actual costs for 2015/16 to 2017/18 and forecast costs for the remainder of CP2. The forecasts are based on the business plan approved by the HS1 Board. All costs are presented in February 2018 prices.

4.4.1. CP2 efficient budget

The efficient budget for CP2 was determined by ORR in the 2014 Periodic Review (PR14). The efficient budget was used in the calculation of access charges for CP2. Table 6 shows the efficient budget for CP2 expressed in February 2018 prices.

Table 6: CP2 efficient budget (£m, February 2018 prices)

	15/16	16/17	17/18	18/19	19/20	Total
NR(HS)[1]	44.3	43.5	42.4	41.6	41.1	212.9
HS1	11.9	12.1	12.7	12.7	12.0	61.3
Pass through	16.0	15.9	15.8	15.7	15.6	79.1
Freight-specific	0.6	0.6	0.6	0.6	0.6	2.9
Total O&M	**72.9**	**72.1**	**71.5**	**70.5**	**69.3**	**356.2**

Table 7 shows CP2 actual costs to 2017/18 and cost forecasts for 2018/19 and 2019/20. Table 8 shows the variance from the efficient budget.

Table 7: CP2 outturn costs (£m, February 2018 prices)

	15/16 actual	16/17 actual	17/18 actual	18/19 forecast	19/20 forecast	Total
NR(HS)	44.3	43.5	42.4	41.6	41.1	212.9
HS1	12.1	12.4	13.9	13.9	13.6	66.0
Pass through	15.2	15.6	17.5	18.6	18.5	85.4
Freight-specific	0.6	0.6	0.6	0.6	0.6	2.9
Total O&M	**72.3**	**72.1**	**74.4**	**74.7**	**73.7**	**367.2**

Table 8: CP2 variance (£m, February 2018 prices)

	Efficient budget	Actual/ forecast	Cost variance	% variance
NR(HS)	212.9	212.9	+0.0	0%
HS1	61.3	66.0	+4.7	+8%
Pass through	79.1	85.4	+6.3	+8%
Freight-specific	2.9	2.9	+0.0	0%
Total O&M	**356.2**	**367.2**	+11.0	+3%

Outturn costs for CP2 are expected to be 3% higher than the efficient budget. Details for individual line items are set out below.

4.4.2. NR(HS) O&M costs

Under the Operator Agreement, NR(HS) charges an Annual Fixed Price for operations and maintenance. The Annual Fixed Price for CP2 was determined as part of PR14; NR(HS) bears the risk of variance from this

[1] NR(HS) costs = the Annual Fixed Price under the Operator Agreement including escalation allowed under the Operator Agreement (1.1%) minus the freight-specific element of NR(HS) costs. The purpose of this adjustment is to show the effective NR(HS) costs which are recovered from passenger train operators through their access charges.

price. In CP2 to date, NR(HS) has reported outperformance against the Annual Fixed Price of:

- £2.0m in 2015/16;
- £3.0m in 2016/17; and
- £0.5m in 2017/18.

The Operator Agreement has 50:50 sharing of financial outperformance by NR(HS) for the last three years of CP2 and we pass on 60% of our share to the train operators. The methodology for calculating the Outperformance Share is set out in the Operator Agreement; on the basis of this calculation, there was no Outperformance Share for 2017/18.

During CP2, NR(HS) has incurred additional costs and delivered a number of efficiencies as summarised in Table 9. The efficiencies achieved by NR(HS) offset the additional costs incurred, therefore NR(HS) expects to exit CP2 within the Annual Fixed Price.

Table 9: NR(HS) additional costs and efficiencies in CP2

Additional costs in CP2	Efficiencies in CP2
▪ Accelerated development of Asset Management capability - NR(HS) has introduced additional resources, processes and technology. ▪ Introduction of Eurostar Class 374s into service has led to changes in maintenance and inspection regimes. ▪ Additional EMMIS controllers recruited to provide greater resilience to the HS1 operation. ▪ NR(HS) has developed its safety maturity to improve safety culture and embed safety behaviour. ▪ Increase in staff costs as a result of legislative changes (introduction of Holiday Pay Supplement and Apprenticeship Levy) and corporate policy changes such as provision of private healthcare to more staff.	▪ NR(HS) re-negotiated contractual terms with NRIL to ensure that the corporate services were delivered at an efficient market rate. Some services were brought in house to secure a dedicated more efficient service. ▪ Implementation of changes to the Inventory Management system allowed NR(HS) to rationalise stock levels, reducing inventory costs. ▪ Investment in mobile technology, leading to flexibility in asset management, inventory management, working practices and the ability to identify and improve workforce productivity. ▪ Reductions in contract costs for security, civils minor works and vegetation management.

4.4.3. HS1 costs

Our activities are driven by Concession Agreement requirements and the concessioning process. We need to manage our concession obligations and run the railway safely and sustainably in line with the output requirements of our stakeholders.

CP2 outturn costs are expected to be 8% (£4.7m) higher than the CP2 efficient budget, driven largely by increased staff and consultancy costs to meet emerging needs as the business has matured and additional "Other" costs related to supporting the railway which were not included in our CP2 efficient budget.

HS1 costs are split into HS1 subcontract costs and HS1 internal costs. Table 10 and Table 11 show a breakdown of the CP2 efficient budget and outturn HS1 costs. Variances are shown in Table 12 and discussed in Table 13 and Table 14. We bear the risk of variance in these costs during CP2.

Table 10: HS1 costs CP2 efficient budget (£m, February 2018 prices)

	15/16	16/17	17/18	18/19	19/20	Total
HS1 subcontract costs						
NR costs	1.8	1.8	1.8	1.8	1.8	9.0
NR GSM-R	0.6	0.6	0.6	0.6	0.6	2.9
NGC connection fees	0.6	0.6	0.6	0.6	0.6	2.8
BTPA	1.1	1.1	1.1	1.1	1.1	5.6
ORR regulatory and safety	0.4	0.4	0.6	0.6	0.5	2.5
Subtotal	**4.5**	**4.5**	**4.6**	**4.6**	**4.6**	**22.8**

	15/16	16/17	17/18	18/19	19/20	Total
HS1 internal costs						
Staff	3.9	3.9	4.0	4.0	4.0	19.8
Technical support/ consultancy	1.5	1.5	2.1	2.1	1.5	8.6
Office running	1.1	1.3	1.1	1.1	1.1	5.7
Other: Concession	0.8	0.8	0.8	0.8	0.8	4.0
Other: Railway	0.1	0.1	0.1	0.1	0.1	0.5
Subtotal	**7.5**	**7.6**	**8.0**	**8.0**	**7.4**	**38.5**
Total	**11.9**	**12.1**	**12.7**	**12.7**	**12.0**	**61.3**

Table 11: HS1 costs CP2 outturn (£m, February 2018 prices)

	15/16 actual	16/17 actual	17/18 actual	18/19 forecast	19/20 forecast	Total
HS1 subcontract costs						
NR costs	1.5	1.4	1.5	1.6	1.6	7.5
NR GSM-R	0.6	0.6	0.5	0.5	0.5	2.7
NGC connection fees	0.5	0.5	0.6	0.5	0.5	2.6
BTPA	1.1	1.1	1.0	1.0	1.0	5.2
ORR regulatory and safety	0.3	0.2	0.3	0.3	0.3	1.4
Subtotal	**4.0**	**3.7**	**3.9**	**3.9**	**3.9**	**19.4**
HS1 internal costs						
Staff	4.0	4.4	4.3	4.7	4.5	21.9
Technical support/ consultancy	1.6	1.7	2.0	2.3	2.1	9.7
Office running	1.0	1.2	1.3	1.1	1.1	5.8
Other: Concession	0.4	0.9	1.5	0.8	0.9	4.6
Other: Railway	1.1	0.6	0.9	1.0	1.0	4.6
Subtotal	**8.1**	**8.7**	**10.0**	**10.0**	**9.6**	**46.5**
Total	**12.1**	**12.4**	**13.9**	**13.9**	**13.6**	**66.0**

Table 12: HS1 costs variance (£m, February 2018 prices)

	CP2 efficient budget	CP2 outturn	Cost variance
HS1 subcontract costs			
NR costs	9.0	7.5	-1.5
NR GSM-R	2.9	2.7	-0.2
NGC connection fees	2.8	2.6	-0.2
BTPA	5.6	5.2	-0.4
ORR regulatory and safety	2.5	1.4	-1.0
Subtotal	**22.8**	**19.4**	**-3.4**
HS1 internal costs			
Staff	19.8	21.9	+2.1
Technical support/ consultancy	8.6	9.7	+1.1
Office running	5.7	5.8	+0.1
Other: Concession	4.0	4.6	+0.6
Other: Railway	0.5	4.6	+4.2
Subtotal	**38.5**	**46.5**	**+8.1**
Total	**61.3**	**66.0**	**+4.7**

Details of variance by line item for HS1 subcontract costs and HS1 internal costs are shown in Table 13 and Table 14 respectively.

Table 13: Changes in HS1 subcontract costs in CP2

Cost category	Comments
NR costs	In our CP2 efficient budget, this category included the following (inflated to Feb 18 prices): ▪ **OMA:** £1.34m p.a. for costs incurred in relation to the interface assets between the NRIL network and HS1; these assets are covered by the OMA ▪ **Ripple Lane:** £0.17m p.a. for Ripple Lane mothballing costs. Even if no freight trains operated on HS1 we would need to protect Ripple Lane as it is part of our concession. The costs of doing this (referred to as mothballing costs) are included in common costs. Any additional costs incurred only because freight trains operate are included in freight avoidable costs. ▪ **Additional Services:** £0.28m p.a. for the costs of Additional Services required on the route over and above services covered by the Operator Agreement with NR(HS). CP2 outturn cost is £1.5m lower than the CP2 efficient budget, largely as a result of the re-categorisation of Additional Services in the CP2 outturn costs to "Other" and "NR GSM-R".
NR GSM-R	This includes: ▪ Maintenance of HS1-owned GSM-R equipment, provided by NR(HS) as an Additional Service in CP2; and ▪ Costs related our GSM-R contract with NRIL, under which we pay a percentage of the national NRIL spine network costs (based on train miles run). CP2 outturn costs are slightly lower (£0.2m) than the forecast in the CP2 efficient budget.
NGC connection fees	These are connection charges for HS1/UKPNS power assets into the national grid. Standard charges are based on UK-wide regulated tariffs. The CP2 efficient budget assumed tariffs increased by RPI. CP2 outturn costs are £0.2m lower than CP2 efficient budget.
BTPA	Fixed price contract (indexed by RPI) with reopeners for vehicles and overtime. CP2 outturn is £0.4m (8%) lower than the CP2 efficient budget as a result of close monitoring of performance with credits received when staff levels were lower than contracted. These lower staff levels did not have a negative impact on HS1 security.
ORR regulatory and safety	Regulatory fees are based on ORR costs incurred, an ORR safety levy based on proportion of UK track length and small other regulatory and safety fees. The CP2 efficient budget was based on ORR costs from 2010 to 2013. Outturn costs are 42% (£1.0m) lower than the CP2 efficient budget.

Table 14: Changes in HS1 internal costs in CP2

Cost category	Comments
Staff	The CP2 efficient budget was based on 25 staff allocated to Route. This staffing level was tight with most roles covering multiple responsibilities and succession was a big risk given the knowledge within a small team. The demands of running the concession were greater than we anticipated at the time of our PR14 submission and we have made significant changes, flexing the HS1 Ltd organisation during CP2 to meet emerging needs, ensuring we continue to comply with our long term obligations under the Concession Agreement, increasing our focus on asset management and performing our role as strategic partner and intelligent client. Organisational restructuring during CP2 to meet the maturing requirements of the business has resulted in a net increase in headcount allocated to Route from 25 to 35 staff. Additional staff have been required to: ▪ Manage and improve supply chain performance with improved risk management and efficient spend on CP2 renewals;

Cost category	Comments
	▪ Improve our asset management capability, and that of our supply chain, to ensure long term sustainability of the HS1 assets; ▪ Transition to a new model for planning for 40-year renewals of the HS1 route; ▪ Replace contractors with permanent staff bringing specialist expertise in house; ▪ Support the complexity of the Concession Agreement and inherited contracts to manage our concession obligations. In some areas, staffing has been reduced with roles removed or merged to reflect the new business priorities. For instance, the SMT was reduced from six to five with the procurement director role being merged into the wider SMT responsibility, the environment manager was merged into the safety and assurance role to avoid duplication of effort with NR(HS) and a PA resource was removed spreading the work over the remaining team. Changes in the HS1 team as a result of this restructuring have led to a significant reduction in cost per employee compared with the CP2 efficient budget. Staff costs are considered on market; as HS1 has over 20% staff turnover per annum salaries are regularly benchmarked to the market. As a result of these changes, CP2 outturn is forecast to be 11% (£2.1m) higher than the CP2 efficient budget across the five years of CP2.
Technical support/ consultancy	CP2 outturn is £1.1m higher than the CP2 efficient budget (which included a stretch target of £200k p.a.) as a result of: ▪ Preparation for PR19 being underbudgeted, in particular the work on renewals deliverability; ▪ Cost of interim contractors to cover gaps in headcount, given the small HS1 Ltd team; ▪ Specialist legal support to review contracts to maximise value, and legal advice on construction defects. In 2016, to improve procurement efficiency, we introduced our Engineering and Asset Management Framework, following an OJEU process. The framework covers the five-year period from April 2016 and emphasises a partnership approach to enable a sustainable increase in high speed rail infrastructure competency.
Office running	During CP2, we were required to move from our Euston office. The increase in rent and service charge for our new office has been offset by efficiencies in other office running costs and IT costs have been maintained at the CP2 efficient budget level despite increasing headcount. As a result, CP2 outturn is only £0.1m (2%) higher than the CP2 efficient budget.
Other: managing the Concession	These costs are not railway-specific and relate to normal business expenditure that a similar organisation in any industry could be expected to incur. Costs include items such as audit, accounting software, rating agencies, corporate memberships, executive recruitment and training. CP2 outturn costs are £0.6m higher than the CP2 efficient budget. The main reason for this difference was the HS1 office move in 2017/18 (cost £0.5m) which was not included in the CP2 efficient budget.
Other: running the railway	CP2 outturn costs are £4.2m higher than the CP2 efficient budget. The main reasons for this variance are: ▪ £1.0m of costs incurred for additional UKPNS EMMIS Control Engineers and the revised UKPNS performance regime which we absorbed in CP2; ▪ NR(HS) Additional Services (which were categorised as NR costs in the CP2 efficient budget); and ▪ Other cost categories which were not included in the CP2 efficient budget including Ashford IECC, stock movements and PR and marketing.

4.4.4. Pass through costs

Pass though costs in CP2 are expected to be 8% (£6.3m) higher than the CP2 efficient budget, driven largely by an increase in rates as a result of the 2017 rates revaluation and increases in electricity prices, partly offset by reductions achieved in insurance costs.

Table 15 and Table 16 show a breakdown of the CP2 efficient budget and outturn pass through costs. Variances are shown in Table 17 and discussed in Table 18. Variance in these costs is passed through to train operators.

Table 15: Pass through costs CP2 efficient budget (£m, February 2018 prices)

	15/16	16/17	17/18	18/19	19/20	Total
Non-traction electricity	1.3	1.3	1.3	1.3	1.3	6.7
Insurance	4.2	4.1	4.0	3.9	3.7	19.8
UKPNS O&M and renewals	5.3	5.3	5.3	5.3	5.3	26.5
Rates	5.2	5.2	5.2	5.2	5.2	26.1
Total	**16.0**	**15.9**	**15.8**	**15.7**	**15.6**	**79.1**

Table 16: Pass through costs CP2 outturn (£m, February 2018 prices)

	15/16 actual	16/17 actual	17/18 actual	18/19 forecast	19/20 forecast	Total
Non-traction electricity	1.3	1.6	1.6	1.7	1.8	7.9
Insurance	3.2	3.3	3.3	3.2	2.9	16.0
UKPNS O&M and renewals	5.4	5.4	5.3	5.3	5.4	26.8
Rates	5.3	5.3	7.3	8.4	8.4	34.8
Total	**15.2**	**15.6**	**17.5**	**18.6**	**18.5**	**85.4**

Table 17: Pass through costs variance (£m, February 2018 prices)

	CP2 efficient budget	CP2 outturn	Cost variance
Non-traction electricity	6.7	7.9	+1.2
Insurance	19.8	16.0	-3.8
UKPNS O&M and renewals	26.5	26.8	+0.2
Rates	26.1	34.8	+8.7
Total	**79.1**	**85.4**	**+6.3**

Table 18: Changes in pass through costs in CP2

Cost category	Comments
Non-traction electricity	Electricity costs for ancillary route equipment (e.g. tunnel ventilation, signalling, Singlewell infrastructure maintenance depot), based on metered volumes. The CP2 efficient budget was based on constant volumes and RPI price escalation. CP2 outturn is 17% higher than the CP2 efficient budget as a result of electricity prices increasing faster than forecast.
Insurance	The majority of insurance requirements are set out in the Concession Agreement. We achieved a large reduction in CP1 and our CP2 efficient budget assumed that we would continue to deliver annual real reductions in insurance premiums. During CP2, we have achieved a £3.8 million (19%) saving compared with the efficient budget. We competitively tender for insurance each year and from November 2015 we have achieved lower than anticipated insurance premiums as a result of increased confidence in HS1 and zero claims history. In 2018, following a competitive process, we selected JLT as our new insurance broker. In November 2018 we achieved a significant saving on like-for-like insurance costs which allowed us to increase our property damage, business interruption and

Cost category	Comments
	public liability cover while still providing a £0.7m per annum saving, of which £0.5m is allocated to the HS1 route. We have locked in this saving on a three year agreement with our main insurer (QBE). To date, insurance has been based on original build costs (inflated) but we are currently undertaking a five year programme of revaluation of route and station assets. The first tranche of revaluation in 2018 increased the value of the assets but this was accommodated without an increase in the insurance premium. The three year agreement with QBE will continue to accommodate increases of up to 20% as a result of revaluation. We have included a small increment of £100k in November 2019 to allow for a potential increase in insurance costs resulting from the revaluation process.
UKPNS O&M and renewals	Fixed price contract with UKPNS (indexed to RPI) to 2057 to provide O&M and renewals of electricity substations and connections to HS1 catenary. CP2 outturn costs are slightly higher (£0.2m) than the forecast in the CP2 efficient budget.
Rates	The 2010 business rates revaluation used a non-standard simplified receipts valuation methodology because of uncertainty pre-concession. A reduction in business rates was achieved; this assessment covered CP1 and the first two years of CP2. The CP2 efficient budget assumed that rates would increase with RPI in CP2, which was the best assessment at the time. The 2017 revaluation used the standardised receipts and payments methodology with a percentage of net profits used to determine business rates. Changes took effect from 1 April 2017 with a transition period in the financial year 2017/18 and the full amount payable from 2018/19. This resulted in a 33% increase in rates during CP2 compared with the efficient budget. The initial 2017 revaluation proposal was an increase in rateable value from £11.3m to £120-130m (a 1000% increase). Following negotiations, the rateable value was set at £20m (an 80% increase). DfT and EIL were involved in our meetings with the Valuation Office. The decision to accept the £20m valuation was made jointly by HS1 Ltd, DfT and EIL with advice from both HS1 Ltd and EIL rates advisers.

4.4.5. Freight costs

Freight-specific O&M costs are made up of:

- Variable costs: operations, maintenance and renewal spend in addition to that required to satisfy passenger usage, as a result of freight traffic operating on shared infrastructure.
- Avoidable track-specific costs: costs relating to track dedicated to freight use. These costs cover the contract with NRIL in relation to Ripple Lane sidings, and a share of the overall efficient budget that relates to Cheriton chord.
- Avoidable freight-specific costs: non-infrastructure costs that would be avoided if freight traffic did not operate over HS1 in the longer term. This includes staff costs and other administrative resources such as legal advice.

Table 19 shows a breakdown of the freight-specific costs in the CP2 efficient budget. Table 20 explains how each of these costs was built up. There have been no changes to the freight-specific cost base in CP2.

Table 19: Freight costs CP2 efficient budget (£m, February 2018 prices)

	15/16	16/17	17/18	18/19	19/20	Total
NR(HS)	0.3	0.3	0.3	0.3	0.3	1.5
NRIL Ripple Lane	0.2	0.2	0.2	0.2	0.2	1.0
HS1	0.1	0.1	0.1	0.1	0.1	0.4
Total	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**2.9**

Table 20: Freight-specific costs in CP2

Cost category	Comments
NR(HS)	This is an allocation from total NR(HS) O&M costs of those costs which are specific to freight operations. In PR14, there was a significant reduction, to £300k p.a. (Feb 18 prices) as a consequence of the reduction in the forecast number of trains and the revised treatment of mothballing costs.
NRIL Ripple Lane	Ripple Lane exchange sidings are used exclusively for freight. Ripple Lane is operated and maintained by NRIL under a bespoke O&M contract. In PR14, the treatment of mothballing costs was revised - mothballing costs are allocated to common costs and therefore not charged to freight operators. This resulted in a reduction of £168k per annum (Feb 18 prices) in freight-specific costs. The remaining Ripple Lane cost was charged to freight. Post-PR14, it was agreed that we would start charging trains accessing Ripple Lane from the NRIL network. Ripple Lane costs were split between freight trains accessing Ripple Lane from HS1 (21%) and freight trains accessing Ripple Lane from the NRIL network (79%) on the basis of the number of trains operated.
HS1	This is an allocation from total HS1 costs of those costs which are specific to freight operations. In PR14, there was a significant reduction to £85k p.a. (Feb 18 prices).

4.4.6. Traction electricity

Traction electricity does not form part of our OMRC charges to train operators. Train operators are charged separately for traction electricity on the basis of actual prices and train numbers/formations. However, as part of PR14, we provided an indicative forecast of traction electricity costs for CP2; this was based on an RPI increase in electricity prices and our forecast increase in train paths. Table 21 shows this indicative forecast and CP2 outturn costs.

Table 21: CP2 traction electricity costs outturn v indicative (£m, February 2018 prices)

	15/16	16/17	17/18	18/19	19/20	Total
PR14 estimate	15.8	15.6	15.6	15.8	15.8	78.5
Outturn	15.8	17.4	16.9	19.6	20.2	89.9
Variance	**0.0**	**+1.8**	**+1.3**	**+3.8**	**+4.4**	**+11.3**

For CP2 as a whole, outturn costs are expected to be 14% higher than estimated costs, as a result of electricity tariffs increasing faster than in our indicative forecast. The electricity price is made up of the commodity price (wholesale cost of energy) and non-commodity price (taxes, levies and network charges). The non-commodity price represents a very significant proportion of the total cost of electricity and has increased over CP2.

Section 11.6 (Energy Review) discusses how we have procured electricity from npower during CP2 and the purchasing strategy we have agreed with the train operators.

In our PR14 submission we set out our programme of work on schemes to reduce electricity consumption. Progress with the two major elements of this programme during CP2 (regenerative braking and system usage) is also summarised in Section 11.6.

4.5. CP2 renewals

In CP2, we have led the development of the renewals supply chain capability, adding value through improved governance, challenging renewal cost and scope and providing coaching to project managers.

4.5.1. Capability and governance improvements in CP2

As CP2 has progressed, we have recognised that there are gaps in the capability of NR(HS) to manage projects. During CP1, the NR(HS) organisation was focused on operations and maintenance and lacked the required experience and capability for longer term planning and delivery of renewals projects.

During CP2, we have driven improvements in NR(HS) renewals capability, put in place the HS1 project process, improving project governance and lifecycle management, and supported NR(HS) in developing its project processes and project delivery and procurement capability:

- The HS1 project process, developed by HS1 Ltd, follows best practice as defined by the Association of Project Managers (APM). The process can be tailored depending on the scale and complexity of the project. NR(HS) is required to adopt the same gate approvals for review by the HS1 renewals board but can vary the work that takes place within each stage. NR(HS) chose to use variants of the NRIL GRIP process, rather than the HS1 process for asset renewal work. NR(HS) is now developing its own process, which is very similar to the HS1 process. This is a very welcome development.
- We have worked with NR(HS) and provided coaching in developing business cases for projects such that they are suitable to be shared with ORR and DfT.
- Where NR(HS) does not have the capability, the HS1 project team supports NR(HS) on specific stations renewals projects.
- We have ensured that NR(HS) renewals projects are driven by good engineering knowledge of the condition of the assets as opposed to manufacturers' recommendations.

In 2018, NR(HS) commenced a programme to improve its project capability. NR(HS) recruited an experienced programme manager, increased its project resources and partnered with a project management organisation to bring in expertise on all aspects of project management. NR(HS) is undertaking a Project Delivery Improvement Plan which is due for completion by the end of CP2. Our assessment of NR(HS) capability requirements for 2020 and the current level of NR(HS) capability against these requirements are summarised in Figure 11. Our assessment is based a HS1 engineering judgement of the evidence over the last four years as NR(HS) has delivered the portfolio in CP2. Green indicates the capability exists at the required level, amber indicates that the capability exists but needs improvement and red indicates a lack of capability.

Figure 11: 2020 NR(HS) capability requirements

Capability	Current level
Project process, documentation, governance, sponsorship	🟡
Defining the scope of work	🟡
Creating a business case	🟡
Resource planning	🔴
Programme office (cost, schedule, risk, change)	🟡
Creating contracts that incentivise suppliers to out-perform	🔴
Technical leadership and standards	🟡
Quality management	🟡
Safety management	🟢
Stakeholder management	🔴
Logistics management	🟡
Project delivery (post gate 4)	🟢

During CP2 we have also made significant improvements to the governance processes under the Concession Agreement. The main elements of the current process are:

- During the control period there are quarterly renewals meetings with ORR and DfT to report on progress and funding requirements;
- Projects are undertaken following the HS1 project process and controlled through the renewals project board;
- The Asset Management Annual Statement (AMAS) outlines any changes to the five year plan and is reviewed by the train operators and ORR. At this time a request for the pre-Gate 4 annual funding required for all projects is made to ORR; and
- Requests for funding as projects reach Gate 4 are made on a project by project basis with the ORR reviewing the business case at Gate 4. We now also share the Gate 4 papers with the train operators.

Improvements during CP2 are summarised in Table 22.

Table 22: Governance improvements in CP2

Start of CP2	2018
All work being done on fixed price contracts with risk money passed to contractor	Work being done on contracts with risk understood and managed openly with the involvement of the ORR
AMAS not shared with operators	AMAS now shared with operators
No principles about sharing information with operators	Operators consulted on changes in scope of the portfolio
Every spending request and stage in project process subject to ORR and DfT approval	Pre-Gate 4 and Gate 4 costs approved upfront and HS1 Ltd can draw down against this
Different processes for route and stations	Similar processes for route and stations
No process for managing project risk and change	Process for managing risk and change
No project process	Project process and project governance

We appointed Arup to review the current governance and control measures and make recommendations for improvements in CP3. Further detail is available in Section 12.3.3.

4.5.2. CP2 renewals budget and outturn costs

As part of PR14, NR(HS) developed a CP2 renewals plan. A small volume of renewals was planned for CP2 focused on preventing obsolescence, reducing failure risks and correcting known localised infrastructure problems. The total CP2 renewal cost was estimated at £23.0 million (February 2013 prices). During CP2, the projects in this plan have been developed through the gate stages of the HS1 project process; business cases have been based on improved asset knowledge and have been subject to challenge to ensure renewals expenditure has a robust justification. This has resulted in significant changes at the individual project level.

The most significant CP2 route renewal project is the renewal of the Data Transmission Network (DTN) which has just passed Gate 4. This is a good example of where the project process and the level of challenge by HS1 Ltd has ensured that we are replacing the network with the most appropriate technology at the best whole life cost. The work resulted in a £2 million cost saving compared with the anticipated final cost at Gate 2. HS1 Ltd and NR(HS) worked closely with ORR to ensure they were involved in the development of the solution.

Other renewals projects where we have added value by challenging and reducing the scope of renewals planned for CP2 include:

- Stratford drainage pumps – the project was descoped from 22 pumps to 3 pumps in CP2 based on asset condition monitoring;
- Boundary fencing – the scope was reduced from 40km to 2km as the remaining 38 km was in an acceptable condition; and
- POE reductions – NR(HS) originally proposed to replace all of the sets. When challenged on the rationale for this, NR(HS) moved to replacement based on the number of operations resulting in a requirement to replace only 33% of the assets. We have suggested that NR(HS) should analyse the units removed to develop an algorithm to link usage to wear rate and the optimum time to replace.

There have also been changes to the timing of renewals as a result of improved asset knowledge, examples include:

- Renewals moved from CP2 to later control periods e.g. ballast renewal – new surveys undertaken by consultants determined that renewal was not required in CP2; and
- Renewals brought forward to CP2 e.g. acoustic barriers - assets failed earlier than anticipated.

During CP2, outturn performance has been monitored against the renewals budget. Table 23 shows the CP2 renewals budget and actual/forecast renewals costs as at January 2019.

Table 23: CP2 renewals – budget v actual (£ million)

	15/16	16/17	17/18	18/19	19/20	Total
CP2 budget	1.4	5.5	4.3	9.4	3.2	23.8
Actual/forecast renewals costs in CP2 (nominal)						
CP2 portfolio	0.3	1.8	2.1	0.8	10.4[1]	15.4
CP3 portfolio b/f					6.2	6.2
Total outturn	0.3	1.8	2.1	0.8	16.6	21.6

Despite significant variances at the individual project level, overall expenditure for the CP2 renewals portfolio is expected to be similar to that forecast at the start of CP2, although the full amount will not be delivered in CP2 as a result of the lack of NR(HS) resource and capability in the early years of CP2. £15.4m of the CP2 renewals portfolio is forecast to be delivered in CP2 with the remaining £6.2m deferred to the start of CP3. We remain concerned about NR(HS)'s capability to deliver the forecast renewals for the remainder of CP2.

In addition to the CP2 renewals portfolio, NR(HS) has plans to bring forward 13 projects from the CP3 portfolio to 2019/20 (see Section 12.3.1) and these are included in Table 23.

A progress report on the full renewals programme is included in the Asset Management Annual Statement (AMAS) which is shared with stakeholders. The current status and cost of CP2 renewals projects is summarised in Table 24.

Table 24: CP2 renewals – projects at each stage

Stage	Projects	CP2 AFC £000
Pre-Gate 1	CCTV cameras	247
	St Pancras fibre optic signalling	110
Gate 1	-	
Gate 2 (Options)	Wheel impact load detector	383
	ITCS system replacement	2,056
	Acoustic barriers	466
Gate 3 (Procurement)	Medway headwall repair	1,219
	Temple Mills chord	575
	Switch blade replacement	377
Gate 4 (Delivery)	RCCS and EMMIS control systems	2,582
	Ventilation control system	772
	Air conditioning in signal rooms	404
	Data transmission network	7,643
	UPS	3,023
	Radio propagation	798
Gate 5 (Completed)	Stratford dewatering control system	238
	Road-rail vehicle	228
	Boundary fencing	107
	Points equipment	994
	HPSS gearboxes	150
	Stratford sump pumps	62

[1] Includes £1.0m for project management

4.6. Renewals escrow account

Part of the OMRC paid by train operators is designed to fund future renewal of the HS1 railway. Our CP2 5YAMS consultation presented two options - Baseline and Asset Stewardship – for the renewals annuity and associated risk. The train operators' preferred option was the Asset Stewardship option. The renewals annuity for this option was calculated at £16.4m per annum (February 2013 prices) and we agreed with train operators and ORR to profile this increase over time with 50% of the

increase from CP1 being funded in CP2, resulting in a renewals annuity of £11.2m (£12.5m in February 2018 prices).

The funds collected from the renewals element of OMRC are paid into a route escrow account each quarter. Any drawdowns from this account must be authorised by the SoS and can only be used to fund renewals expenditure which has been approved by the ORR. The Concession Agreement allows for cash to be moved into Authorised Investments to earn a greater return. Interest earned from escrow bank accounts and Authorised Investments offsets future renewals funding requirements.

4.6.1. Changes to Concession Agreement provisions

The original terms of the Concession Agreement relating to escrow funds were very restrictive, in particular the provisions relating to credit ratings for acceptable investments and the length of the investment period. This resulted in low rates of interest on escrow funds.

During CP1 we proposed new investment criteria which would allow a much better return on escrow deposits. TOCs were consulted on our proposals and we worked with DfT and ORR to agree changes and consequent amendments to the Concession Agreement. Table 25 summarises the changes to the Concession Agreement; these were applicable from March 2015.

Table 25: Concession Agreement changes

	Original Concession Agreement	Amended Concession Agreement
Credit rating	Bank deposits ▪ S&P: A+ or higher ▪ Moody's: A1 or higher Treasury Bills or short-dated gilts ▪ S&P: AAA ▪ Moody's: Aaa	S&P: A- or better Moody's: A3 or better
Investment Period	Bank deposits - up to 12 months Treasury Bills or short-dated gilts - up to the end of the current Control Period	Maximum duration of five years, no investments can mature later than 12 months after the end of the Control Period
Diverse portfolio	-	No more than £40m in any one investment (to be reviewed at the end of CP3)
% of escrow balance in Authorised Investments	-	No more than 90% of the escrow balance may be invested Authorised Investments
Emergency access to funds	-	HS1 Ltd must be able to readily access funds in Authorised Investments if required for emergency renewal work

4.6.2. CP2 investment strategy

The changes to the provisions of the Concession Agreement allowed us to review our investment strategy. We increased the number of signed counterparties from one to four to improve interest earning potential and appointed an external treasury contractor at HS1 Ltd cost to review strategies; draft options for CP2 were slimmed down to simple cash deposits. The optimum option during CP2 is to lock away as much as possible to maximise interest; this is possible because of the limited risk of significant renewal spend in CP2. Locking in rates limited downside risk although it did mean that we would not be able to take full advantage if market conditions improved. EIL reviewed and agreed this strategy.

We commenced implementation of our new investment strategy on 31 March 2016 when we deposited £40.7m for four years with an interest rate

of 2.02%. We have made further deposits on 30 September and 31 March each year.

Although Concession Agreement changes were applicable from the start of CP2, implementation of the new investment strategy was delayed due to lack of alignment between EIL, HS1 Ltd and DfT on strategy and escrow risk. A temporary investment strategy was employed for the first year of CP2 with deposits placed for six months pending discussions and interest was foregone in year 1 of CP2 from not investing for longer periods.

4.6.3. Reporting to stakeholders

To provide greater transparency, we agreed the following escrow reporting requirements for CP2:

DfT/ORR	TOCs
Escrow amounts included in quarterly report	Prior sight of investments – counterparty / strategy
Bi-annual update on escrow investments prior to investment	Informed of new banks signed up to check against TOC exposure
Report by exception	
Sign off for investments in the month prior to new investments being placed	

4.6.4. Escrow account movements in CP2

Table 26: Escrow account in CP2 (£000, nominal)

	15/16 actual	16/17 actual	17/18 actual	18/19 forecast	19/20 forecast
Opening balance	33,635	45,466	56,414	66,449	79,992
Transfers in	11,901	11,923	11,977	12,605	13,439
Withdrawals	(310)	(1,819)	(2,055)	(786)	(16,617)
Interest	240	844	112	1,724	1,003
Closing balance	45,466	56,414	66,449	79,992	77,816

Table 26 shows escrow account movements in CP2 in nominal terms. This table includes both current account and deposit account balances. Table 27 compares the PR14 escrow forecasts for CP2 with the current outturn forecast.

Table 27: PR14 estimate and current outturn forecast for the end of CP2 (£000, nominal)

	Original CP2 model	CP2 outturn	Difference
Opening balance	30,386	33,635	3,249
Transfers in	62,226	61,845	(381)
Withdrawals	(25,817)	(21,587)	4,230
Interest	5,908	3,923	(1,985)
Closing balance	72,704	77,816	5,112

Variances between the PR14 estimate and our current forecast of CP2 outturn are a result of:

- In PR14, we under-forecast the CP2 opening balance; we started CP2 with £3.2 million more in the escrow account than our forecast;
- Transfers in are very slightly lower than forecast as a result of the net effect of domestic train paths being higher than forecast, international train paths being lower than forecast and RPI variance from the forecast of 2.75%;
- Withdrawals are lower than forecast as a result of changes in the renewals spend profile discussed in Section 4.5.2 above;
- Market conditions coupled with delays in executing our investment strategy have resulted in interest received being lower than forecast. At the time of PR14 we assumed that 80% of funds would be placed in Authorised Investments with interest rates of 1.37% in 2015/16 rising to 3.73% by 2019/20. Although we are now able to place 90% of funds in Authorised Investments, actual interest rates have been significantly lower than forecast (between 0.73% and 2.02% as shown below).

As required by the Concession Agreement, Table 28 shows details of the amounts withdrawn from the escrow account to make Authorised Investments. The interest arising from these Authorised Investments has been paid into the escrow account. For the first year of CP2 a temporary investment strategy was in place with deposits placed for six months. The new investment strategy was implemented in March 2016. £60.2m is currently on deposit, maturing between March 2019 and March 2020.

Table 28: Authorised Investments in CP2

Deposit Amount (£000)	Start and end dates	Interest Rate	Counterparty	Description	Interest (£000)
29,100	Mar-15 Sep-15	0.73%	Lloyds	6 month fixed	107
33,000	Sep-15 Mar-16	0.90%	Santander	6 month fixed	149
40,000	Mar-16 Mar-20	2.02%	Lloyds	4 year Fixed	3,232
700	Mar-16 Mar-20	2.02%	Santander	4 year Fixed	57
4,800	Sep-16 Sep-19	1.12%	Santander	3 year Fixed	161
3,600	Mar-17 Mar-20	1.26%	Santander	3 year Fixed	136
1,300	Sep-17 Sep-19	1.35%	Santander	2 year Fixed	35
2,800	Sep-17 Sep-19	0.78%	Scotia Bank	2 year Fixed	44
4,000	Mar-18 Mar-20	1.00%	Scotia Bank	2 year Fixed	80
3,000	Sep-18 Mar-19	0.85%	Scotia Bank	6 month Fixed	13

4.7. Progress with CP2 key initiatives

In Table 33 of our CP2 5YAMS we summarised the key asset management changes and initiatives to be undertaken by NR(HS) for CP1, CP2 and beyond; the purpose of these initiatives was to mature NR(HS)'s approach to asset management. We report on progress against these each year in our AMAS. All CP1 promises have been completed. The current RAG status of the CP2 initiatives is set out in Table 29; the majority of these initiatives are complete or on track for completion by the end of CP2. The outputs of these initiatives have informed the development of NR(HS)'s Specific Asset Strategies.

Table 29: Key initiatives for CP2

Assets	CP2 key initiatives	
Track	Introduce IRIS320 high speed measurement train at full line speed	A
	Establish "strategic route sections" across HS1 to allow more targeted work – for example grinding	G
	Plain line pattern recognition software to reduce resource and improve information	A
	Improved rail defect management approaches	G
	Install under-sleeper pads in two locations to rectify track geometry faults and optimise ballast life	G
SC&C	Review all remaining inspection frequencies	G
	Investigate opportunities to roll out remote condition monitoring across all asset classes	A
	Incorporate a more risk-based approach within the modelling framework, including improved information and models around the impact of varying inspection/ maintenance frequencies	G
E&P	Review inspection frequencies to target more critical assets (i.e. where there is higher wear / more critical location)	A
	Passenger train mounted CCTV to help with OCS inspection	A

Assets	CP2 key initiatives	
	Review of OCS inspection methodology in conjunction with SNCF	G
	Review proposals to undertake isolations more quickly without any change in safety	G
	Life extension of contact wire from 15-20 years to 25-30 years based on observed minimal degradation	G
Civils	Risk-based inspection of lineside buildings to challenge standards. Existing standards are based on NRIL so designed for older buildings. Reinforce with improved condition monitoring	A
	Collect more detailed component information to enable bottom up whole life cost modelling	A
	Verify move to decreased inspection frequencies for earthworks	G

Selected initiatives marked as Amber are discussed below:

- Passenger train mounted CCTV to help with OCS inspection (originally Pantograph mounted CCTV to help with OCS inspection)

NR(HS) is proposing the instrumentation of Eurostar trains including with cameras. This would achieve the OCS inspection requirements and supersede the pantograph-mounted CCTV initiative. The instrumentation of Eurostar trains is likely to be in CP3.

- Introduce IRIS320 high speed measurement train at full line speed

Following a feasibility study which highlighted the difficulty of getting the French measurement train through the Channel Tunnel, we concluded that this was not the best solution. We are currently exploring alternative technologies.

- Plain line pattern recognition software to reduce resource and improve information

The tool will not be used in the same way as on the NRIL network; the appropriate use on HS1 is being investigated. HS1-specific algorithms need to be developed using HS1 fault data but there are too few faults for the tool to learn. We are looking to complete in CP2 but this initiative may continue into CP3.

4.8. Upgrades

We led the efficient delivery of the Specified Upgrade of GSM-R in CP2 and we are planning the 4G upgrade project to improve mobile network coverage; these are discussed below. There have been no other Specified Upgrades or upgrades in CP2 to date and none are anticipated for the remainder of CP2.

4.8.1. GSM-R

The only Specified Upgrade in CP2 is the upgrade of the GSM-R system. GSM-R is an international wireless communications standard for railway communication and is the train radio system mandated by European TSIs aimed at achieving interoperability.

4.8.1.1. GSM-R upgrade scope

The HS1 railway infrastructure assets include 30 GSM-R base stations connected to the GB GSM-R radio system operated by NRIL. Before the upgrade, GSM-R on HS1 was used only as a maintenance radio system and Cab Secure Radio (CSR) was used for driver to signaller communications. This project upgraded GSM-R to signaller/driver communications and implemented mobile roaming for international trains as well as upgrading the base stations to the latest model. This aligned HS1 with other networks (NRIL, Getlink, SNCF Réseau and Infrabel) where GSM-R was already in use or being rolled out.

The GSM-R upgrade project included two NRIL work packages and upgrade of the base stations by KapschCarrierCom (KCC) and NR(HS).

- Work Package 1 related to UK operations including radio network optimisation, configuration of the GSM-R network, lineside signage, updates to operational rules, training, testing, commissioning and approvals;

- Work Package 1a related to provision of a simulator and relocation of a fixed terminal at Temple Mills Depot;
- Work Package 2 related to the international connectivity of HS1's GSM-R with the French GSM-R network, including updates to operational rules, testing, commissioning and approvals;
- Base station upgrade work included approvals, delivery and installation, configuration, commissioning and testing.

4.8.1.2. Efficient costs

Work Package 1 and Work Package 2 were undertaken by NRIL. NRIL is the sole licence holder of GSM-R in the UK and was the most appropriate solution. While we could have used the French alternative, this would have been very high risk given interfaces with the NRIL network. The base station work was undertaken by KCC and NR(HS). An efficient cost base was achieved via the following activities:

- Negotiations between NRIL and HS1 Ltd resulted in a substantial reduction on the initial price;
- Discussions between DfT, ORR, NRIL and HS1 Ltd, facilitated by the ORR and DfT, to reach a mutually acceptable negotiated position between NRIL and HS1 Ltd;
- Detailed work with KCC and NR(HS) to identify the most efficient way of procuring, delivering and installing the base stations;
- Consideration of other partners and options for implementation; and
- Engagement of a GSM-R expert for an independent assessment of work packages and costs.

The estimated capital cost was £7.3m, as shown in Table 30.

Table 30: GSM-R cost summary (£ million)

Category	£m	Cost allocation
NRIL contract		
Work Package 1	0.4	Common
Work Package 2	3.1	Common £0.5m International £2.6m
HS1 costs	0.9	Common
Risk provision 15%	0.7	Common
Subtotal	**5.1**	
Base stations		
Kapsch equipment supply	1.0	Common
NR(HS) implementation	1.0	Common
Risk provision 10%	0.2	Common
Subtotal	**2.2**	
Total	**7.3**	

4.8.1.3. Additional IRC

Investment in a Specified Upgrade is paid for through an Additional IRC chargeable to train operators which is intended to recover the efficient investment cost. The Concession Agreement does not define how the Additional IRC should be calculated; the assumptions we made to calculate the Additional IRC were sourced from and consistent with our PR14 renewals proposals and annuity methodology. Costs were allocated between train operators as follows:

- Work Package 2 costs were allocated to international operators with the exception of £0.5m allocated to common costs;
- All other costs were considered to be common costs and were split between train operators on the basis of minutes on HS1.

On the basis of these assumptions and our cost estimate, the Additional IRC is £0.85 per minute for EIL and £0.31 per for LSER, applicable from the start of CP2 to the end of CP3 (10 years).

Our upgrade proposals included reopener provisions to deal with changes in scope, cost outturn and new operators.

We expect that all remaining actions will be completed by the end of February 2019 which will allow us to close out the project. Outturn costs are expected to be lower than forecast and this saving will be passed on to train operators. An update will be provided in our 5YAMS submission in May 2019.

4.8.1.4. Funding application

For each Specified Upgrade, ORR approval is needed for the efficient cost and the Additional IRC to be charged to train operators. The Concession Agreement sets out the information to be provided to ORR (the Implementation Information) and the process for ORR approval.

We submitted a funding application to ORR for the GSM-R upgrade in January 2015 which reflected the scope, costs, Additional IRC and reopener proposals set out above. ORR approved the funding application in February 2015 which allowed the formal release of the Network Change Notice to train operators.

4.8.1.5. Implementation

The Specified Upgrade was implemented in accordance with the Implementation Information.

Work Package 1 went live in December 2015, allowing domestic services to operate with upgraded GSM-R. Work Package 2 went live in August 2016, allowing international services to operate with upgraded GSM-R. The base station upgrade works were delivered after the delivery and approval of Work Package 1, to coordinate with the final approvals to the 2012 TSI programme.

The following documents were updated to reflect the GSM-R upgrade and new charges:

- Regulatory document updates: Passenger Access Terms (Section 7 Track Charges), Track Access Agreements (Charging Schedules), Network Statement (GSM-R operations and change in charging structure); and
- Operational document updates: Rule book, operational notices, O&M manuals, Sectional Appendices.

4.8.2. 4G network

Currently there is no public mobile coverage in the tunnel sections of the HS1 route; in the open sections of the route, coverage is via the general macro layer mobile signal available from mobile network operators (MNOs). Wi-fi systems are installed at St Pancras International and Stratford International stations.

To improve customer experience, we are installing a 4G system in the HS1 tunnels and at St Pancras International and Stratford International stations. The objective is to create a system that interfaces with the existing macro layer signal coverage to provide 4G connectivity throughout the HS1 route and stations. The system will be designed to be direct to handset but with secondary connectivity to onboard train wi-fi systems.

We have chosen EE to lead the design, implementation and ongoing management of the 4G system. EE accounts for the highest percentage of mobile device services within the UK and has been selected by the Home Office to deploy the Emergency Services Network (ESN) services for a geographical area of the UK that incorporates the HS1 route. The system is designed to be multi-operator capable. EE will fund the installation and other MNOs can pay a share of the costs to join the scheme.

The 4G system is planned to be installed in the HS1 tunnels by the end of 2019 and the stations in Spring 2020. The system will go live in early 2020.

In summary, we have led our supply chain as a strategic partner and intelligent client in CP2, delivering value through:

- Excellent safety and operational performance with improved infrastructure resilience;
- Improving asset management capability to ensure long term sustainability;
- Maximising value from subcontracts, for example, improved resilience, information sharing and asset management commitments in the revised UKPNS contract;
- Minimising pass through costs through efficient procurement and securing the best possible outcome from the 2017 rates revaluation;
- Efficient spend on CP2 renewals with improved renewals delivery capability and project governance;
- Implementing our escrow investment strategy to maximise returns; and
- Leading the efficient delivery of the Specified Upgrade of GSM-R.

Part 2: CP3 Proposals

5. Overview

In CP3 we will continue to manage the HS1 asset in a sustainable way to ensure we achieve the asset stewardship and handback requirements in our Concession Agreement and maintain high asset performance and availability at the most efficient cost. We will continue to act as a strategic partner and intelligent client, leading a sustainable, efficient and high-performing supply chain.

During CP2 we led a programme of joint working with NR(HS) to develop our asset management capability to enable us to make more informed decisions about asset interventions and to create the foundations for continuous improvement in the way that work is planned and delivered. We have driven a transformation in NR(HS) and strengthened our own capability; improved our asset management system, aligning it with ISO 55000 best practice; and improved our asset knowledge to enable better assessment of asset risks and more informed decisions on asset intervention strategies. We will continue to build on our CP2 achievements in CP3.

We have improved our ability to plan and deliver renewals and introduced project processes and a project governance framework that have delivered major benefits in terms of scoping and costing of renewal projects. In CP3, we will build on the systems put in place during CP2, continuing to improve our capability, and that of our supply chain, and introduce enhanced project governance arrangements.

In developing the O&M costs for CP3, our focus has been on what we need to do to deliver our asset management obligations, continue to operate a safe, sustainable and high-performing railway and manage our concession at the most efficient cost. We have built CP3 costs bottom up, based on our improved understanding of the HS1 asset since our last periodic review, and building in target efficiencies. Costs have been subject to a robust process of internal review and challenge. Our benchmarking analysis has developed significantly since PR14 and throughout the PR19 process we have challenged NR(HS) to deliver improved cost efficiency. Between CP2 exit and CP3 exit O&M costs are forecast to reduce by 3%.

We will continue to focus on improving O&M cost efficiency in CP3, for example through efficient procurement, identifying opportunities to improve the value of our subcontracts and taking forward activities identified in our Energy Review to minimise energy costs for our customers.

As the asset ages and renewals volumes increase, our challenge is to transform into a renewals delivery organisation. In preparation for this step change in renewals, we have commenced detailed upfront planning for the renewal of the HS1 route infrastructure for the next 40 years. The deliverability study commissioned from Bechtel confirmed that 40-year renewals volumes are deliverable with limited disruptive access and developed a high level costed plan for CP4 to CP10. By strategically planning this work ahead of time, we are in a unique position to challenge the industry to move high speed line renewals forward and make a real and lasting difference.

The deliverability study provides a strong engineering baseline for long term renewals costs, based on aggressive productivity and efficiency assumptions. However, long term renewal costs have increased significantly compared with the PR14 estimates, largely as a result of the inclusion of indirect costs and ERTMS. The best estimate of total renewals costs for CP3 to CP10 is £1,524 million including direct costs, fees and contingency.

We use a renewals annuity arrangement to smooth the funding of renewals spend over time. The increase in renewals costs has driven a significant increase in the renewals annuity to £37.9 million per annum, compared with the renewals annuity of £18.4 million per annum calculated in PR14 (this was phased in over time with a reduced amount of £12.5 million payable in CP2). Our approach to calculating the renewals annuity reflects the requirements of our Concession Agreement but we recognise the affordability implications for train operators. We have modelled a number of alternative options for calculating the renewals annuity and will continue to engage with stakeholders on annuity options during the consultation period.

The increase in renewals costs discussed above has driven a significant increase in OMRC. OMRC for passenger operators is shown in Table 31.

Table 31: CP2 and CP3 OMRC (£ per train minute, Feb 2018 prices)

	International passenger services	Domestic passenger services
CP2 OMRC	£54.07	£40.79
CP2 with full £18.4m annuity	£58.36	£43.44
Proposed CP3 OMRC	£78.95	£49.91

For freight operators on HS1, the proposed charge is £13.43 per train-km, a 78% increase compared with the current charge of £7.54 per train-km.

For freight operators accessing Ripple Lane from the NRIL network, the proposed charge is £54.49 per train compared with the current charge of £55.65 per train.

The remainder of this Part 2 is structured as follows.

Section 6 sets out the key **outputs** we plan to deliver in CP3, based on consultation with our stakeholders.

Section 7 discusses the **key assumptions** we have made including traffic forecasts, financial assumptions and other assumptions underpinning our asset management plans.

Section 8 sets out our **safety and security** plans for CP3. Our approach demonstrates a clear division between our responsibilities for our own organisation and the assurance process for the management of our industry partners.

Section 9 describes our **asset management approach** and how this has informed our plans for CP3 and beyond. It describes how we have delivered on our commitment to improve our asset management maturity, and that of our supply chain, building capability to ensure we meet our long term asset stewardship obligations. It also discusses how we will build **innovation** into our plans to deliver improvements in efficiency, safety and performance.

Section 10 outlines our approach to **operations and maintenance** in CP3. It summarises the NR(HS) Operations Strategy and Possessions Strategy, the maintenance approach set out for each asset discipline in the SASs and NR(HS)'s approach to developing maintenance costs.

Section 11 outlines our approach to identifying efficient **O&M costs** and the benchmarking work undertaken as part of PR19. It sets out our forecast of O&M expenditure for CP3, separately identifying the NR(HS) Annual Fixed Price and other O&M costs.

Section 12 sets out our approach to **renewals**. We discuss the CP3 renewals workbank and costs, NR(HS)'s plans for the delivery of renewal projects in CP3 and our proposals for improving renewals governance. This section also summarises the long term renewals deliverability study undertaken by Bechtel and the resulting costs. We discuss the methodology we have used to calculate the renewals annuity and the resulting level of annuity we propose for CP3.

Section 13 discusses **access charges** for CP3. It describes how our access charging model allocates costs between operators to calculate per minute and per train-km charges for passenger and freight operators respectively and sets out our proposed charges for CP3.

Section 14 discusses **upgrades** planned during CP3.

6. Our outputs for CP3

Unlike other regulated industries we do not have binding regulatory output targets with penalties for failure. For CP3, we have developed a set of outputs based on our consultation with stakeholders. We have used these outputs to inform the development of our plans for CP3 and beyond.

The purpose of HS1 is to deliver for our customers, and in turn for their customers – the travelling public and freight forwarders. HS1 is a relatively new and strategically important piece of infrastructure used by domestic high-speed commuters, connecting international passengers to France, Belgium and further afield, and delivering gauge and speed advantages for freight customers. Our strategy has been to deliver a world-class high-speed railway and to engage with our stakeholders with open, transparent and forward-looking behaviours.

The nature of our railway is such that we engage closely with our customers on a day-to-day basis, and we are always open to reviewing and improving the service that we provide. PR19 provides an opportunity to test more formally what customers want. Dialogue with our key stakeholders is critical to our purpose and to the success of the PR19 process itself.

We commenced this dialogue with informal 1:1 interviews with all stakeholders in April and May 2017 to discuss their aspirations for PR19; key messages from these meetings were presented at the stakeholder workshop in June 2017. We used these stakeholder aspirations to develop a set of outputs for CP3 which are listed below. These outputs were presented in the October 2017 stakeholder workshop.

Outputs for CP3
Maintain good condition of the railway to preserve long-term sustainability
Continued improvement in safety culture to deliver our vision of everyone home safe every day
Continued excellent performance, less than 10 seconds per train from infrastructure delay
Improved resilience – reduce the impact of big incidents within the risk appetite of operators
Improve railway availability in a predictable way to assist freight
Understand and work to best deal with whole life cost through smart asset management and engineering solutions
Lower costs within CP3 without compromising long-term sustainability
Reduce carbon emissions
Fully understand the operational criticality of stations assets, and devise asset management plans to deliver this

Consistent with our ambition to be a strategic partner and intelligent client, we will ensure appropriate management focus on delivering against these outputs. This will include improving the Line of Sight process we began with operators in CP2, supported by improved operational metrics and a heightened focus on strategic challenges facing HS1 Ltd and operators. We will work with operators to agree a new approach for CP3, using the last year of CP2 to test and embed the changes.

7. Key assumptions

7.1. Traffic forecasts

This section discusses how passenger numbers and train paths have grown over time and our forecasts of future traffic growth:

- The forecast of CP3 train paths is used to apportion CP3 operating, maintenance and renewal costs between train operators; and
- The long term traffic forecast is a driver of asset intervention (maintenance, renewals and upgrades) over the longer term.

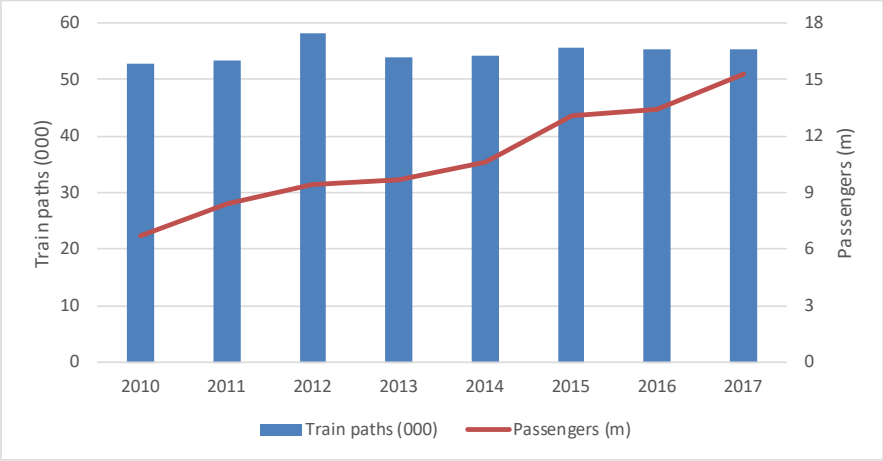
We are actively marketing the HS1 route with the aim of encouraging traffic growth to make more efficient use of capacity and to deliver increased socio-economic and environmental benefits. Increased traffic would benefit existing train operators by reducing charges as fixed costs would be apportioned across more train services.

We are working to remove barriers to entry for new operators (for example, on border controls), collaborating with other infrastructure managers to align the offer to train operators (as described in Section 2.2.5) and we have engaged with train manufacturers to understand their offer. On Brexit, we have been actively working with government to ensure that the risks are understood and mitigated as far as possible and to ensure the regulatory regime is as favourable as possible to new entrants (see Section 7.2.1).

7.1.1. Domestic passenger services on HS1

Domestic passenger services on HS1 are operated by LSER under a franchise let by DfT. The Southeastern High Speed (SEHS) service is predominantly a London commuter operation. Trains connect with the classic network to serve destinations in north Kent (via Ebbsfleet International) and east Kent (via Ashford International).

Figure 12: Domestic train paths and passengers



Note: 2012 figures include London 2012 Olympics

SEHS services commenced in 2009. Passenger demand growth has been strong, with domestic growth at some stations of 7% to 12% per annum. SEHS services dominate market share between London and central and south Kent, owing to significant journey time savings compared to services on the classic network. Passenger demand is heavily focused on peak hours and significant crowding is observed on some peak services.

The number of train paths increased through CP1 as the high speed service was established, and the split between Ashford and Ebbsfleet services was refined. Train paths have remained relatively flat during CP2; in 2017/18 there were 55,348 domestic train paths on HS1.

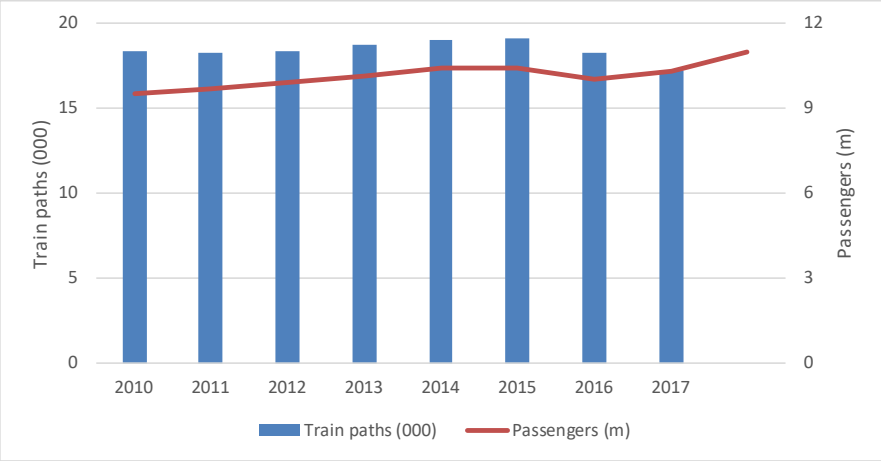
26 of the 29 Class 395 units used to operate the SEHS service are in service in the weekday peaks, operating as a mixture of 6-car and 12-car trains. Any train lengthening or additional services in the peak would require additional units.

The new South Eastern franchise is planned to start in 2019 with an initial term of eight years and the option for SoS to extend by up to 13 periods.

7.1.2. International passenger services on HS1

International passenger services on HS1 are operated by EIL. Eurostar services commenced in 1994 (from London Waterloo). Eurostar services link St Pancras International, Ebbsfleet International and Ashford International with Paris, Brussels, Amsterdam, Lille and Calais. There is also a daily service to Disneyland Paris and seasonal services to Lyon/Provence and the Alps.

Figure 13: International train paths and passengers



Eurostar passengers account for 80% of the combined air and rail market between London and Paris/Brussels and 86% of the city-to-city market. Historically, Eurostar passenger growth has been strong - 2.7% per annum between 2004 and 2016 - with rapid recoveries after one-off disruptive events. Passenger demand reached 10.4 million by 2014. Passenger numbers were static in 2015 and fell to 10.0 million in 2016 as a result of the terrorist attacks in Paris and Brussels in November 2015 and March 2016 respectively. By 2018 passenger numbers had grown to 11.0 million.

In November 2015, EIL commenced introduction of its new Class 374 trains with 19% more seating capacity than the Class 373 rolling stock. The combination of stagnant passenger growth and the introduction of higher capacity trains led to a decline in the number of train paths. In 2017/18 there were 17,203 international train paths on HS1.

In April 2018, EIL launched a direct London-Amsterdam service, operated by Class 374s, with journey times of 3hr01 to Rotterdam and 3hr41 to Amsterdam. This is an extension of existing Brussels services and therefore generates no additional train paths on HS1. EIL has announced plans to increase the number of services to Amsterdam; our forecasts assume that these are also extensions of Brussels services.

7.1.3. Freight services

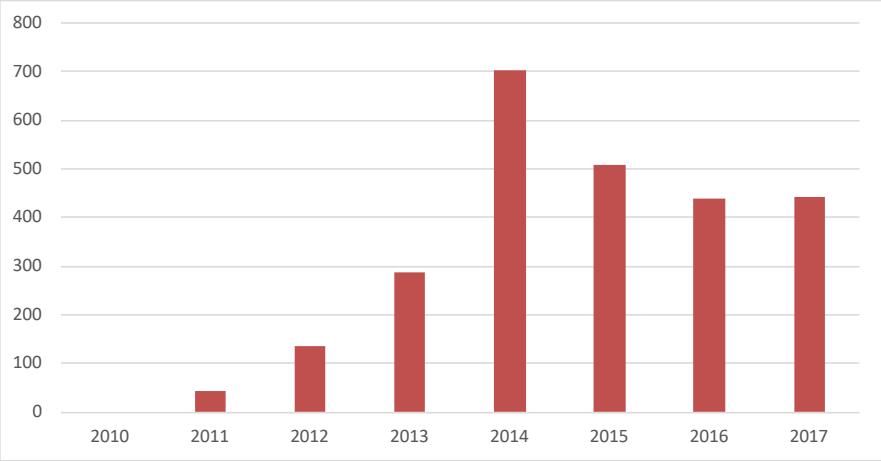
Only a small fraction of current freight flows between the UK and the Continent travel by rail. In 2017, only 2,012 freight trains operated through the Channel Tunnel. 444 (22%) of these trains used HS1.

Current freight services on HS1 are operated by DB Cargo which operates regular services between London and Spain (Valencia) and London and Poland (Wroclaw). All movements on HS1 are at night, operate at 120 km/h and use Class 92 locomotives.

Freight services commenced on HS1 in 2011/12 with operation by DB Cargo between the UK and Poland. A new regular DB Cargo service to Spain in January 2014 increased freight paths to around 40-60 per month with a further increase to around 60-80 paths per month following introduction of a regular GB Railfreight (GBRf) service in November 2014.

In the summer of 2015, the migrant crisis had a direct impact on cross-channel freight. As a result, there was a period of severe disruption to freight services for a number of weeks. This resulted in a significant reduction in cross-channel freight as operators found alternative routes via the North Sea or shifting to road transportation. GBRf no longer operates regular freight services on HS1.

Figure 14: Freight train paths



7.1.4. CP3 train path forecasts

We have open engagement with train operators to understand short-term movements and this forms the basis of our assumptions for CP3. We are assuming that train paths during CP3 will remain at the current level. We expect passenger growth on both domestic and international services over CP3 but this is not expected to translate into train path growth during CP3. As set out above, no additional units are available to operate extra domestic peak services and international passenger growth is expected to be accommodated by the higher capacity Class 374 fleet.

Our CP3 train path forecasts are set out in Table 32. We propose to base the OMRC apportionment calculations on these forecasts. Any significant change from these forecasts, including the introduction of a new operator, would trigger the reopener provisions in the HS1 Passenger Access Terms or HS1 Freight Access Terms to adjust the apportionment of operating, maintenance and renewal costs between train operators.

Table 32: CP3 train path forecast

	CP3 train paths per annum
Domestic passenger	
Ashford	28,800
Springhead Junction	26,300
Ebbsfleet up	0
Ebbsfleet down	300
Total domestic passenger	**55,400**
Total international passenger	**17,700**
Total freight	**454**

7.1.5. Train path forecasts beyond CP3

We recognise the importance of long-term demand forecasts and engaged independent experts to provide analysis of the underlying drivers and the likely range of future demand. The analysis included a sophisticated approach to how forecasts of passenger demand are likely to translate into demand for domestic and international train paths on HS1.

The key points from the domestic traffic forecast are:

- The Base Case forecasts capacity-constrained domestic passenger demand growth of 3.5% per annum between 2015 and 2040. Total capacity-constrained passenger demand growth is 135%.
- Most peak demand growth can be accommodated using longer trains (the charging structure on HS1 favours doubling 6-car trains before adding new services), but four extra paths each peak will be required before the end of the concession to address trains which cannot be lengthened further.
- Off peak service enhancements include increased service frequency to Canterbury West via Ashford and additional weekend paths between St Pancras and Ebbsfleet to cater for demand to Swanscombe Theme Park (a major development north of Ebbsfleet)

- The Base Case forecasts a total of 9,200 additional domestic train paths per annum by the end of the HS1 concession.

The key points from the international traffic forecast are:

- Forecast international passenger growth is greatest on the Brussels axis (2.3% p.a.) with train loadings positively affected by the extension of some Brussels services to Amsterdam.
- Passenger growth on Paris services is lower at 1.9% per annum, reflecting the slower macroeconomic growth expected on this axis.
- The forecast increase in international train paths reflects organic growth in existing markets, new destinations and competitive entry by new operators.
- The Base Case forecasts an increase in train paths to approximately 32,200 per annum by 2040 from a combination of additional Eurostar services and a new entrant.

Based on the operational characteristics of HS1 and the economic/political outlook for cross-channel rail freight, the forecast was a modest increase to 740 freight paths per annum by 2040 from an increase in DB Cargo paths, a return of GBRf or a new freight operator.

The long term traffic forecasts we have used to inform our asset intervention workstreams are set out in Table 33.

Table 33: 2040 train path forecast

	2017/18	2040	Increase
Domestic passenger (000)	55.3	64.5	17%
International passenger (000)	17.2	32.2	87%
Freight	444	740	67%

We have shared these forecasts with NR(HS) who have taken them into account in preparing their long-term plans, and continue to work on understanding the relationship between train path demand and asset degradation over time.

Modelling of operational flows of the combined train path forecasts to 2040 on HS1, Channel Tunnel, French and Belgian track and station platforming confirmed that there is sufficient capacity along the whole route to operate the forecast level of train paths.

7.2. Financial assumptions

7.2.1. Impact of Brexit

Our forecasts assume no impact on the cost base from Brexit.

Brexit risk and mitigation

We have sought to understand and proactively mitigate the risks presented by Britain leaving the European Union. The risks identified and how we have sought to mitigate them are set out below.

Supply chain

The unique nature of HS1 and its tracks being built largely to French TGV specifications and standards means that the HS1 route depends on the supply of goods and services from the EU. To mitigate the risk of interruption of the supply of key components we have worked actively with our suppliers to ensure they are prepared. We have been given written assurance that none will face supply interruption due to Brexit.

If Britain were to revert to trading with the EU and the rest of the world on WTO rules the imposition of new tariffs would inevitably lead to cost increases. In principle, while we would seek to use our purchasing power to bear down on any resulting cost pressures, eventual cost increases would ultimately be felt by operators through increased OMRC (subject to agreement by the ORR of an appropriate adjustment to the charges established in PR19). At the time of this periodic review, with the lack of certainty about the future trading relationship Britain will have with the EU and the rest of the world, we have deemed it inappropriate to speculatively incorporate in our OMR costs unquantifiable price changes that may potentially never materialise. Where prices do rise as a result of Brexit, we would seek to use the Interim Review mechanism in the Concession Agreement, where applicable, to reopen and reallocate charges to reflect the Brexit-related cost increase.

Licensing and certification

Our current and future customers depend on European legislation to licence their trains and their drivers and to certify their safety systems across borders. We have proactively worked with EIL to ensure governments are aware of the need for a continued licensing and safety regime that allows EIL to operate

internationally. To mitigate this risk, we have met with senior officials at DfT at the highest level to ensure they understand the impact and act to find a regime that ensures EIL can continue to operate.

Immigration control

We identified the risk that any change in immigration control due to Brexit is likely to have a negative impact on the flow of passengers through St Pancras, Gare du Nord and Brussels Midi. These stations have the unique juxtaposed border control system. To mitigate this risk, we have participated in the HM Border Readiness Group ensuring government is aware of the risks. To help ensure that St Pancras remains a safe and operational station we hosted a Brexit Readiness Workshop, bringing together NR(HS), the safety duty holder for St Pancras station, and stakeholders.

Safety standards divergence

The British government has indicated that it will no longer automatically harmonise the Technical Specifications for Interoperability (TSIs) between the UK and EU. Regulatory safety divergence creates an interoperability risk for our current and future international customers. To mitigate this risk, we and NR(HS) have adopted a policy of seeking to ensure the HS1 route adheres to EU TSIs wherever possible. We are working with the ORR, in its capacity as a safety authority, and DfT to ensure they understand this risk and create a post-Brexit safety regime that recognises the unique need for interoperability in a non-burdensome way.

New barriers to entry for competition

The HS1 route has approximately fifty percent unused capacity. There are currently only two passenger operators who bear OMR costs. We are pursuing a strategy to increase capacity usage (see Section 7.1), in part to help reduce OMR costs on existing operators. We have identified the risk that the current operators will continue to bear these costs alone in a post-Brexit regime where market entry is harder for a new operator.

In the absence of a bilateral treaty between Britain and France that guarantees fair and equal access to their respective networks, the default will be a dual licensing regime where operators must hold licensing and certification from the UK and France. New international operators will therefore be required to seek an operating licence from the 'Ministère de la Transition écologique et solidaire', the French equivalent of the DfT. This potentially exposes such applications to an institutional conflict in decision-making from the ministry's relationship with SNCF. Unlike Britain, where conflicts between DfT's interests and licensing are managed by access being adjudicated by the statutorily independent ORR, no such regime exists in France. European law guarantees non-discrimination of applications from operators from other member states. However, when Britain leaves the EU, and in the absence of a treaty that ensures equal treatment, applications from British operators have no legal guarantee of equal treatment. To mitigate this risk, we have actively sought to lobby government and ensure the Rail Delivery Group, the British industry's representative body, is aware of the risk.

7.2.2. Inflation rate

We have assumed an inflation rate of 2.75%.

This is based on the Bank of England forecast of 2.0% CPI and 75 to 100 bp between CPI and RPI; we have assumed the bottom of this range. This forecast is consistent with our internal forecasting principles.

7.2.3. Discount rate

For calculation of OMRC, we have used a real discount rate of 2.29% based on our nominal WACC of 5.1% and inflation of 2.75%.

7.2.4. Escrow account

We have assumed that 80% of funds are placed in Authorised Investments and 20% remain in the escrow account. We have assumed the following interest rates based on our experience in CP2 and analysis of likely future trends:

- For Authorised Investments 1.2248%
- For funds remaining in the escrow account 0.7%
- For negative escrow account balances 5.1%.

We have assumed an escrow account opening balance at the start of CP3 of £77.816 million (as in Section 4.6.4).

7.3. Asset management assumptions

The Annual Fixed Price in the NR(HS) 5YAMS is subject to the following assumptions:

- The CP3 forecast assumes that CP2 exit Annual Fixed Price will be achieved, with CP2 changes included in CP3 baseline costs;

- The forecast does not consider the impact of political changes (i.e. Brexit) or factors relating to fatigue management;
- The Annual Fixed Price is based on the maintenance volumes identified as an outcome of the CP3 Projects Cost Plan. Any changes to this plan as a result of renewals rejected by HS1 Ltd may result in amendments to the Annual Fixed Price;
- The Annual Fixed Price and Projects Portfolio for CP3 are based on the traffic forecast provided by HS1 Ltd. Should there be any change to traffic volumes, NR(HS) will seek to recover any additional and allowable costs arising from this;
- The Annual Fixed Price takes no account of any new train operating companies which may begin services during CP3 and assumes that any refranchising terms and conditions will not change objective outcomes and performance levels. Should a new train operator be introduced during CP3 or refranchising terms and conditions change with an impact on performance levels, NR(HS) will seek to recover any additional and allowable costs arising from this.
- The Annual Fixed Price takes no account of variations, other than the traffic forecasts provided by HS1 Ltd, in any of the following operational or rolling stock characteristics: (i) changes to types of rolling stock in use; (ii) design of existing rolling stock which could result in modification of their mechanical or electrical characteristics; (iii) annual tonnage or number of train axles running; (iv) timetable changes.

8. Safety and security

Safety is central to all that we do. Our safety performance is good but we strive for continuous improvement. Our goal is to achieve zero harm to all staff, industry partners, suppliers, contractors, passengers and members of the public through the effective management of health and safety on HS1. We all have a duty to take care of our own health and safety and that of others who may be affected by our actions at work.

Our strap line "*Safety is no accident – we all play our part*" was developed by HS1 staff in 2013 and endorsed by the senior management team.

8.1. HS1 Health & Safety Management System

In CP2, we updated the HS1 Health & Safety Management System (HSMS) to reflect our evolving role as intelligent client.

Figure 15: HS1 Health & Safety Management System

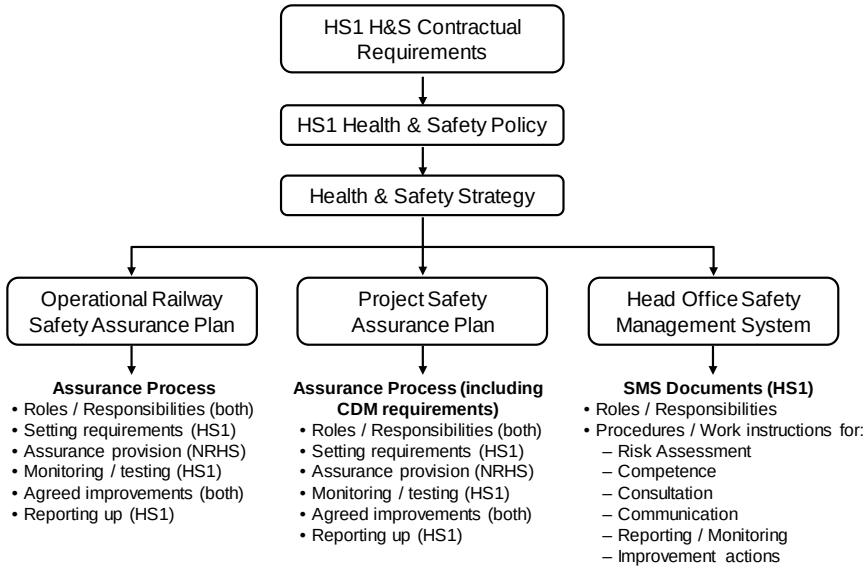


Figure 15 shows an outline of the structure of our HSMS. Our approach demonstrates a clear division between our responsibilities for our own organisation and the assurance process for the management of our industry partners.

The key documents in the HS1 HSMS are:

- **HS1 Health & Safety Policy:** this sets out how we will maintain and continually improve our HSMS. It references our systems for managing our industry partners, suppliers and contractors (including setting specific health and safety objectives and monitoring performance against these objectives) and supporting our industry partners in establishing good health and safety management by the provision of funding through the various commercial arrangements in place.
- The **Health & Safety Strategy** describes how the HSMS and high level processes are divided between direct management at our head office and assurance of the operational railway and associated project work.
- The **Operational Railway Safety Assurance Plan** establishes what is required of NR(HS), Mitie and UKPNS and sets out the processes by which we gain assurance that these organisations are meeting these requirements.
- The **Project Safety Assurance Plan** establishes what is required of our principal contractors and details how we gain assurance that these organisations are meeting both HS1 and regulatory requirements.
- The **HS1 Head Office Safety Management System** is focused on our own responsibilities and demonstrates a clear commitment to protect our own staff, contractors and visitors to our offices.

8.2. Delivery of operational safety on the HS1 route

NR(HS) holds the Safety Authorisation and has prime responsibility in law for the safe operation of HS1 railway infrastructure. We play a key role in assuring NR(HS)'s responsibilities are being executed properly. The

NR(HS) Safety Authorisation document (authorised by the ORR) describes its Safety Management System (SMS) and references the processes and procedures by which safety will be delivered. It describes how safety performance will be managed through control of safety risk to as low as is reasonably practicable (ALARP) using the SMS. The outputs from the SMS deliver the majority of measures to provide assurance of the effectiveness of the delivery of safety and security.

It is important to us that there should be continuous improvement in the safety performance of our system, so far as is reasonably practicable, and this is also one of the requirements of the European Railway Safety Directive. NR(HS) produces an Annual Safety Plan in which it sets out how it intends to improve safety. In accordance with our safety objectives, we review the Safety Plan to satisfy ourselves that sufficient provision has been made by NR(HS) to enable its delivery.

To support further safety improvement initiatives in CP2 and CP3, NR(HS) has developed a Safety Strategy in consultation with HS1 Ltd. The deliverables from this strategy will be embedded across the organisation and monitored through HS1 Ltd / NR(HS) contract review meetings.

NR(HS) is also responsible for maintaining the security of the railway, including St Pancras International, Stratford International and Ebbsfleet International stations, in conjunction with the BTP and security contractors. HS1 Ltd is responsible for security at Ashford International and discharges its responsibility through Mitie, with appropriate assurance in place.

HS1 Ltd maintains contact with the ORR, as the infrastructure safety regulator, though the formal regulatory relationship is with the Safety Authorisation holders (NR(HS) and Mitie). The ORR responsibilities are discharged through formal intervention plans, professional liaison, assurance activities and incident investigation with the two duty holders.

8.2.1. Audit and assurance of operational safety

Audit and assurance are important tools to measure performance against the specifications described in NR(HS)'s SMS.

The ROGS require NR(HS) to carry out internal audits of compliance to its Safety Authorisation. NR(HS)'s annual audit programme is consulted with HS1 Ltd at the start of each year. NR(HS) advises us of key audit findings in the Safety, Environment Assurance Report (SEAR), and when necessary these are reviewed with relevant HS1 Ltd personnel.

We use assurance to provide regular feedback on safety performance using the 4-weekly SEAR in which NR(HS) collates various outputs of the SMS. The SEAR is sent to us, as well as reviewed internally by the NR(HS) senior management team and at a Director level meeting between HS1 Ltd and NR(HS). Safety is also subject to regular HS1 Board reviews.

In CP2, we introduced quarterly HS1 Assurance Meetings with NR(HS) to provide additional longer term safety assurance. These meetings, which are independently chaired, review route engineering and station activities, event precursor information and learnings from any key incidents.

8.3. Safety strategy for CP3

Our strategy to deliver the safety vision and objectives during CP3 builds on progress made in CP2 and is focused on:

- Developing and embedding organisational understanding of risks and precursors to predict and reduce risk; and
- Building on and improving safety culture maturity.

This is a natural progression from the safety activities undertaken in CP2, with the aim of aligning NR(HS) with its objective of "moving towards an industry best safety culture and industry leading safety management system". This is important as the HS1 asset ages and moves from a relatively new railway to a railway requiring asset renewal, introducing different risks and different methods of working which NR(HS) must manage effectively.

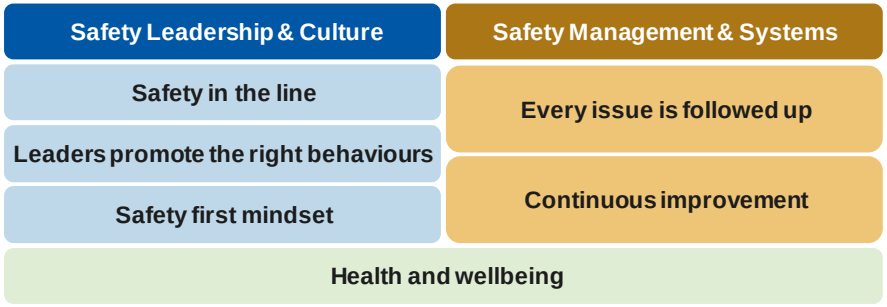
The adoption of the Risk Management Maturity Model (RM3) allows NR(HS) to define what excellence looks like in safety and risk management. It is an industry recognised tool, developed by the ORR, that details common criteria against which levels of current organisational

maturity can be measured. It assists in the identification of activities which, if undertaken, would provide a greater demonstration of cultural maturity.

The increase in the volume of renewals introduces a different risk profile and a change in the nature of occupational safety risk. The safety strategy for CP3 recognises this changing environment and the need to embed safety into the entire renewal lifecycle from planning, movement of materials, accessing the infrastructure through to completion of physical works. Embedding safety risk management across the organisation introduces an integrated approach to reducing safety risk.

NR(HS)'s CP3 Safety Strategy aims to deliver safe asset operations and provide a safe environment for passengers to deliver its vision of "Everyone Home Safe Every Day". The Safety Strategy sets out NR(HS)'s vision, objectives and delivery plan to improve safety performance on HS1. It is based on key performance improvement areas with improvement initiatives managed through two distinct work streams; Safety Leadership & Culture and Safety Management & Systems as illustrated in Figure 16.

Figure 16: NR(HS) CP3 Safety Strategy



The CP3 improvement plan proposes a distinct set of initiatives that have been developed and delivered with proven results within the wider NRIL route business to improve safety performance in CP3. The Safety Strategy will be delivered by the Safety Improvement Group to ensure robust governance and management of improvement initiatives.

The CP3 Safety Strategy takes into account:

- Changes to the Possession Strategy: to improve possession utilisation in CP3, NR(HS) will adopt multi-disciplined possessions which will be a significant change to the current ways of working for its staff. NR(HS) will ensure that staff are trained to understand the new risks that come with multi-disciplinary working.
- Increased volumes of maintenance and renewal in CP3, which will increase the amount of time staff spend on the railway. By using the Single View of the Plan (SVoP), NR(HS) will ensure that work plans are agreed early and staff are well briefed on the work packages they are going to carry out.
- Initiatives to improve asset management such as remote condition monitoring which will reduce the overall safety risk on the infrastructure. The NR(HS) safety team will continue to work with the asset disciplines to identify initiatives and innovative solutions that change the way NR(HS) operates and reduce the risk to staff and contractors.
- The Rail Plant Strategy for CP3. Rail plant is operated and maintained by third parties, NR(HS) safety teams must be provided with the assurance that contractors are competent and sufficiently briefed to operate and maintain the relevant rail plant.

NR(HS) intends to deliver a 10% reduction in LTIFR (compared with CP2 exit) by the end of CP3.

8.4. Measuring safety performance

Safety performance is measured through a number of activity and outcome indicators, tailored to providing not only assurance of specific activities but also assurance of overall safety performance. Precursor identification, introduced in CP2, provides a means for the proactive monitoring of elements which contribute to catastrophic safety risk, allowing for pre-emptive risk mitigation actions to control catastrophic risk. Hazardous events, and the corresponding precursors, will be continuously reviewed to make sure the change in the infrastructure risk profile in CP3 is appropriately reflected.

Outcome, or lagging, indicators will include, as a minimum, the present 20 indicators currently reported against by NR(HS), with this information provided on a periodic basis. Activity (leading) indicators include precursor

information and RM3 criteria to monitor and drive continuous improvement in safety and risk management. Information will be provided by NR(HS) through a number of channels, including periodic compliance dashboards, period safety performance reports and formal contract liaison arrangements.

Reporting performance against the Common Safety Indicators (CSIs) is the responsibility of NR(HS) as the Duty Holder under ROGs. Data is collated by RSSB, on behalf of the ORR, and is submitted on a national basis to the EU Agency for Railways.

8.5. Security strategy for CP3

Our security strategy is to provide infrastructure that can be operated safely and efficiently. Security risks to railway users and systems, and to those affected by the railway, are controlled to as low as is reasonably practicable taking into account the following factors:

- Likelihood of risk occurring;
- Costs and benefits;
- Funding and resources; and
- Views of relevant stakeholders.

At stations, security complies with mandatory standards (National Rail Security Programme (NRSP)) set by the DfT Maritime & Land Transport Security Division (MLTS). In addition, security within the Restricted Zones at stations and the Temple Mills International Depot complies with the requirements of the Channel Tunnel Security Order 1994.

We follow DfT guidance on security. Because the security threat varies over time, our security arrangements are always subject to review.

Security and policing is delivered by a combination of:

- BTP: policing for line of route and stations;
- Land Sheriffs: line of route security; and
- Station staff: carry out the main duties under NRSP.

We recognise the need to integrate our security arrangements to deliver efficient and effective security. Our Security and Policing Strategy aims to deliver the right level of security and policing at an efficient cost by deploying the right blend of BTP and security resources. We review our overall strategy annually and agree an annual policing plan with BTPA.

We also work with NR(HS) to test our security arrangements through audits and desktop studies.

8.6. Cybersecurity

Cybersecurity encompasses all forms of networked, digital activities; it includes the content of and actions conducted through digital networks.

During CP2, HS1 Ltd and NR(HS) have taken steps to reduce the vulnerability of operational (signalling and communications) systems and information systems to cyberattack.

We are compliant with the Network and Information Systems Regulations 2018 (NISR) which came into force in May 2018 and place legal obligations on providers to protect critical services (including transport) by improving cybersecurity.

8.6.1. Information Systems

We have developed an HS1 Information Security Policy and supporting documentation and achieved Cyber Essentials certification for HS1. Cyber Essentials is a Government-backed scheme to help organisations protect themselves against common online threats. Requirements for information technology systems and software cover firewalls, secure configuration, user access control, malware protection and patch management. We are aiming to achieve Cyber Essentials Plus certification in 2019.

The NRIL Information Security Policy applies to NR(HS) information systems.

8.6.2. Operational systems

8.6.2.1. Risk Assessment

In 2016, Portcullis (a cybersecurity consultancy) was engaged to undertake a risk assessment of HS1. The risk assessment focused primarily on the Route Control Centre System (RCCS) and the Electrical Mechanical Management and Information System (EMMIS).

The review concluded that HS1 is not subject to an elevated threat level but faces a background level of threat similar to most other organisations with the main risks being malware attacks and employee actions.

The key risks identified and the actions taken by HS1 Ltd and NR(HS) to address them are summarised in the table below. The report also presented a list of secondary findings to be considered as part of an ongoing risk management strategy.

Risk	Actions to address
Physical connections e.g. the connection to Atos for timetable information	Firewalls have been upgraded
Employee actions e.g. not adhering to processes for the use of USB sticks	This risk is covered by the NR(HS) Cyber Security Policy (see below)
Out of date software	Technology refresh in CP2. NR(HS) has used a single recognised supplier for all machines and is moving to the latest version of Windows. There is a programme of technical refreshes in the future to keep up to date. Once the hardware and software refresh is complete, we will undertake some more intrusive testing with Cisco before the start of CP3.

8.6.2.2. NR(HS) Cyber Security Policy

NR(HS) has developed the NR(HS) Operational Technology Information Security Policy with Cicso Security Advisory Services. The policy defines the requirements for developing and maintaining a good level of information security management within the operational technology on HS1 infrastructure.

The policy covers, but is not limited to, mobile working policies, asset management policies, physical security policies and incident management policies. It is based on ISO 27001, the international standard for Information Security Management Systems, modified for use with operational systems, and takes into account DfT Rail's Rail Cyber Security Guidance to Industry.

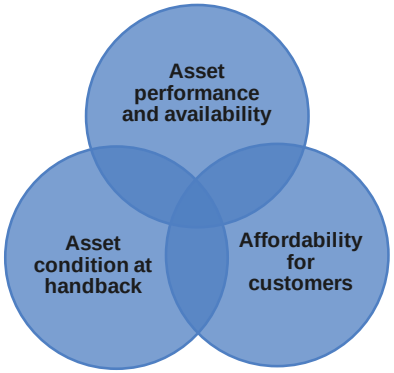
The policy details the objectives and controls that must be put in place to achieve and maintain good information security practice for the operational (command and control) systems on HS1 infrastructure. It applies to all NR(HS) employees working on an operational technology system, the operational technology systems themselves and the sites containing these systems. Operational systems include signalling systems, control systems, telecommunication systems and maintenance systems.

The policy will be reviewed every three years or in the event of an organisational change, legislative change or following any accident or incident in which it may have been a factor.

9. Asset management approach

9.1. Overview

Our asset management objective is to manage the HS1 infrastructure in a sustainable way to ensure we achieve the asset stewardship and handback requirements in our Concession Agreement and maintain high asset performance and availability while remaining affordable for train operators. Our approach to this challenge needs to evolve over time to respond to an ageing asset and a changing environment. Building the shared capability with our supply chain to meet this challenge is a long term, step by step project that goes beyond individual periodic reviews.



Schedule 10 of the Concession Agreement requires us to secure the operation, maintenance, renewal, replacement and upgrade of the HS1 railway infrastructure:

- In accordance with best practice;
- In a timely, efficient and economical manner; and
- Save in the case of the UKPNS assets, as if we were responsible for the stewardship of the HS1 railway infrastructure for 40 years following the date that any such activities are planned or carried out.

Schedule 10 of the Concession Agreement also requires us to:

- Establish, maintain, develop and implement an Asset Management Strategy in respect of operations, maintenance and renewal and, to the extent appropriate, Specified Upgrades and other upgrades;
- Maintain appropriate, accurate and up to date information about the assets comprising the HS1 railway infrastructure, including information as to their condition, capability and capacity; and
- Produce, update and keep updated an Asset Register at all times listing the assets comprising the HS1 railway infrastructure and their condition, including when they are due to be renewed or replaced.

In PR14 we made a commitment to **improve our asset management capability**. During CP2 we have led a programme of joint working with NR(HS) to develop our asset management capability to enable us to make more informed decisions about asset interventions and to create the foundations for continuous improvement in the way that work is planned and delivered. We have improved our Asset Management System, aligning it with ISO 55000, improved the collection and analysis of asset data and done further work in the areas of asset criticality and long-term renewals planning. This approach has enabled prediction of asset lives based on utilisation, condition and reliability information rather than solely manufacturers' recommendations. This is discussed in the remainder of this Section 9.

This section also discusses how we will build **innovation** into our plans to deliver improvements in efficiency, safety and performance.

HS1 is still a relatively new asset with limited renewals required. As the asset ages, the volume of renewals will start to increase. One of the key challenges for PR19 has been to improve our understanding of **renewals deliverability and cost** by starting detailed planning in preparation for CP4. This is discussed in Section 12.

9.2. Improving our asset management capability

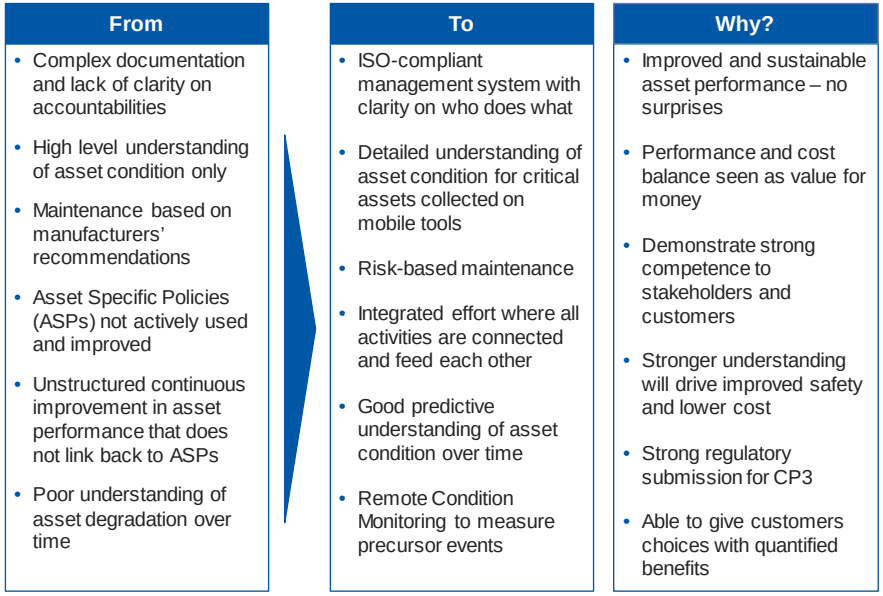
For our PR14 submission, the main focus was on reducing costs while maintaining excellent operational performance. While this was appropriate for this stage in the life of the HS1 assets, our PR14 submission

acknowledged the need to improve our asset management capability, and that of our supply chain, to ensure delivery of our long term asset stewardship requirements.

The 40-year renewals plan is key to delivering the Concession Agreement requirements of cost, performance and handback condition. We recognised the weaknesses in NR(HS)'s PR14 renewals planning and the underlying Asset Specific Policies (ASPs) and appointed Arup to review the PR14 renewals plan and recommend actions to improve the maturity and accuracy of our planning.

Figure 17 summarises the issues with the PR14 plans, shows how we have improved our asset management capability during CP2 and the benefits of these improvements.

Figure 17: Improving our asset management capability



We have achieved these improvements in asset management capability by improving our:

- Leadership and culture (see Section 9.3);
- Asset Management System (see Section 9.4);
- Asset condition data collection and analysis (see Section 9.5); and
- Specific Asset Strategies (SASs) (previously Asset Specific Policies) (see Section 9.6).

As a result of these improvements, NR(HS) obtained certification to ISO 55001:2014 (Asset Management) in March 2018. NR(HS) is the first function within the Network Rail group to have achieved ISO 55001 certification. UKPNS also made a commitment to obtaining ISO 55001 certification and has achieved certification.

In 2018, we commissioned AMCL, a leading specialist asset management consultancy, to undertake an independent assessment of HS1 Ltd and NR(HS) competency in asset management using the Asset Management Excellence Model (AMEM) framework. The AMEM framework is used by both ORR and NRIL. The analysis for the assessment is still being completed and the scores are yet to be moderated and refined. We have discussed the initial findings with NR(HS) and the ORR. Overall, it was acknowledged that within each individual organisation, asset management capability has improved. Other key findings and early recommendations from AMCL include:

- Cooperation and collaboration between HS1 Ltd and NR(HS) could be improved - the use of the Asset Intensive Business Architecture should be continued to improve the definition of roles and responsibilities;
- HS1 Ltd is advised to further develop assurance capability to ensure NR(HS) is delivering Asset Management in accordance with HS1 Ltd requirements;
- It was noted that HS1 Ltd's existing contractual framework is complex, with multiple stakeholders, and does not lend itself to delivery of maximum value from assets.
- The overall management of asset information should be improved with better asset information governance.

9.3. Leadership and culture

Early in CP2, we commenced high level engagement with the NRIL South East Route to discuss and agree how to drive improvements in NR(HS), particularly in terms of asset management and long term planning.

To start this process, we developed our Joint Vision 2020, "to deliver the world's leading high speed rail experience", and the underlying seven pillars of being world leading in continuous improvement, operational expertise, asset management, customer experience, value for money, reputation and safety.

We clearly defined the roles of HS1 Ltd and NR(HS) in delivering this vision and, in a series of Vision 2020 workshops, we provided direction to NR(HS) by clearly setting out our requirements and what NR(HS) needs to do to deliver them.

The 2020 Joint Vision drove a transformation in NR(HS). During CP2, NR(HS) has made a number of fundamental changes to the way it operates, restructuring its executive leadership team and introducing enhanced governance and assurance arrangements including an increase in the frequency of NR(HS) board meetings from six-monthly to quarterly.

NR(HS) is now demonstrating value from NRIL affiliation, with NRIL leading technical competence. The NRIL Group Director for Safety, Technology and Engineering now sits on the NR(HS) board and provides engineering leadership. Closer integration between the NRIL SE Route and NR(HS) has increased the focus on NR(HS); the NR(HS) leadership team has clear accountabilities to deliver outcomes. NR(HS) learns from and is supported by NRIL, for example, NRIL guidance on engineering and asset management issues and shared use of NRIL initiatives such as the trespass strategy.

We identified a capability gap in asset management in NR(HS) and worked with NR(HS) to develop its capability. In 2016, NR(HS) appointed its first Head of Asset Management to provide asset management leadership within NR(HS). A joint asset management training programme for HS1 Ltd and NR(HS) Professional Heads and senior maintenance delivery staff both developed asset management skills and built relationships between the two organisations. Over 25 staff achieved Institute of Asset Management certification. At the same time, NR(HS) appointed an Infrastructure Maintenance Engineer to lead the maintenance delivery team.

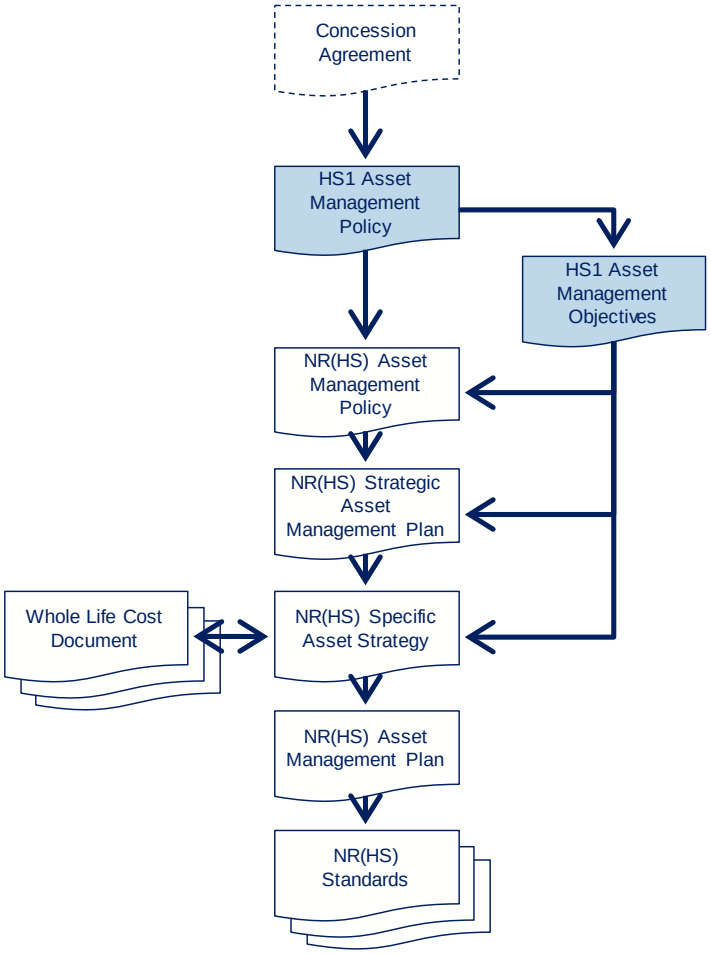
In 2018, NR(HS) appointed a new Head of High Speed Infrastructure, to provide engineering leadership, and NRIL led a review of NR(HS)'s engineering and delivery capability which identified areas where NR(HS) teams needed to be strengthened. One of the key changes resulting from this review was the creation of a Head of Asset Management role (reporting to the Head of Infrastructure), to provide engineering leadership for Professional Heads.

In parallel, we have strengthened our own capability. We recognised in CP1 that our resources were not sufficient to drive the right actions from the supply chain as well as performing an assurance role for day to day operations. Before the start of CP2, we appointed a Head of Asset Management with responsibility for asset management strategic vision and leading the supply chain, with the Head of Route Engineering being responsible for providing technical leadership to the organisation.

9.4. Asset Management System

During CP2, we have worked with NR(HS) to improve the HS1 Asset Management System, aligning it with ISO 55000. The components of the asset management system for the HS1 route are summarised in Figure 18 and discussed in the remainder of this section.

Figure 18: Route Asset Management System



We started by refreshing the HS1 Asset Management Policy and creating a new set of HS1 Asset Management Objectives (AMOs) which place customer requirements at the centre of our asset management.

The **HS1 Asset Management Policy** reflects our commitment to deliver sustainable operational performance and asset availability through world leading asset management. It confirms that we will:

- Deliver our shareholder requirements, comply with our contractual obligations, and endeavour to outperform stakeholder expectations;
- Engage with our suppliers to ensure AMOs are cascaded and the approach to asset management is consistent;
- Define asset management roles and accountabilities between HS1 Ltd and our supply chain;
- Continue to build a customer orientated culture with a structured approach to stakeholder engagement;
- Use the AMOs to anchor asset intervention decision-making to be consistent with customer expectations;
- Continually improve asset management capability in line with other leading industry practitioners, following the principles of ISO 55000 asset management best practice; and
- Measure asset management capability through a series of key performance indicators.

The **HS1 Asset Management Objectives**, shown in Table 34, help shape our decisions about how to operate, maintain and renew our assets, placing customer requirements at the centre of our asset management. The AMOs have been tested through the CP3 stakeholder engagement sessions and have received positive feedback.

Table 34: Asset Management Objectives

Business Attribute	Asset Management Objective	Weighting
Safety	We will manage our assets so that the risk of a safety incident is as low as reasonably practicable	25%
Punctuality	We will manage our assets so that passengers arrive on time	20%
Availability	We will manage our assets so that the availability of route and stations assets will meet the needs of passengers and the train operators	20%

Business Attribute	Asset Management Objective	Weighting
Cost	We will ensure that the total cost (maintenance and renewal) of managing our assets is demonstrably cost effective and provides good value by optimising cost risk and performance	15%
Passenger Satisfaction	We will manage our assets to maintain the asset related elements of the NRPS score at or above the current levels.	15%
Passenger Comfort	We will manage our route assets to give a ride quality that is rated good or outstanding by over 90% of our customers.	5%
Legal compliance	We will comply with all legislation, HS1 consents, Historic England conditions and environmental policy commitments	Mandatory

The HS1 Asset Management Policy and AMOs provide the framework within which NR(HS) has developed its Asset Management System Framework (AMSF) in line with ISO 55000 best practice. The AMSF sets out the framework and processes necessary to develop, document, implement and continually improve the approach to asset management.

The **NR(HS) Asset Management Policy** outlines the purpose and vision of NR(HS) in the delivery of operations and maintenance of the HS1 route infrastructure. It is aligned with the HS1 Asset Management Policy and demonstrates NR(HS)'s commitment to maturing in asset management capability and supporting HS1 Ltd in the achievement of the AMOs.

The **Strategic Asset Management Plan (SAMP)** is NR(HS)'s system-level document that describes how the NR(HS) Asset Management Policy will be delivered. The SAMP provides strategic guidance for development of the Specific Asset Strategies in terms of context, planning, enablers and delivery of asset management practices.

The **Specific Asset Strategies (SASs)** are discipline-specific strategy documents which cascade the SAMP across asset disciplines on the HS1 route infrastructure. The SASs set out the operation, maintenance and renewal interventions, based on our understanding of the asset portfolio, its condition, performance, risks and associated costs. The SASs adopt a whole life cost approach with the intention of managing risks to service, passengers and the public to deliver NR(HS)'s performance targets. Further detail on the SASs is provided in Section 9.6.

The development of the SASs was informed by **Whole Life Cost** modelling. During CP2, we improved our ability to calculate the whole life cost of different intervention strategies and NR(HS) adopted the HS1 Asset Decision Support Tool (ADST). This has given us a better understanding of trade-offs between different intervention strategies and enabled us to improve decision-making about maintenance v renewals, types of maintenance activity and the timing of interventions. The Whole Life Cost documents provide a record of the different whole life cost options considered, and support the economic justification of the strategies for operation, maintenance and renewal described in the SASs.

The **Asset Management Plan** is driven by the SASs. It sets out the schedules of work for the operation, maintenance and renewal of the assets. NR(HS) is developing a Single View of the Plan (SVoP), which will set out the projected work volumes for 10-year and 40-year time horizons. The SVoP will combine asset management plans for individual disciplines with resource and project requirements. This industry-leading approach will enable optimisation of possessions and resources and create a live planning and scheduling tool. The SVoP is currently under development and will be implemented and embedded into working practices in CP3.

9.5. Asset data collection and analysis

Good asset information is required to support asset management decision making. Since PR14 we have worked with NR(HS) to improve the asset information we hold - both the data itself and the information systems.

9.5.1. Asset criticality

Asset criticality is a measure of how important an asset group or system is in delivering the AMOs. Understanding asset criticality enables improved decision making and management of risk. It enables us to anticipate the

consequences and/or impact of the failure of an asset. This information can be used by NR(HS) to prioritise investment at a system level.

The asset hierarchy has been updated to reflect asset criticalities. In CP2 the approach was to focus on the most critical 80% of assets. For CP3, the renewals plan includes 100% of assets with more detail for more critical assets.

Each of the SASs describes the asset criticality for each asset group or system with intervention strategies based on these asset criticalities. Subject to acceptance of the impact on the AMOs, it may be possible to rationalise interventions for lower criticality assets.

9.5.2. Asset condition

By improving our understanding of asset condition, we can better assess asset risks to inform improved asset intervention strategies.

During CP2, NR(HS) has started to move from maintenance and renewal interventions based on fixed time intervals to reliability-centred maintenance informed by improved asset utilisation and condition data.

In 2015, HS1 Ltd and NR(HS) Professional Heads held a series of failure mode and effects analysis (FMEA) workshops to determine detectable precursors to asset failure. Following this we specified condition measures for the 36 most critical asset groups and systems.

The asset condition required for an asset group or system is defined with respect to its importance in delivering the AMOs. NR(HS) has prioritised improvements to asset information collection for higher criticality assets.

A common scoring system has been developed for all HS1 route assets and this is set out in Table 35.

Table 35: Asset condition scoring system

Score	Comment
1	The asset is in a condition commensurate with a new asset
2	The asset has been installed for more than five years and has a high level of reliability. Maintenance visits result in minor adjustments and occasional component replacements.
3	The asset is carrying out its stated function and is performing to an acceptable level of performance. In-service faults are infrequent and require occasional component replacement.
4	The asset is operating in a degraded mode or is suffering repeat faults and frequent component replacement. The system could be nearing the end of its supportable life or becoming obsolete with only remaining spares holding to maintain it in operation.
5	The asset cannot perform its given function and has been removed from operation. Renewal is required if it is to be re-introduced into operation.

The method of collecting asset condition information varies across the asset disciplines. Some asset groups use technologies such as remote condition monitoring, while others rely on manual inspection. By investing in technology and other maintenance improvement initiatives, NR(HS) intends to improve the quality of asset data and information collected. This will enable effective decision making and is a key enabler for adopting the risk-based approach in the future.

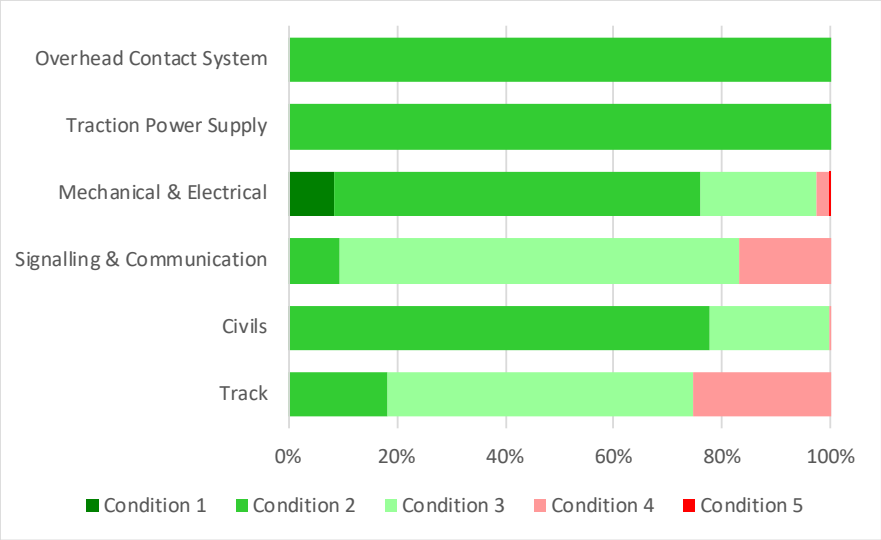
Asset condition information is held by NR(HS) in the Electronic Asset Management System (eAMS). In 2017, NR(HS) delivered a significant upgrade to eAMS improving the way that asset condition is recorded for critical assets. eAMS is now capable of allowing ‘dynamic data’ to be collected in real time for specific assets. NR(HS) has also made improvements in how historic condition information is stored in eAMS.

The following strategic objectives have been set for CP3:

- All assets will have contemporary condition information stored within eAMS, rated using the 1-5 scoring framework within CP3; and
- Remote condition monitoring feasibility studies for critical assets will be completed by the first year of CP3.

Asset condition across the HS1 route is commensurate with the age of the assets. Asset condition scores (not adjusted for asset volumes) are summarised in Figure 19.

Figure 19: Asset condition scores[1]



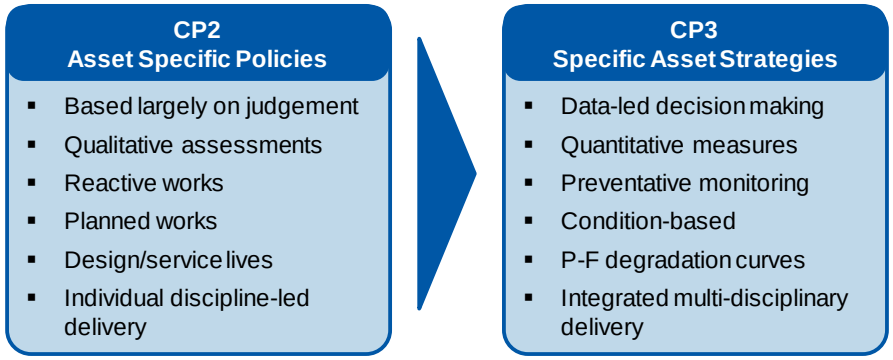
9.6. Specific Asset Strategies

The SASs set out the strategy for the management of the assets, based on our understanding of the asset portfolio, its condition, performance, risks and associated costs. There are six SASs for the HS1 route, one for each of the following asset groups:

- Track;
- Civils and lineside buildings;
- Signalling, Communication and Control Systems;
- Electrification & Plant: Overhead Contact System;
- Electrification & Plant: Traction Power Supply; and
- Electrification & Plant: Mechanical and Electrical.

In addition to the SASs there is a Rail Plant Strategy.

The SASs replace the Asset Specific Policies (ASPs) developed during CP1 and represent a significant improvement in asset management maturity. Whereas the ASPs were developed by external consultants on behalf of NR(HS), the SASs are written and owned by the NR(HS) Professional Heads who are also accountable for the NR(HS) Asset Management Plans and NR(HS) Standards which are driven by the SASs.



The benefits of the SASs compared with the ASPs are:

- Improved understanding of asset condition and degradation;

[1] The Track condition scores take into account the Eurotunnel track assets at the interface with HS1. These are covered by a separate agreement between HS1 Ltd and Getlink and are managed by NR(HS) on our behalf.

- Better use of data in developing asset intervention strategies;
- Cost, risk, performance and safety scenarios appraised;
- Options considered for our stakeholders;
- More holistic approach to asset management including applying AMOs;
- Increased clarity and focus on efficiency;
- Move from time-based recurring asset interventions to more efficient and targeted asset management; and
- Improved long term renewal strategy through improved end of life prediction.

The SAS for each asset type sets out:

- An overview of the operating context for the assets;
- A summary of NR(HS) performance obligations including the AMOs that underpin the strategy and the KPIs that align with them;
- A description of the asset portfolio, its current condition, any performance issues and expected asset life;
- Outcomes of the criticality analysis and the key risks posed by the assets to the service, passengers and the public;
- A summary of historic spend and intentions to improve the understanding of costs;
- The overarching strategy for the management of the assets covering both maintenance and renewal strategies and their key drivers;
- The proposed CP3 and 40-year renewal plans based on the overarching strategy and underpinned by knowledge of asset condition, performance issues and risks;
- Initiatives for improving/enhancing NR(HS) asset management capabilities for more data-driven decision making and for creating greater efficiencies; and
- Roles and responsibilities for the management of the assets.

The SASs are intended to be reviewed annually.

The SASs and the Rail Plant Strategy are Appendices to the NR(HS) 5YAMS which is provided as a supporting document.

9.6.1. Assurance of SASs

We commissioned Vertex Systems Engineering (Vertex-SE) to review NR(HS)'s understanding of asset condition and degradation and the processes and reasoning behind the proposals in the SAS for each asset group. The review covered the engineering elements of the proposals; costs were out of scope. It was initially based on April 2018 drafts of the SASs, interviews with NR(HS) Professional Heads, review of supporting documentation and site visits. During the process the SASs were updated and the August 2018 drafts were included in the Vertex-SE review.

Overall Vertex-SE has confidence that NR(HS) understands the condition and the degradation profiles of the assets and has made realistic plans. Some flexibility in the timing of remedial action and the ability to adjust the programme to deal with changes in reliability of certain assets types is required. Vertex-SE also noted that:

- The challenge is the transition from a new system to an ageing system with significant renewals requirements. The SASs contain a recognition of this challenge but the organisation of NR(HS) and the competencies of its staff will need to change to address it.
- A key issue not adequately dealt with in the SASs is the potential impact of the forecast increases in traffic on assets that degrade with use. This issue will be worked on in future iterations of the SASs.
- Obsolescence of mostly electronic and IT based assets is already causing difficulty in certain asset areas.
- NR(HS) uses a range of condition assessment techniques. A move to more use of technology such as remote monitoring and monitoring from train to infrastructure is an aspiration that should be supported.
- The review identified specific shortcomings in some of the SASs relating to testing and inspection.

Vertex-SE also provided detailed comments to NR(HS) on each of the August 2018 draft SASs. NR(HS) addressed some of these comments in the December 2018 versions of the SASs (which form part of the NR(HS) 5YAMS). The remainder are being taken forward by HS1 Ltd to be addressed in future iterations of the SASs.

9.7. Innovation

Our approach to managing our assets needs to evolve over time to respond to an ageing asset. We need to do things differently, innovating in terms of technology, processes and contracting strategy to deliver our long term renewals requirements efficiently whilst minimising disruption to the operational railway. In preparation for the step change in renewals that will be required from CP4 onwards, we commissioned Bechtel to undertake a deliverability study (see Section 12).

The deliverability study proposed volumes and productivity rates in line with international industry practice, which approximately triples the volumes traditionally achieved in the UK. The study focused on providing innovative, but achievable, solutions that will allow us to implement the renewal programme with minimal disruption to operational services. It verified that performing the works without disrupting the service is largely achievable and defined the challenge to the supply chain for the elements of work for which this is not currently achievable, posing four key questions as development challenges for the industry:

- What would it take to eliminate all post renewals temporary speed restrictions?
- How could works of any kind be carried out with the adjacent line open at normal speed?
- How could possession and isolation procedures be eliminated for renewals?
- How could all work be completed within the access constraints, within a maximum of six hours?

The deliverability study is the starting point for our work in CP3, setting out an integrated plan and building blocks for successful delivery. In CP3, we will continue to develop the elements of the detailed integrated plan in readiness for the execution of the works from 2025, engaging with stakeholders, shareholders and the supply chain. We will review the operating concept to ensure we have the right infrastructure to support renewals delivery, the right competencies and skills and the right plant. We will drive the rest of the industry to innovate to deliver ambitious productivity improvements and to address the key challenges identified in the deliverability study. We have made provisions to fund this work during CP3 in our renewals costs.

In CP3, we will also introduce new processes to ensure a structured approach to innovation in the short and medium term and help future-proof our projects. Innovation will be targeted to deliver improved outputs in terms of efficiency, safety and performance and to meet the evolving needs of the travelling public.

To help us drive this short and medium term innovation, we have set up a framework with Transport Systems Catapult (TSC), the UK's innovation centre for Intelligent Mobility. TSC is part of the wider Catapult programme – a government-supported network of elite technology and innovation centres – with a remit to transform the UK's capability for innovation within the transport sector and to help drive future economic growth. TSC brings together industry and academia to accelerate the development of new products and services.

TSC will support us in applying innovation on HS1 in a structured way to fill a defined need and deliver measurable benefits. The first task to be undertaken by TSC, early in 2019, is a horizon scanning study to identify new developments and assess their relevance to and potential impact on HS1 over the next 10 years. We intend to undertake a similar exercise at the start of each control period. Additional work to identify applicable innovation will be carried out as the need arises.

We will also work with other infrastructure managers to share best practice on tools, techniques and processes; participate in forums such as the European Infrastructure Managers technical working groups; obtain feedback from NRIL and SNCF; and consider innovative ideas in other comparable industries.

As part of the HS1 project process, we will require each project being undertaken by or on behalf of HS1 to consider innovation. Projects will be shared with TSC for identification of potential project-specific innovation. At Gate 3, all projects will be required to demonstrate that innovation has been considered and provide an associated business case which will allow us to track and measure the impact of innovation. The intention is to cover

operations and maintenance in the same way, using the renewals board to provide governance for all innovation projects.

HS1 may also be a test bed for research projects and we will consider providing funding – these will be considered on a case by case basis.

10. Operations and Maintenance

10.1. Operations

NR(HS) has developed an Operations Strategy for the HS1 route and stations covering the period 2018/19 to 2029/30. The strategy does not advocate any major changes to current arrangements. In Q1 2019, we plan to review the current situation to understand any weak points and the key cost drivers. This “health check” will make sure that the operating structure will deliver the outputs for CP3 and identify whether there are any quick wins we should be considering to make operational delivery more efficient or resilient.

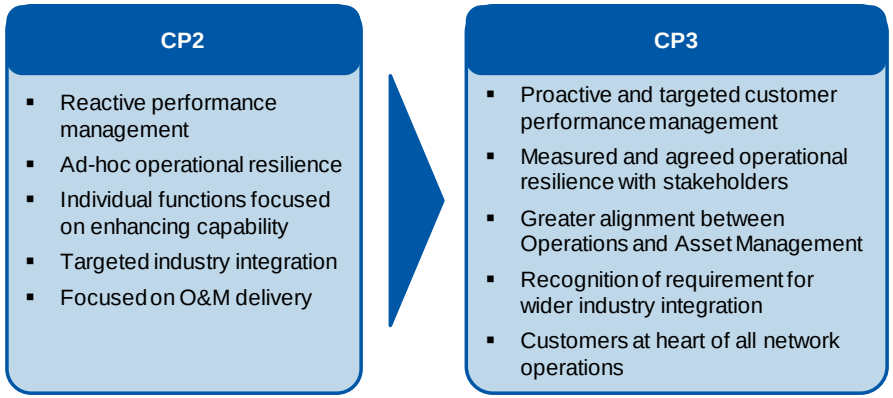
10.1.1. Operations Strategy

The NR(HS) Operations Strategy sets out the strategy for delivering a **safe, resilient and sustainable operation, efficiently and effectively to meet the future needs of stakeholders**. It is designed to meet the following stakeholder aspirations:

- Continue excellent performance, less than 10 seconds delay per train;
- Improve resilience i.e. reduce the impact of big incidents within the risk appetite of operators; and
- Fully understand the operational criticality of stations assets and devise asset management plans to deliver this.

The Operations Strategy provides an input to the SASs to ensure that engineering requirements are driven by, and aligned with, train service operational priorities and criticalities.

The Operations Strategy has been developed recognising CP2 challenges and a maturing approach in CP3.



It draws on quantitative and qualitative evidence from current operational performance of the HS1 network and its underpinning and contributory risks, constraints and challenges, as well as anticipated changes to the operating environment in CP3 and beyond. Key assumptions regarding changes to the operational context in CP3 are:

- Traffic volumes on the HS1 route as in the HS1 Ltd traffic forecasts;
- 12% growth in passenger volumes at stations by the end of CP3;
- Greater expectations from passenger and freight train operators for more effective possessions planning;
- No immediate major infrastructure changes during CP3 (but need to consider changes to the IECC in CP3); and
- Increased renewal volumes in CP3 compared with CP2.

The Operations Strategy identifies five key priorities and underpinning workstreams as set out in Figure 20.

Figure 20: Operations Strategy priorities and workstreams

Priority	Workstreams
Safety: **Everyone home safe every day**	Safety leadership & culture Safety management & systems
Performance: **Increased operational resilience**	Incident management Timetable resilience Asset resilience Trespass and security Interface resilience AFC resilience Enhanced infrastructure works readiness
Alignment: **Greater NR(HS) operational and asset management alignment**	Planning Assurance South East Route
Integration: **Improved integration with wider industry**	Joint incident response Standards and Rule Book delegation Integration of management posts IECC migration Control room Knowledge share
Customer: **Be the leader in the UK rail passenger experience**	Communication Passenger experience Physical systems

10.1.2. Operations costs

The operating team accounts for the majority of operations costs and is largely fixed because of safety and operational requirements; these are aligned to NRIL practice given the overall unionised environment. NR(HS) has grown the EMMIS team from six to ten in CP2 to reduce the risk of line closure and improve incident management. Support teams are currently not aligned with NRIL structures due to the bespoke HS1 rule book and standards. The Operations Strategy notes that, in CP3:

- NR(HS) will retain the existing operating team establishment given the consistent volume of train paths forecast for CP3;
- The existing response establishment will also be retained given there is no change to performance risks to NR(HS) during CP3; and
- NR(HS) will identify opportunities to integrate support functions with NRIL to achieve cost efficiencies. Any planned change will retain the same degree of focus on HS1.

Further details are available in the NR(HS) 5YAMS, Section 6 and Appendix H.

10.2. Access and Possessions Planning

NR(HS) has developed a Possession Strategy to support the delivery of the CP3 maintenance and renewal activities identified in the SASs. The primary objective of the strategy is to provide a balance between the operation of passenger and freight services and access to maintain the safety and reliability of the asset.

The Possession Strategy has been developed with a customer focus. NR(HS) has engaged with stakeholders to understand their requirements, which are summarised below.

Stakeholders	Aspirations
EIL LSER	Maintain asset performance Maintain asset availability Minimise disruption
DB Cargo GBRf	Improved visibility of possession planning Improved asset availability

In developing the strategy, NR(HS) has recognised the changing nature and condition of HS1 assets and the changes to NR(HS) ways of working as outlined in the SAMP and SASs. NR(HS) has built on CP2 possession

performance and initiatives to develop a customer-driven strategy to deliver the best access arrangements and outcomes for stakeholders.

The strategy is based on four key objectives:

Access Optimisation	NR(HS) will improve possession utilisation and performance management in CP3. NR(HS) will achieve this through optimising renewal access by combining maintenance activities where it is safe to do so. NR(HS) will collaborate cross-discipline in its possessions to improve utilisation and interface with its asset management team to make data-driven decisions.
Integrated Planning	With one single planning team, NR(HS) will facilitate cross discipline access and planning. NR(HS) will improve governance in its processes and develop internal capabilities by bringing maintenance and planning together into one integrated team. NR(HS) will learn from best practice and interface with infrastructure managers to minimise disruption across network boundaries.
Work Bank Visibility	With visibility of the workbank and use of the Single View of the Plan, NR(HS) will create robust and resilient access plans. NR(HS) will understand asset risk in order to prioritise access requirements and provide clear visibility of maintenance and renewal tasks for delivery staff and operations.
Customer Focus	NR(HS) will drive efficiencies in engineering access to build on its stakeholder relationships and minimise disruption to the network. NR(HS) will continue to follow the Engineering Access Statement process in line with the HS1 Network Code; however, engagement processes will be brought in-house. This will enable NR(HS) to engage directly with its stakeholders and customers and continue to build on existing stakeholder relationships. NR(HS) will create and continually review its project plans with TOCs and FOCs and identify optimal access points to minimise disruptive access.

Further details are available in the NR(HS) 5YAMS, Appendix K.

10.3. Maintenance

Section 9 discussed the SASs and how they set out the strategy for the management of the assets, based on current understanding of the asset portfolio, its condition, performance, risks and associated costs. The SASs adopt a whole life cost approach to maintenance and renewals. This section summarises, for each asset discipline:

- The assets included;
- The current condition of the assets; and
- Drivers for maintenance and inspection activities.

NR(HS)'s approach to developing maintenance costs is discussed in Section 10.3.8.

Further information is available in the SASs for each asset discipline, which are Appendices B to G of the NR(HS) 5YAMS.

10.3.1. Track

Track asset portfolio	
Plain line	Rail management products
Switches and crossings	Road rail access points
Ballast	Expansion devices
Slab track	Glued insulation joints
Buffer stops	Wheel impact load detector

Most of the Track assets are largely in an acceptable condition except for specific locations and types of asset that have either reached the end of their serviceable life or are not meeting performance expectation and require replacement in the near future.

Track maintenance is driven by periodic inspections to inform a workbank of planned preventative maintenance. Maintenance is delivered subject to the criticality and condition of the asset. Higher risk assets are subject to more rigorous frequencies of inspection and maintenance to reduce the likelihood asset failures.

The Track asset is heavily inspection biased; time-based inspection intervals are derived from SNCF track inspection standards. Based on experience and knowledge gained over the past 10 years, NR(HS) has started using a risk-based maintenance approach. The programme started in the first quarter of 2017 and is supported by an increasing number of strategically placed remote condition monitoring devices; it is due to finish in time for the start of CP3. This programme will determine the optimised levels of inspection of track components and be gradually adopted to allow bespoke and tailored inspection and maintenance plans.

The use of in-service trains for inspection and recording track geometry is currently being investigated. This would increase the frequency of inspections, which translates to safer infrastructure and more proactive maintenance. The overall cost of inspection would reduce as the requirement for hiring dedicated measurement trains and the frequency of manual basic visual inspections would reduce.

10.3.2. Civils and Lineside Buildings

Civils and Lineside Buildings asset portfolio	
Access	Fencing and boundary management
Ancillary structures	Lineside buildings
Bridges	Retaining walls
Culverts	Tunnels
Drainage	Vegetation
Earthworks	

The condition of the Civils and Lineside Buildings assets is generally acceptable and in line with that expected from these assets in this early phase of their lifecycle.

In CP2, maintenance has been carried out in accordance with the original Rail Link Engineering (RLE) maintenance manuals, with enhanced maintenance regimes adopted where accelerated degradation of the asset has been observed. The RLE maintenance manuals specify set inspection frequencies, which does not make the best use of resource and access.

By CP3 a risk-based maintenance process will be developed and implemented taking into account asset and location criticality, asset condition, and capability requirements. The asset criticality scores have been banded into categories and a maintenance strategy statement developed for each. To implement these strategies, risk thresholds for intervention will be developed for each criticality band.

10.3.3. Signalling and Communication Systems (S&CS)

Signalling and Communication Systems asset portfolio	
Signalling	
Points operating equipment (POE)	Train dispatch
Integrated Train Control System (ITCS)	Vehicle Health Monitoring Equipment (VHME)
Train detection	Markers
Automatic Train Protection (ATP)	Relays
Signals	Switches
Control systems	
Electrical Mechanical Management and Information System (EMMIS)	
Route Control Centre System (RCCS)	
Ventilation Control System (VCS)	
Communication systems	
Data Transmission Network (DTN)	Fibre Optic Network (FON)
GSM-R	Fibre Optic & Aerial Earth Cable (FOAEC)
CCTV	RF Propagation System
Local Area Network (LAN)	Emergency Radio System

The condition of the S&CS assets is generally acceptable and in line with that expected from assets in this early/mid phase of their lives.

Routine maintenance and inspection of signalling assets is carried out in accordance with the NR(HS) Signal Maintenance Testing Handbook which is based on the operating and maintenance manual provided as part of the build of HS1.

Communication system assets follow a preventative maintenance approach. Each asset group has a different inspection regime to determine condition. The DTN and GSM-R networks use electronics card based systems that do not require regular maintenance inspection or examination.

Control systems do not require extensive planned maintenance. Typically planned maintenance covers daily, weekly and monthly system checks which are low cost activities. Benchmarking with other organisations including Eurotunnel and SNCF established that the maintenance regime is robust and properly dimensioned.

10.3.4. Overhead Contact System (OCS)

Overhead Contact System asset portfolio
OCS supporting structures (masts)
OCS tensioning equipment (anchors)
Neutral sections and insulator sections
OCS grouped and linear assets

The OCS assets are largely in good condition with limited signs of ageing. Equipment is early in its lifecycle and minimal wire wear has been recorded due to the relatively low number of pantograph passes compared to the original railway design specification. Faults that were found as a result of errors in design, installation and fabrication have been corrected.

There is little to no redundancy in OCS assets, meaning that failures and faults can pose an operational risk to the railway. The maintenance strategy for the OCS assets is based on routine planned maintenance, designing out fault modes, reaction to faults and early prediction/ intervention where possible; prediction of failure is currently limited in scope but may be improved by emerging technologies.

Routine maintenance of the OCS asset is performed either via ground level operations, such as track walks, or through at-height maintenance where alignment and bolt tightness may be checked. Much of the maintenance of OCS assets is performed as part of a yearly cycle; annual maintenance passes provide assurance on condition and geometry.

10.3.5. Traction Power Supply (TPS)

Traction Power Supply asset portfolio	
Motorised switch drives	Voltage transformers
AC/DC isolation transformer compounds	Traction bonds
Surge arrestors	High voltage switchgear

Asset degradation of the TPS assets is not significant.

The levels of redundancy within the TPS system mean that, in most cases, asset failures do not have immediate operational or safety impacts. This drives the maintenance strategy.

The maintenance strategy is based on routine planned maintenance and reaction to faults. Limited prediction of failure is undertaken. In most cases faults are rectified when they are found (fix-on-fault) rather than predicted; this is acceptable due to low impact levels and high redundancy. Routine maintenance is undertaken to extend life.

TPS assets are routinely inspected in accordance with NR(HS) standards. There are a number of asset specific inspections that are used to identify faults.

10.3.6. Mechanical and Electrical (M&E)

Mechanical and Electrical asset portfolio	
Marshalling boxes	HVAC
Tunnel ventilation	Fire systems
Cross-passage doors	Points heating
Pumping systems	Security systems
Lighting	Lifts
UPS systems	Auxiliary power distribution

In general, the M&E assets are in good condition for their age.

The M&E assets were built with a level of redundancy which means that systems can often maintain functionality despite failure, or isolation for maintenance, of certain components within the system. This allows maintenance to be conducted during operational hours and removes impact costs. Fix-on-fault is currently considered to be the best solution to maintaining the non-critical M&E portfolio or where significant redundancy exists.

Where faults are safety or operationally critical and for assets where replacement components are on long lead times, prediction methods such as vibration analysis, flow rates and insulation testing are used.

Across the M&E portfolio, NR(HS) employs proactive principles to design out faults, and where possible, re-engineer components to remove known failure modes and improve overall asset reliability.

10.3.7. Rail Plant

NR(HS) uses rail plant, both leased and managed, to support the delivery of asset operations and maintenance on HS1 infrastructure. Managed plant is owned by HS1 Ltd and is operated and maintained by a third party, Balfour Beatty Rail (BBRL). Where maintenance activities require specialist equipment, such as rail tamping and grinding, additional plant is leased from third party providers.

NR(HS) has developed a Rail Plant Strategy which establishes a strategy for maintenance, procurement and renewal of the managed plant portfolio. The strategy also summarises NR(HS)'s plans for the management of leased plant.

Managed Rail Plant asset portfolio	
Cassettes	KFA wagons
MPVs	Rail road vehicle
Auxiliary power units	Work platforms
SNCF Track Renewal and Maintenance Machine (STRAMM)	Lifting jacks
	Test measure equipment

The Managed Plant portfolio is in a condition that is commensurate with asset age and usage. Managed plant maintenance follows a planned preventative maintenance strategy, with heavy maintenance and overhauls planned in based on hours run or time.

10.3.8. Approach to maintenance costing

As part of its maturing asset management capability, NR(HS) has improved its cost capture approach in readiness for CP3. NR(HS) has identified all the activities that take place on the railway and developed a bottom-up consistent approach to capturing the time it takes to perform the activities at the most granular level – Cost Time Resource (CTRs). This has enabled NR(HS) to undertake activity-based estimates, combining Activity Based Plans and Maintenance Unit Costs.

NR(HS) has used its CTR approach to develop a 10-year activity expenditure forecast for each asset discipline. The CTR approach is outlined in Section 5 of the SAMP.

NR(HS) aims to develop more robust costing methodologies to define unit rates before the end of CP3. The CTR tool is a key enabler to move towards an Activity Based Cost model during CP3.

11. Proposed O&M cost levels

Our aim is to deliver our obligations at the most efficient cost. In this section we outline our approach to identifying efficient O&M costs for CP3, how we will continue to drive efficiency during the control period and our forecast of O&M expenditure for CP3.

11.1. Identifying efficient costs for CP3

In developing the O&M costs for CP3, our focus has been on what we need to do to deliver our asset management obligations, continue to operate a safe, sustainable and high-performing railway and manage our concession at the most efficient cost. We have built CP3 costs bottom up, based on our experience in CP2. Since the submission of the 5YAMS for CP2, we have five more years' experience of operating HS1, an improved understanding of the HS1 asset and have further developed our role as strategic partner and intelligent client to ensure we meet our long term asset stewardship obligations.

Efficiency means delivering the chosen outputs for the lowest cost. Our asset stewardship obligations under the Concession Agreement – and good asset management practice – suggest this means delivering value for money by focusing on whole life cost.

We have followed these principles in undertaking the efficiency analysis:

- Making the effort proportional to the potential savings;
- Having a mix of 'top-down' and 'bottom-up' analysis;
- Reflecting the incentives on HS1 Ltd to achieve efficiency gains given the provisions of the Concession Agreement; and
- Specific analysis that is relevant to each cost line.

Much of the work that feeds into achieving value for money is not a specific 'efficiency initiative', it is part of our core business, for example, work to improve asset management capability.

Costs have been examined line by line and have been subject to a robust process of internal review and challenge. Where appropriate, costs have been benchmarked. In other cases, we have provided evidence of the efficiency of our procurement strategy to justify our proposed cost levels. We will continue to pursue improved efficiency throughout CP3, challenging NR(HS) to outperform its Annual Fixed Price, identifying opportunities to reduce HS1 costs and working to minimise costs which are passed through to train operators.

A high level breakdown of cost categories and the benchmarking/efficiency approach taken for each is shown in Table 36. Further details are provided in the remainder of this section.

Table 36: Efficiency approach by category of cost

Cost category	Approach
NR(HS) Annual Fixed Price	NR(HS) cost initiatives Oxera review of NR(HS) management fee Expanded and improved benchmarking (OMR Effectiveness Study) Engineering assurance of NR(HS) proposals HS1 review and challenge of NR(HS) proposals
HS1 costs - subcontract	Review each subcontract to identify areas of potential efficiency and challenge our suppliers to provide better value
HS1 costs - internal	Bottom-up budgeting linking the outputs for CP3 to the resources required to deliver them. Headcount reflects the tasks needed to comply with our long term obligations under the Concession Agreement, our increased focus on asset management and performing our role as strategic partner and intelligent client. More efficient ways of working – reduced use of consultants as more work delivered in house Bottom up comparisons where possible e.g. office rent and salaries £1.6 million target efficiency is built into our CP3 cost forecast

Cost category	Approach
Pass through costs Traction electricity	These cost forecasts are indicative. During CP3, we will work to minimise the outturn costs passed through to operators through: ▪ Efficient procurement strategies (insurance, electricity); ▪ The Energy Review has identified potential opportunities to reduce costs to operators; and ▪ Robust negotiation on rates revaluation, work to create industry group to engage on this topic.
Freight-specific costs	We are reviewing potential options to reduce Ripple Lane costs.

Table 37 summarises our CP3 O&M cost forecasts. These are discussed in Sections 11.2 to 11.4. Traction electricity is not included in this table; it does not form part of the OMRC but is charged separately to operators as incurred (see Section 11.5).

Table 37: CP3 O&M cost summary (£m, February 2018 prices)

	20/21	21/22	22/23	23/24	24/25	Total
NR(HS) costs	41.9	41.8	41.0	40.8	40.0	205.5
HS1 costs						
- subcontract	3.7	3.7	3.8	3.8	3.8	18.7
- internal	7.9	8.2	8.6	8.5	8.0	41.2
Pass through costs	19.1	19.1	19.1	19.1	19.1	95.4
Freight costs	0.4	0.3	0.4	0.4	0.4	1.8
Total O&M cost	**73.0**	**73.1**	**72.8**	**72.5**	**71.2**	**362.6**

It should be noted that these cost forecasts:

- Exclude any potential impact of Brexit on our O&M cost base. This is discussed further in Section 7.2.1; and
- Exclude any costs related to a potential market test of the Operator Agreement in CP3. This is discussed further in Section 16.6.2.

The NR(HS) cost shown in this table is the Annual Fixed Price in the NR(HS) 5YAMS with adjustments for the Operator Agreement 1.1% increase and the freight-specific element of the NR(HS) costs (see Section 11.3.8 for further details of this adjustment).

We forecast an overall reduction of 3% in O&M costs between CP2 exit and CP3 exit as shown in Table 38.

Table 38: CP3 exit v CP2 exit O&M costs (£m, February 2018 prices)

	CP2 exit – outturn (2019/20)	CP3 exit (2024/25)	Difference	% difference
NR(HS) costs	41.1	40.0	-1.1	-3%
HS1 costs				
- subcontract	3.9	3.8	-0.2	-5%
- internal	9.6	8.0	-1.6	-17%
Pass through costs	18.5	19.1	+0.6	+3%
Freight costs	0.6	0.4	-0.2	-37%
Total O&M cost	**73.7**	**71.2**	**-2.5**	**-3%**

11.2. OMR Effectiveness Study

11.2.1. Approach

We commissioned RebelGroup to undertake an OMR Effectiveness Study to identify ways to deliver a more cost-effective service to operators. The OMR Effectiveness Study is more than a top-down benchmark comparing financials; it also maps and compares the organisation and underlying operation and maintenance strategies and activities that drive the costs.

The study approach and findings are summarised below. Full detail is available in the OMR Effectiveness Study which is provided as a supporting document.

The aims of the OMR Effectiveness Study are:

- To assess current OMR strategies and processes against similar organisations;
- To evaluate best practice and identify opportunities to improve whole life cost efficiency; and
- To provide ORR and operators with insight into the relative efficiency and effectiveness of current and planned OMR activities.

The 2017/18 OMR Effectiveness Study is the third study of its kind and builds on previous studies. The Rebel team that worked on the study also undertook the 2013 benchmarking study for PR14 and the 2015 update.

The 2013 study developed the "ISSR" cost driver framework as its methodology. This framework provides a comprehensive overview of all aspects that define the total cost of an infrastructure manager.

- **Inherent** cost drivers constitute the characteristics of the railway and are beyond the power of the infrastructure manager to optimise;
- **Structural** cost drivers include fundamental choices for the maintenance strategy and supply chain;
- **Systemic** cost drivers describe the processes and supporting systems that are in place for delivery of the OMR activities;
- **Realised** cost drivers define the actual people, service, asset and material efficiency and effectiveness.

The 2015 and 2017/18 studies followed the framework established for the 2013 study with the following improvements:

- Additional participants and comparator lines, including a privately-owned high-speed line;
- Focus areas and case studies incorporated to create extra insight into costing elements;
- Data added to the database and differences in cost, staff, processes and activities identified and interpreted;
- Deeper insight in costing, staff and cost drivers for all participants;
- Improved insights into indirect costs; and
- On selected issues, best practices from non-high speed infrastructure managers are included to enrich the analysis.

The 2017/18 study included 20 high speed rail lines from seven European countries. Since PR14, Belgium, Germany, Spain and Lisea (the infrastructure manager for the LGV Sud Europe Atlantique) have been added to the comparators.

Table 39: OMR Effectiveness Study participants

	PR19 number of lines	PR14 number of lines
UK – HS1	1	1
Belgium	4	-
France – SNCF	5	5
– Lisea	1	-
Germany	2	-
Italy	2	2
Netherlands	1	1
Spain	4	-
South Korea	-	1

The study was based on 2016/17 cost and performance data and included the following costs:

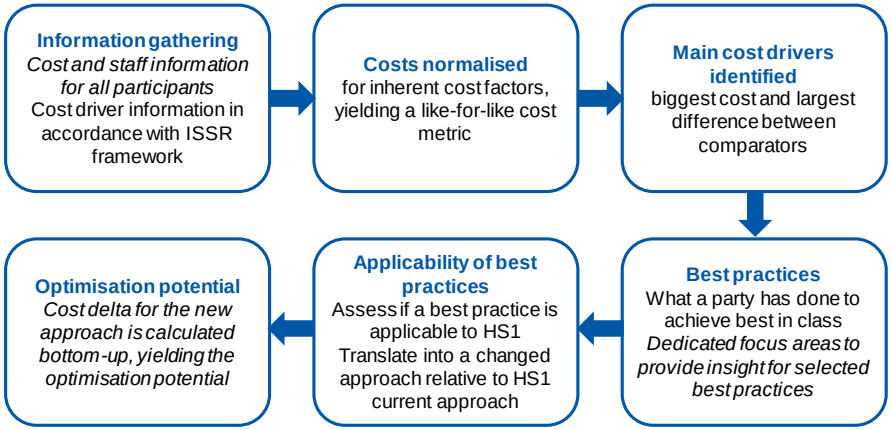
- Operation — Elementary functions to operate the railway
- Maintenance — Direct maintenance "hands on tools"
- OMR support — All functions that are directly related to O&M

- Support functions Business support, security, insurance, legal etc.

Comparative cost data is presented as £ per 'equivalent track-km'. The 'equivalent track-km' calculation uses normalisation factors to compensate for additional or reduced maintenance need relative to a standard track-km with adjustments made for complexity, usage and line speed.

The OMR Effectiveness Study approach is summarised in Figure 21. Elements shown in italics are components of standard top-down and bottom-up benchmarking approaches. The remaining elements show the more comprehensive approach of the OMR Effectiveness Study.

Figure 21: Overview of OMR Effectiveness Study approach



11.2.2. Findings

The study indicated that cost effectiveness has increased since CP1. The total annual route cost for CP2 has decreased by 7% compared to the final year of CP1. A further 18% cost optimisation is realistic in the long term. This could be achieved in three main areas:

- Reduction in the size of the OMR organisation (cost optimisation potential 6.6%);
- Reduction in the cost of supporting functions (cost optimisation potential 9.8%); and
- Network optimisation (cost optimisation potential 1.9%).

We have reviewed the findings of the OMR Effectiveness Study and have been working with NR(HS) to challenge their efficiency assumptions. NR(HS) has addressed some of the challenges in its 5YAMS and we recognise that in a number of areas the efficiencies identified in the OMR Effectiveness Study will require time and planning to implement. We are working with NR(HS) in three main areas:

Operating concept: The HS1 network layout and functionality is based on an operational concept developed in the design phase of the railway. Eliminating unused infrastructure would reduce maintenance cost and failure rates, especially if points could be eliminated. Potential network optimisations could include Southfleet Junction; the track layout at St Pancras; certain loops, connections and over-designed redundancies and simplified bi-directional functionality.

We plan to undertake a review of the operating concept to make sure that the railway configuration and operation is appropriate for the concession life. This review will take into account the changing nature of the railway (including passenger and freight traffic forecasts and changes in maintenance and renewals interventions) to assess the appropriateness of the current configuration, systems and processes and make recommendations to improve the efficiency and effectiveness of the operation of the railway over the next 20 years. The review will include an implementation plan. We plan to complete the review by January 2020.

Ripple Lane: NRIL operates and maintains Ripple Lane exchange sidings on our behalf under a bespoke O&M contract. We are considering whether the costs associated with Ripple Lane could be reduced by NR(HS) taking over the NRIL contract. The first stage is to ascertain whether this is a feasible option in terms of standards, safety case and the likely ongoing need for NRIL signalling. The second stage will be to consider how the contract could be structured to provide better value.

Risk: We are reviewing both NR(HS)'s and HS1 Ltd's approach to risk to identify opportunities to manage it more efficiently across both our organisations. We plan to complete the review by January 2020.

Table 40 sets out the findings of the OMR Effectiveness Study in more detail along with the NR(HS) responses.

Table 40: OMR Effectiveness Study findings and NR(HS) responses

Finding	NR(HS) response
The NR(HS) O&M organisation is significantly larger than peers. The potential reduction in size of the maintenance organisation is ~20-25%. Reduction could be achieved by: ▪ Increasing staff flexibility to work across technology disciplines to increase efficiency and productivity ▪ Rapid response teams deployed from their homes when on standby ▪ Reducing maintenance activities by a condition-based approach. A precondition is improved risk allocation between NR(HS) and HS1 Ltd.	▪ NR(HS) will improve possession utilisation by deploying multi-disciplined teams on single work sites ▪ NR(HS) will integrate maintenance and renewals planning under a single view of the plan (SVoP) and move to a risk-based maintenance regime in CP3. ▪ NR(HS) rapid response teams undertake both reactive and routine maintenance activities. The impact on train performance needs to be assessed given variable time to site. NR(HS) will undertake an impact analysis and engage with stakeholders to determine if this model is appropriate for the HS1 network. ▪ NR(HS) will work closely with HS1 Ltd on collaborative efficiency targets and exploring improved ways of working together. ▪ NR(HS) expect they can deliver almost double the efficiency identified in the study.
A mature asset management system is key to balancing maintenance and renewals activities in relation to the system performance it supports. Potential areas of optimisation are: ▪ Reduction of maintenance activities by condition-based approach ▪ Increasing asset life as a result ▪ More accurate renewal forecasting. This could be achieved by: ▪ Implementing the asset management plan ▪ Incorporating international OMR best practice. A precondition is a clear allocation of asset management roles and responsibilities between NR(HS) and HS1 Ltd.	▪ NR(HS) will move to a risk-based maintenance regime in CP3. Risk based approaches, by discipline, are outlined in the SASs. ▪ NR(HS) will integrate both maintenance and renewals planning under a single view of the plan (SVoP).
Costs for support functions, relative to the sum of operations, maintenance and OMR support, are significantly higher than peers. The size of the organisation for support functions is large compared to peers. Reductions could be achieved by ▪ Eliminating non-specified costs ▪ Combining risk premium and outperformance ▪ Reducing NRIL corporate charges A precondition is improved risk allocation between NR(HS) and HS1 Ltd.	▪ NR(HS) has reallocated or removed the non-specified costs ▪ NR(HS) requires clarification on the recommendation to combine risk premium and outperformance ▪ NRIL corporate charges reduced under the terms of the PSA by 10% net.
The HS1 network is based on an operational concept developed in the design phase of the railway. An updated operational concept matching actual and forecast use would provide updated views on the required network layout and functionality.	▪ NR (HS) maintenance obligations represents the current Operator Agreement.

11.3. NR(HS) O&M costs: Annual Fixed Price

The NR(HS) Annual Fixed Price for CP3 is discussed in Section 8 of the NR(HS) 5YAMS and summarised below.

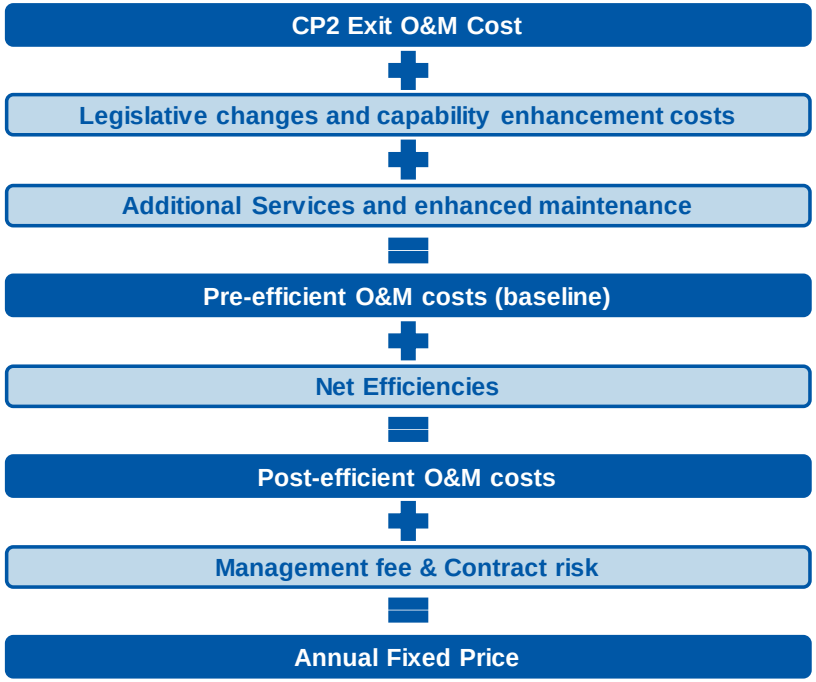
11.3.1. Structure of Annual Fixed Price

NR(HS)'s Annual Fixed Price structure for CP3 is consistent with the approach taken in CP2. It includes:

- Management fee: a reasonable and proportionate financial reward for NR(HS) undertaking the services;
- Contract risk (previously known as risk premium): proportionate cover for known and unknown cost risks; and
- Outperformance sharing provisions: providing an incentive for NR(HS) to seek opportunities for cost reduction in CP3.

NR(HS) has built up the Annual Fixed Price as follows:

Figure 22: Build up of NR(HS) Annual Fixed Price



11.3.2. NR(HS) pre-efficient O&M cost (baseline)

The pre-efficient O&M costs reflect the cost of delivering current levels of O&M activities with the current organisation. NR(HS) has developed the CP3 pre-efficient O&M costs through a bottom-up process with business leaders. Known changes that will have an impact on the cost of delivery have been reflected in the pre-efficient O&M costs, as follows:

- Increased asset management capability (£200k p.a.)
- Additional EMMIS controllers to increase resilience (£240k p.a.)
- Increase in staff costs as a result of legislative and corporate policy changes (£270k p.a.)

- Activities that were identified as Additional Services (Variations) in CP2 becoming business as usual activities in CP3 (£340k p.a.)
- Enhanced maintenance and cyclical activities arising from the renewals review process with HS1 Ltd (£350k p.a.).

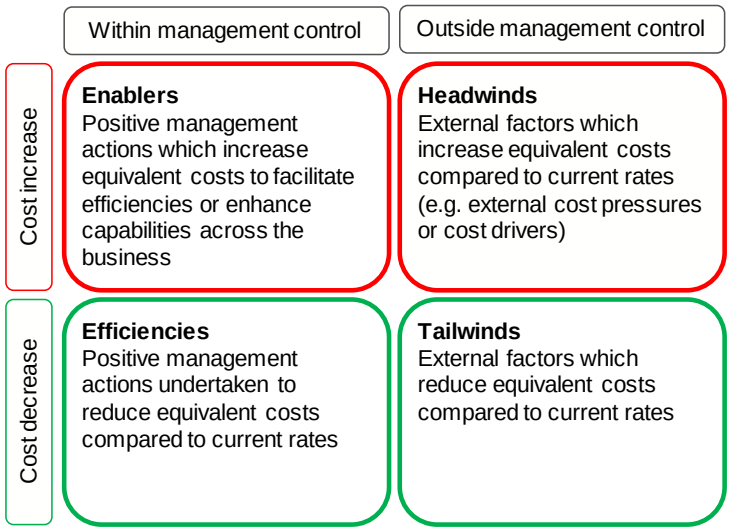
This gives a total of £1.4 million (a 3.8% increase the CP2 Exit O&M cost) which is added to the CP2 Exit O&M cost of £36.6 million to give pre-efficient O&M costs for CP3 of £38.0 million.

NR(HS) has performed a bottom-up validation of direct maintenance costs using its Cost Time Resource (CTR) tool developed during CP2. Further information is available in Section 10.3.8.

11.3.3. Cost Initiatives

NR(HS) has introduced a structured approach, consistent with the NRIL approach in its PR18 submission, to identify and quantify a number of cost initiatives that are likely to have an impact on delivery in CP3. These cost initiatives were applied to the pre-efficient O&M costs to generate the post-efficient O&M costs for CP3. Cost initiatives and efficiencies are defined in Figure 23.

Figure 23: Cost initiative definitions



NR(HS) undertook an extensive exercise to identify and quantify cost initiatives, developing efficiency plans bottom up and top down, building on existing CP2 efficiency plans and considering the findings of the benchmarking exercise.

Efficiencies have been developed on the principle that NR(HS) will deliver savings in CP3, with efficiency implementation plans and a robust tracking process in place prior to the commencement of CP3.

For each of the cost initiatives identified, NR(HS) developed and costed three scenarios (Worst Case, Base Case and Stretch Case). NR(HS) adopted the Stretch Case in developing its Annual Fixed Price; NR(HS) estimates that this represents an O&M cost saving of circa £3 million over five years, on top of the Base Case.

In the final year of CP3, the Annual Fixed Price includes an additional Continuous Improvement target efficiency of £0.5m as a result of external benchmarking outputs, emerging opportunities and joint working efficiencies, to be defined and achieved in collaboration with HS1 Ltd.

Net efficiency is forecast to be £8.4 million in total over the five years of CP3 which equates to 4.4% of total CP2 O&M cost (£189.6 million in February 2018 prices, excluding management fee and risk premium).

Further detail of cost initiatives by business function (Infrastructure, Operations, Support/Other) are shown in the NR(HS) 5YAMS, Section 8.4.

These cost initiatives generate a post-efficient O&M cost. By CP3 exit, the post-efficient O&M cost is £35.4 million, a 7% reduction on the pre-efficient O&M cost of £38.0 million.

11.3.4. Management fee

The Annual Fixed Price includes a management fee which is intended to represent the everyday risks that NR(HS) faces, over which it has some degree of control. These include risks that have both potential upsides and downsides. For example, NR(HS) may set out a particular operating and maintenance strategy, but the actual strategy implemented may differ and NR(HS) could incur cost overruns or lower costs than expected. The management fee is comparable to profit margins in the private sector.

In CP2, the management fee was 8% of the core O&M cost (expressed as a fixed amount in the Annual Fixed Price) based on recommendations from Oxera analysis of regulatory precedents, comparable companies and contracts.

For PR19, NR(HS) again appointed Oxera to undertake an independent review of the appropriate management fee for CP3. To do this, Oxera assessed the economic risks associated with the services that NR(HS) provides and identified relevant comparators. Directly comparable data is very limited, therefore Oxera considered three types of comparator:

- Profit margins of comparable companies in terms of services provided;
- Comparable contracts within NR(HS); and
- Regulatory precedents on profit margins.

Oxera concluded that the management fee should be set at a level that is comparable to the fee that would be earned if the NR(HS) contract were delivered in a competitive market. Therefore, the most relevant comparators for NR(HS) are private sector companies in comparable industries. This provides a range of 3.3% to 12.2%.

Given that NR(HS) bears all the costs for underperformance and only gains 50% of the benefits of outperformance in years three to five of CP3, the review considered that the management fee should be set between the mid-point and the third quartile of the range. This provides a range of 7.8% to 9.9%, with a mid-point of 8.9%.

NR(HS) has considered the recommendations of this review and determined that an appropriate level of management fee for CP3 is 8% of the post-efficient O&M cost, the same percentage as the CP2 management fee.

11.3.5. Contract risk

The Annual Fixed Price also includes contract risk (previously known as risk premium) which provides for downside risks from externally caused events that are outside the control of NR(HS).

In CP2 the risk premium was 5% of the core O&M cost (expressed as a fixed amount in the Annual Fixed Price) based on recommendations of analysis by Oxera.

For PR19, NR(HS) has undertaken a risk assessment process in order to determine the appropriate level for CP3. NR(HS) is exposed to five categories of asymmetric risk:

- Asset risk;
- Third-party / external risk;
- Supplier risk;
- HS1 Ltd / customer-driven risk; and
- Other risk.

Through its Quantitative Cost Risk Assessment (QCRA) process, NR(HS) has reviewed the risks it holds which are out of NR(HS) control, their likelihood of occurrence and their impact should they materialise. This included a review of current risk registers and risks which materialised in

CP2 (including performance risk). Risks included in the NRIL Strategic Business Plan were also considered.

Costs were calculated in accordance with the NR(HS) Level A Risk Assessment Matrix and events NR(HS) considers to be force majeure or reopener events (e.g. changes to legislation) were excluded. NR(HS) ran the QCRA process outputs through Monte Carlo analysis.

On the basis of this review, NR(HS) calculated a value for contract risk of 4.33% of the post-efficient O&M cost (reflecting P80 risk exposure), compared with 5% in CP2.

11.3.6. CP3 O&M headcount

NR(HS) has ensured that its Annual Fixed Price contains only costs relating to the O&M organisation. In building up the headcount profile, NR(HS) has estimated:

- The level of support which will be provided to projects or stations, which will be off-charged and recovered; and
- The number of staff hours which will be released as a result of NR(HS)'s Asset Management Effectiveness cost initiative (including risk based maintenance). It is assumed that this additional resource will work on CP3 projects.

Both of these elements have been excluded from the headcount used in the calculation of the Annual Fixed Price, as shown in Table 41.

Table 41: NR(HS) headcount forecast for CP3

Headcount	20/21	21/22	22/23	23/24	24/25
Full O&M FTE	318	314	307	307	307
Recovery from stations/projects	-10	-10	-10	-10	-10
Reduction from Asset Management Effectiveness	-9	-11	-15	-16	-17
Total FTE for Annual Fixed Price	299	293	282	281	280

The increase in headcount between CP2 exit (310) and the start of CP3 is a result of new posts for CP3, including infrastructure resilience roles. The reduction during CP3 is driven by upskilling non-frontline staff (indirect and support staff) and continuing to appropriately resource the NR(HS) organisation.

11.3.7. Annual Fixed Price for CP3

NR(HS)'s proposed Annual Fixed Price for CP3 is shown in Table 42.

Table 42: Annual Fixed Price for CP3 (£m, Feb 2018 prices)

	CP2 Exit submission / restated [1]	20/21	21/22	22/23	23/24	24/25	Total CP3
Infrastructure		23.8	23.8	23.6	23.6	23.6	
Operations		5.6	5.6	5.6	5.6	5.6	
Support		3.5	3.5	3.6	3.6	3.5	
Other		5.1	5.1	5.1	5.1	5.1	
Total O&M (pre-efficient)		**38.0**	**38.1**	**38.0**	**37.9**	**37.9**	**189.9**
Net Efficiency	-	(1.0)	(1.2)	(1.8)	(1.9)	(2.5)	(8.4)
Total O&M (post-efficient)	**36.6 / 38.0**	**37.0**	**36.9**	**36.2**	**36.0**	**35.4**	**181.5**
Management Fee	2.9 / 3.0	3.0	3.0	2.9	2.9	2.8	14.5
Contract Risk	1.8 / 1.9	1.6	1.6	1.6	1.6	1.5	7.9
Annual Fixed Price	**41.4 / 42.2**	**41.6**	**41.5**	**40.7**	**40.4**	**39.7**	**203.9**

1 CP2 exit restated reflects the NR(HS) pre-efficient O&M cost in Section 11.3.2

The Annual Fixed Price is subject to the assumptions in Section 7.3.

The CP3 exit Annual Fixed Price of £39.7 million represents a 4% saving compared with the CP2 exit Annual Fixed Price of £41.4 million. The Operator Agreement includes a 1.1% increase for the Annual Fixed Price; taking this into account, the saving is 3%.

The CP3 total Annual Fixed Price of £203.9m represents a 5% saving compared with the CP2 total Annual Fixed Price of £214.3m. Taking into account the 1.1% increase, the saving is 4%.

Any outperformance against the Annual Fixed Price in the last three years of CP3 will be shared with HS1 Ltd and train operators. The Operator Agreement has 50:50 sharing of financial outperformance by NR(HS) for the last three years of CP3 and we pass on 60% of our share to the train operators.

Kent County Council (KCC) has contracted with Network Rail (Infrastructure Limited) (NRIL) to undertake work to modify the electrical supplies to the trains at Ashford by installing new switch equipment on the track which will enable the Class 374 trains to stop at the station. The work will be completed by March 2020. NR(HS) has notified us that it will need to recover the cost of ongoing maintenance work on the new equipment but that this cost has been omitted from the NR(HS) 5YAMS.

11.3.8. Adjusted Annual Fixed price

Two adjustments are needed to the Annual Fixed Price to produce the "NR(HS) cost" line shown in our overall O&M costs and used in calculating the charges to passenger train operators:

- The Operator Agreement includes a 1.1% increase which has been added to the Annual Fixed Price; and
- The freight-specific element of the NR(HS) costs has been netted off the Annual Fixed Price (and included in the separate "freight-specific costs" category).

This calculation is shown in Table 43.

Table 43: Adjustments to the Annual Fixed Price (£m, February 2018 prices)

	20/21	21/22	22/23	23/24	24/25	Total
Annual Fixed Price	41.6	41.5	40.7	40.4	39.7	203.9
+ 1.1% escalation	+0.5	+0.5	+0.4	+0.4	+0.4	+2.2
AFP +1.1%	42.1	41.9	41.1	40.9	40.2	206.2
- freight-specific costs	-0.1	-0.1	-0.1	-0.1	-0.1	-0.7
NR(HS) costs (adjusted AFP)	41.9	41.8	41.0	40.8	40.0	205.5

11.4. Other O&M costs

11.4.1. HS1 costs

We have split HS1 costs into HS1 subcontract costs and HS1 internal costs. The breakdown of CP3 costs for both of these categories is shown in Table 44.

Table 44: HS1 costs forecast (£m, February 2018 prices)

	20/21	21/22	22/23	23/24	24/25	Total	CP3 exit v CP2 exit
HS1 subcontract costs							
NR costs	1.6	1.6	1.6	1.6	1.6	7.8	0.0
NR GSM-R	0.3	0.3	0.3	0.3	0.3	1.4	-0.3
NGC connection fees	0.5	0.5	0.5	0.5	0.5	2.4	0.0
BTPA	1.0	1.0	1.0	1.0	1.0	5.1	0.0

	20/21	21/22	22/23	23/24	24/25	Total	CP3 exit v CP2 exit
ORR regulatory & safety	0.4	0.4	0.4	0.4	0.4	2.0	+0.1
Subtotal	**3.7**	**3.7**	**3.8**	**3.8**	**3.8**	**18.7**	**-0.2**
HS1 internal costs							
Staff	4.6	4.6	4.6	4.6	4.6	22.8	0.0
Technical support/ consultancy	0.8	1.1	1.4	1.1	0.7	5.2	-1.4
Office running	1.1	1.0	1.1	1.3	1.3	5.7	+0.2
Other: Concession	0.9	0.9	1.0	1.0	0.9	4.9	0.0
Other: Railway	0.5	0.5	0.5	0.5	0.5	2.7	-0.5
Subtotal	**7.9**	**8.2**	**8.6**	**8.5**	**8.0**	**41.2**	**-1.6**
Total	**11.7**	**11.9**	**12.4**	**12.3**	**11.7**	**59.9**	**-1.8**

We forecast a £1.8 million (13%) reduction in HS1 costs between CP2 exit (2019/20) and CP3 exit (2024/25).

The remainder of this section sets out the rationale behind the CP3 forecasts for each category of cost.

HS1 subcontract costs are primarily single choice supplier long term arrangements with limited potential for future savings. Our focus is on delivering value from each of the contracts. Table 45 sets out the rationale behind the CP3 forecasts for each category of cost.

Table 45: HS1 subcontract costs in CP3

Cost category	Comments
NR costs	This category includes the following costs: **OMA:** costs incurred in relation to the interface assets between the NRIL network and HS1; these assets are covered by the OMA. Our forecast for CP3 is that OMA costs will continue at the current level (£1.34m p.a.) with RPI indexation. We have commissioned Vertex to undertake a technical review of the OMA, to determine if it is fit for purpose and if NRIL is carrying out its obligations in line with the OMA. Vertex will review the obligations in place, maintenance records and costs and determine areas of potential improvement and efficiency. One of the areas to be addressed by this review is the Rebel benchmarking recommendation regarding HS1 infrastructure which is not being used, for example, Fawkham Junction. **Ripple Lane:** Ripple Lane exchange sidings mothballing costs of £0.17m p.a., as in the CP2 submission **Safety audit:** High level safety audit costs of £0.1m in total for CP3.
NR GSM-R	Under our GSM-R contract with NRIL, we pay for a percentage of the national NRIL spine network costs based on train miles. Our forecast for CP3 is that these costs will continue at the 2019/20 forecast outturn level (£275k p.a.) with an annual RPI increase as in our contract with NRIL. We have driven better value by building obsolescence management into this contract at no additional cost. In CP2, maintenance of HS1-owned GSM-R equipment was provided by NR(HS) as an Additional Service. For CP3, NR(HS) has included this cost in its Annual Fixed Price and it has therefore been removed from HS1 costs, resulting in a reduction of £0.25m p.a. compared with CP2.
NGC connection fees	These are connection charges for HS1/UKPNS power assets into the national grid. Standard charges are based on UK-wide regulated tariffs. For CP3, we have assumed that these charges will continue at the same level as the 2019/20 forecast outturn level with tariffs increasing by RPI.

Cost category	Comments
BTPA	Our forecast for CP3 assumes that costs will continue at the current level with indexation with RPI. We are currently actively challenging the cost base and renegotiating the terms of our Police Service Agreements with BTPA. We aim to deliver the right level of security and policing at an efficient cost by deploying the right blend of BTP and security resources; any changes to the existing resource levels will be reflected in any replacement agreement. We are currently exploring options and will provide an update in our 5YAMS submission in May 2019.
ORR regulatory & safety	Regulatory fees are based on ORR costs incurred, an ORR safety levy based on proportion of UK track length and small other regulatory and safety fees. ORR has provided an estimate for CP3 regulatory fees of £1.2m. We have also included the following costs (based on CP2 outturn): ▪ £120k p.a. for the ORR safety levy; and ▪ £38k p.a. relating to the Access Disputes Committee.

Table 46 sets out the rationale behind the CP3 forecasts for each category of HS1 internal costs. We have built CP3 efficient costs bottom up by cost category. In addition, we have included a stretch target of £1.6 million of further efficiency savings over CP3; we will seek efficiencies in all cost categories but for simplicity we have shown the full £1.6 million in the technical support/ consultancy cost line.

Table 46: HS1 internal costs in CP3

Cost category	Comments
Staff	The organisation design has been an iterative process as the business moves to a steady state to reflect the changing character of the asset. The focus at the start of CP2 was building up the asset management and projects capability in the organisation. These changes were supported by changes in corporate support functions, such as bringing in incremental procurement and legal support to aid contract negotiations. The finance team brought in a project accountant to support the project management function and the governance processes around renewal spend and operational escrow management, with the aim of having governance in place in advance of the ramp up in renewals spend to ensure spend is well controlled, with appropriate oversight. These changes were completed in CP2 based on current expectations of asset management requirements and the balance of responsibilities between HS1 Ltd and NR(HS). We believe the current headcount is appropriate for CP3 and do not anticipate any further changes in staff numbers during CP3; our forecast assumes that staff costs will remain constant in real terms. We expect to continue to bring in high quality staff to develop their career with broad roles that have wide responsibilities and spans of control. Given the small number of roles within the business and the limited internal promotion opportunities, by targeting high quality ambitious individuals we expect staff turnover to remain consistent with CP2, so staff costs will maintain at market rates. We have demonstrated over CP2 that we will undertake work to manage costs for the benefit of train operators, for example, negotiating business rates with support from advisers to limit the pass through cost increase. We will continue to require the current staff resource through CP3 to manage the concession and railway requirements and to target new opportunities to drive value, balancing long term asset management requirements with the short term need to ensure costs are as efficient as possible. Examples of focus areas for CP3 include preparation for long term renewals, including future contracting strategy; operating concept review; management of pass through costs including two rates reviews in CP3 and implementing recommendations from our energy review; continuing to review subcontracts for efficiencies; implementing a more proactive escrow investment strategy and reviewing our charging framework.

Cost category	Comments
Technical support/ consultancy	During CP2 we have increased headcount, hiring full-time specialists to support the demands of running the concession and reducing our reliance on consultants. This is a more efficient solution and ensures knowledge is retained in HS1 Ltd. Technical support during CP3 will focus on: ▪ Developing asset information system/standards to ensure efficient management of renewals; ▪ Engineering & safety assurance to ensure we meet the obligations of the Concession Agreement; and ▪ Consultancy support for CP4 periodic review. We are forecasting a reduction in consultancy support for CP3 with a £2.8m saving compared with CP2 outturn, a £1.8m saving compared with the CP2 efficient budget. In addition, as noted above, we have included a stretch target of £1.6 million of further efficiency savings over CP3.
Office running	The main costs included in this category are: ▪ Rent and service charge (55% of total) ▪ IT/telecoms (30% of total) ▪ Other running costs (15% of total). Our office rent is fixed until 2022/23. Other tenants at Kings Place have seen a 25% rent increase this year reflecting the increased desirability of the Kings Cross/St Pancras area. Our forecasts include an expected rent increase of £155k p.a. starting part way through 2022/23 when our lease is up for renewal, and no relocation costs. The resulting total increase of £387k in CP3 is only half the cost of our office move in CP2. We have offset this with forecast efficiency savings in the general cost of running the business, including a target of £200k savings in IT costs over CP3.
Other: Concession	These costs are not railway-specific and relate to normal business expenditure that a similar organisation in any industry could be expected to incur. Costs include items such as audit, accounting software, rating agencies, corporate memberships, executive recruitment and training. Our forecast for CP3 has CP3 exit costs equal to CP2 exit.
Other: Railway	During CP2, we incurred £1.0m for the additional UKPNS EMMIS Control Engineers and the revised UKPNS performance regime. We absorbed these costs in CP2. However, these costs are part of our contract with UKPNS, so for CP3 they have been transferred to the UKPNS O&M and renewals cost category in pass through costs (a total of £0.5m per annum). The main costs included in Other: Railway are: ▪ £0.9m. for the rescue locomotive; ▪ £0.6m for Ashford IECC; and ▪ £0.9m for route-specific PR and marketing.

11.4.2. Pass through costs

Our forecasts of pass through costs for CP3 are shown in Table 47. As noted above, our forecasts exclude any costs which may be incurred in relation to a potential market test of the Operator Agreement in CP3; we would propose to recover market testing costs as a pass through cost and this is discussed in Section 16.6.2.

Table 47: Pass through costs forecast (£m, February 2018 prices)

	20/21	21/22	22/23	23/24	24/25	Total	CP3 exit v CP2 exit
Non-traction electricity	1.8	1.8	1.8	1.8	1.8	9.0	0.0
Insurance	3.0	3.0	3.0	3.0	3.0	15.0	+0.1
UKPNS O&M and renewals	5.9	5.8	5.8	5.8	5.8	29.2	+0.5
Rates	8.4	8.4	8.4	8.4	8.4	42.2	+0.0
Total	**19.1**	**19.1**	**19.1**	**19.1**	**19.1**	**95.4**	**+0.6**

We are expecting pass through costs in CP3 to remain broadly at CP2 exit levels. The differences from CP2 exit are:

- Transfer of additional costs for UKPNS EMMIS Control Engineers and the revised UKPNS performance regime from HS1 internal costs to pass through costs; and
- A small increase in insurance costs to reflect the revaluation of the HS1 assets for insurance purposes.

Section 4.4.4 discusses our work to minimise pass through costs in CP2. We will continue to focus on getting the best deal for our customers in CP3. Any savings will be fully passed through to customers.

Table 48 sets out the rationale behind the CP3 forecasts for each category of cost.

Table 48: Pass through costs in CP3

Cost category	Comments
Non-traction electricity	The forecast for CP3 is based on electricity price forecasts provided by our current supplier, npower, and volumes remaining constant at the CP2 level.
Insurance	We achieved significant reductions in insurance costs in CP2; overall we achieved an 18% saving compared with the CP2 efficient budget as described in Section 4.4.4. Our current insurance agreement locks in the price for the three years from November 2018 to November 2021, which includes the first 18 months of CP3. We have assumed we will be able to continue to procure insurance at this rate for the remainder of CP3 and that the rate will increase with RPI. The five year programme of revaluing route and station assets (discussed in Section 4.4.4.) will continue to 2023. There is a potential risk that this will increase the value of the assets and that this will lead to an increase in the insurance premium. We have included a small increase of £100k in November 2020 as a result of the revaluation process but no further increases beyond this during CP3.
UKPNS O&M and renewals	Fixed price contract with UKPNS (indexed to RPI) to 2057 to provide O&M and renewals of electricity substations and connections to HS1 catenary. The annual cost has increased by £0.5m from CP2 exit to reflect the cost of the additional UKPNS EMMIS Control Engineers and the revised UKPNS performance regime. As noted in Section 2.2.3.2, during CP2 we worked with UKPNS and DfT to improve and clarify the contractual documentation governing our relationship with UKPNS. The restated contract provides greater transparency, information flows, a revised performance regime and clarity on the measurement of outages. The revised performance regime includes both incentives and penalty payments and is designed to protect future performance in the context of an ageing asset. Performance is based on a loss of electrical supply, within the UKPNS network, which causes a delay or disrupts commercial services on HS1. A performance payment is due, unless UKPNS can prove its equipment responded as designed. The performance measure is outage duration, calculated as the time to restore power to the catenary system/point of use with a peak and non-peak element. There is an annual cap for both incentive and performance payments. We propose that all incentive and penalty payments under the UKPNS performance regime flow through to train operators as pass through costs and, to avoid double counting, the existing performance regime is modified to exclude the UKPNS-related elements of performance. Based on current UKPNS performance, we have included the full incentive payment (i.e. to the capped level) within our cost forecast.
Rates	There was a significant increase in business rates during CP2 as a result of the 2017 revaluation (as explained in Section 4.4.4). Business rates revaluation timing is changing from every five years to every three years meaning that there are likely to be two revaluations in CP3. The methodology for calculating business rates is *de novo*, meaning the methodology can change at each rates valuation. We have approached the

Cost category	Comments
	Valuation Office to get more certainty on future revaluations, and approached NRIL, Heathrow Express, Getlink and TfL (via its advisors), to create an industry group to engage on this topic. There was limited appetite for this early engagement. In the absence of any evidence to the contrary, we have assumed that the rates revaluations in CP3 will be on the same basis as the 2017 valuation i.e. a payments less receipts methodology. For CP3, we have therefore assumed that rates will continue at the CP2 exit level, increasing with RPI, as this is the main driver of our costs and revenues.

11.4.3. Freight costs

Forecast freight-specific O&M costs for CP3 are shown in Table 49.

Table 49: Freight-specific O&M cost forecast (£m, February 2018 prices)

	20/21	21/22	22/23	23/24	24/25	Total	CP3 exit v CP2 exit
NR(HS)	0.1	0.1	0.1	0.1	0.1	0.7	-0.2
NRIL Ripple Lane	0.2	0.1	0.2	0.2	0.2	0.9	0.0
HS1	0.1	0.1	0.1	0.1	0.1	0.3	0.0
Total	**0.4**	**0.3**	**0.4**	**0.4**	**0.4**	**1.8**	**-0.2**

As part of PR14, we discussed and agreed with ORR how freight mothballing costs should be treated. The costs of mothballing the freight-specific assets would not be avoided if no freight traffic operated on HS1, as under our Concession Agreement we are required to continue to look after and hand back assets in line with our asset stewardship obligations. The costs of mothballing the freight-specific assets are therefore excluded from the avoidable costs category and allocated to common costs. The cost associated with mothballing the freight-specific assets has been calculated as £182k per annum (£168k for Ripple Lane and £14k for other freight-specific assets).

Table 50 sets out the rationale behind the CP3 forecasts.

Table 50: Freight-specific O&M costs in CP3

Cost category	Comments
NRIL costs (Ripple Lane)	There is no change in total Ripple Lane costs or the treatment of mothballing costs compared with CP2. We are considering whether the costs associated with Ripple Lane could be reduced by NR(HS) taking over the NRIL contract. The contract with NRIL to operate, maintain and renew the freight assets at Ripple Lane exchange sidings includes £273k p.a. for operations, inspections, regular proactive and reactive maintenance and vegetation clearance. There is also a smoothed allowance of £70k p.a. for heavy maintenance works. Mothballing costs of £168k p.a. (as in CP2) are subtracted from total Ripple Lane costs, with the remaining cost charged to freight operators. In the freight charging calculations Ripple Lane costs are split between freight trains accessing Ripple Lane from HS1 and freight trains accessing Ripple Lane from the NRIL network in proportion to the number of trains operated.
NR(HS) costs	This is an allocation from total NR(HS) O&M costs of those costs which are specific to freight operations. NR(HS) freight-specific costs are calculated as a proportion of total NR(HS) O&M costs based on the number of trains, train weights and equivalent track-km. For CP3 this is a total cost of £130k p.a. comprised of £62k p.a. variable cost plus £68k p.a. avoidable cost.

Cost category	Comments
HS1 costs	This is an allocation from total HS1 costs of those costs which are specific to freight operations. We have reduced our forecast of HS1 costs allocated to freight to £50k p.a. (compared with £85k p.a. assumed in setting the CP2 freight charge). This reflects the reduced workload; at the time of PR14 we were actively discussing issues such as expansion of services, the need for a freight depot, and reviews of the performance regime.

11.5. Traction electricity costs

Traction electricity does not form part of our OMRC charges to train operators. Operators are charged separately for traction electricity on the basis of usage.

Traction electricity is a significant cost for operators, accounting for circa 20% of OMR costs. A key objective for us is therefore to minimise the unit cost of electricity through efficient procurement and reducing electricity consumption.

Forecast traction electricity costs for CP3 are shown in Table 51. This forecast is indicative only; train operators will pay for traction electricity on the basis of actual prices and train numbers/formations.

Table 51: Traction electricity cost forecast (£m, February 2018 prices)

	20/21	21/22	22/23	23/24	24/25	CP3 exit v CP2 exit
Total cost (£m)	20.8	20.2	20.1	20.1	20.0	-0.2

This forecast is based on the traffic volumes set out in Section 7.1.4 and electricity price forecasts provided by our current supplier, npower, which assume that we continue with our current purchasing strategy.

11.6. Energy Review

The energy requirements to operate trains on HS1 and HS1 infrastructure assets are a significant component of the overall costs faced by our customers. We pass energy costs on to our customers through traction electricity charges and non-traction electricity charges (for ancillary route equipment such as tunnel ventilation, signalling and Singlewell infrastructure maintenance depot). Traction electricity alone accounts for almost 20% of total route OMR costs. Energy costs are increasing – particularly non-commodity costs (network charges, taxes and levies imposed by government) that currently account for over 50% of the total electricity price. At the same time the cost of renewable energy is falling, and technological capability is growing rapidly.

We have been working closely with our customers and suppliers to review all aspects of energy usage and procurement in CP2 and activities we can undertake in CP3 and beyond to lower the energy burden on our customers.

The HS1 Energy Review has been a root and branch review of how HS1 assets use energy now and options for the future. The review includes how operators use power on our network and opportunities such as regenerative braking, metered billing and renewables. The review has been split into four areas:

1. Optimising current HS1 infrastructure;
2. Opportunities for infrastructure enhancements;
3. HS1 energy purchasing; and
4. Opportunities for operators.

As part of this review, we commissioned UKPNS to develop an Energy Strategy for the HS1 network (route and stations). The UKPNS analysis focused on two main aspects:

- A review of energy usage and procurement; and
- Identification of technology-led initiatives that could reduce energy costs.

UKPNS also prepared a roadmap setting out when the identified technology initiatives could be implemented.

The UKPNS Energy Strategy report is provided as a supporting document and recommendations from the report are included below.

The remainder of this section summarises the Energy Review and sets out opportunities for the future.

11.6.1. Optimising current HS1 infrastructure

11.6.1.1. System usage

When HS1 was designed the specification was to provide:

- A high level of power to meet the demands of forecast services;
- Extreme reliability of supply; and
- A dedicated local supply to the network as existing infrastructure was insufficient to meet the requirements of HS1.

UKPNS has previously undertaken studies to review system usage within the HS1 traction power supply system and shared the results with train operators. For PR19, we appointed SNC-Lavalin (SNCL) to examine system usage, building on the UKPNS studies, and presented findings to the December 2017 stakeholder workshop. The main findings are summarised below.

The 17% system usage for HS1 is not comparable to the circa 6% system usage for the NRIL network. NRIL connects directly to the local supply and system usage is measured from the local supply to the railway. Connection to the local supply was not an option for HS1. On HS1, traction electricity is supplied directly from the National Grid at 400kVa and system usage is measured from the National Grid to the railway.

Connecting directly to the National Grid gives the high resilience required for HS1 (20km of the route is in tunnels and the safety case is based on this resilience). However, the National Grid connection requires additional power conditioning equipment to transform the voltage and protect the quality of supply. This additional equipment is power-hungry and accounts for the majority of the difference between NRIL and HS1 system usage. In other respects, the HS1 line is similar to the most efficient NRIL infrastructure.

Potential ways to reduce system usage have been examined a number of times and presented to stakeholders. In particular, the UKPNS study looked at where energy was being used and ways of reducing consumption by switching off back-up systems. De-energising one or more of the feeder stations (but retaining for immediate availability in case of failures of other infeeds) would reduce the reliability of supply, require safety case review and increase maintenance cost. Disconnecting alternate autotransformers would have similar issues but a smaller saving. These options are considered to import too much risk for the relatively small annual savings that could be achieved.

For these reasons we have not taken this potential cost reduction option forward at this time but we remain open to considering opportunities in this area.

11.6.1.2. Sub-metering project

HS1 has a large low voltage private network transmission system that supplies various types of infrastructure and different end users within each of the four stations and adjacent route buildings. While we bill users for their use of electricity through a range of meters, the meters themselves supply several pieces of infrastructure and do not provide enough detail to break down the use of specific buildings – for example between stations and HS1 buildings. The sub-metering project is in its early stages and will give us the capability to bill each user more accurately for their use.

11.6.2. Opportunities for infrastructure enhancements

We have been working with customers and suppliers during CP2 to consider potential infrastructure enhancements that could be pursued to either reduce the energy burden on customers or provide commercial opportunities that increase the overall value of the DfT concession.

The UKPNS Energy Strategy report identified low carbon and emerging technologies that could be applied to the HS1 network and tested their

feasibility for each of the main HS1 sites (depots, stations and grid supply points) through a process of technical scrutiny and financial modelling. The technologies considered were solar photovoltaics (PVs), wind energy, battery storage, electric vehicle charging, combined heat and power, energy from waste and community energy.

The initiatives for the HS1 route which UKPNS considered to be technically feasible and which had a positive business case are summarised in Table 52. UKPNS also made recommendations for HS1 stations, mainly for electric vehicle charging points and solar bays.

Table 52: Potential infrastructure enhancements for the HS1 route

Initiative	Capex	Payback (years)	IRR (over 15 years)	Annual carbon emissions reduction ($tnCO_2$)
Singlewell depot				
Installation of 100kW wind turbine	£350k	11.1	9.2%	83
Installation of 150kW ground-mounted solar PVs	£120k	9.6	12.1%	45
Temple Mills depot				
Installation of 720kW roof mounted solar PV	£605k	12.2	10.9%	215
Extension of roof-mounted solar PV to 1,800kW coupled with 1MW/1.5MWh Li-ion battery	£2.8m	10.2	10.4%	495
Singlewell grid supply point				
Installation of 1,500kW ground mounted solar PV	£1.1m	12.8	9.5%	448
Sellindge grid supply point				
Explore synergies with nearby solar PV plant	Qualitative analysis only			

UKPNS analysis suggests that these initiatives could be implemented in CP3, with the exception of the extension initiative at Temple Mills depot which could be implemented in CP4. In the remainder of CP2 we will continue to progress work on these initiatives.

11.6.3. HS1 energy purchasing

UKPNS reviewed and validated our current energy purchasing strategy, concluding that it represents a reasonable balance between risk and best prices.

11.6.3.1. Contracts

In CP2 there was a major change in the way we purchase electricity. In CP1, we purchased electricity directly from NRIL who passed through the cost set out in their contracts (a legacy dating back to how HS1 was set up). Under this approach, although we had the benefit of receiving the preferential rates NRIL received as one of the largest electricity users in the UK with significant bulk buying power, we had no direct contractual relationship with energy suppliers.

We have moved from purchasing electricity under the main NRIL purchase agreement to purchasing our electricity on a standalone basis. In 2014/15 we joined the NRIL process to procure a new electricity contract with npower following a competitive (OJEU) tender. This approach enabled us to leverage the buying power of NRIL in the procurement process but gave us scope to enter into a direct contract with the electricity supplier. The contract with npower runs throughout CP2 with the option to extend beyond the initial period (2015-2020).

Extending the current contract with npower into the “Rolling Period” (2020 – 2025) is our preferred option for CP3 as we would continue to benefit from the preferential terms of the existing contact. Should a subsequent decision be made to terminate, this could be done during the Rolling Period with three months’ notice and electricity could be sourced from another provider if there was a net benefit in such a course of action.

The UKPNS Energy Strategy report recommended that for future energy contracts, we should continue with a joint procurement approach (“energy

aggregation") with NRIL or another appropriate organisation to achieve competitive rates.

We are actively considering how we might procure our energy supplier beyond 2025 including repeating the process with NRIL or utilising other frameworks and would welcome customer input as part of our decision making.

11.6.3.2. Purchasing process (commodity price)

Under the electricity supply contract with npower we have a number of choices for how energy is purchased including the level of risk we will accept, the degree of complexity of the purchasing process and the degree to which renewable energy is a component of the strategy. Given that the cost is passed through to our customers, we place significant weight on their views in determining which strategy to adopt. At the start of the npower contract we worked closely with our customers to agree a purchasing strategy, and this will only be changed with their agreement. Our customers (particularly EIL and LSER) said they wanted a purchasing strategy that:

- Was as low risk as possible with a focus on certainty rather than volatility in prices;
- Was as simple as possible and therefore not focused on direct input into energy trading, hedging or other dynamic opportunities to manage energy costs more directly with npower; and
- Would not focus on the use of renewable energy unless it becomes a cheaper option than standard non-renewable rates.

The purchasing strategy sets the parameters for npower to leverage its specialist experience and capability in purchasing wholesale electricity on our behalf and guarantees that the specified budget will not be exceeded. It follows a low risk approach to the market whereby the majority of the volume is purchased seasonally with the aim of minimising the exposure to prompt market volatility. The aim is to continuously build on the open position, purchasing small amounts each month in order to achieve a market average with the budget overlaying the strategy to ensure the position is closed out before the market moves up significantly.

We review the purchasing strategy every six months in conjunction with customers. Customers have advised they want us to maintain the approach agreed at the start of the contract.

We remain open to changing our approach to purchasing under the current contract and note there are potential opportunities for cost savings if operators agree to take on some risk and move away from the current approach, for example, greater scope to forward purchase and hedge against market movements.

11.6.3.3. Purchasing options (non-commodity)

To date, the focus of the purchasing strategy has been on the wholesale commodity price as opposed to the non-commodity price of electricity. The non-commodity price of electricity reflects a series of charges imposed by government on all energy consumers; it is greatest at peak hours in winter (weekdays 16.00 – 19.00). The non-commodity price represents a very significant proportion of the total cost of electricity; it is currently over 50% of the total price and is projected to increase.

Given customer requirements and the way power comes into the HS1 network (see above) it is virtually impossible for us to reduce the demand for power during peak winter periods without significant infrastructure enhancements such building energy storage facilities than can charge during off peak periods and release energy into the network during peak periods. We have worked with npower and UKPNS to consider options for battery storage; there is currently no commercial business case for this.

For this reason we are not proposing to invest in infrastructure enhancements to manage peak pricing costs in CP3.

11.6.3.4. Available Supply Capacity reduction

Many of the non-traction railway assets do not require the current levels of Available Supply Capacity (ASC) that are held for their use; for example an asset may have an ASC of 500kVa but only ever achieve a maximum usage of 200kVa. The excess ASC introduces a cost in the short term although it may be required in the longer term. We worked with Entech to review 17 key non-traction assets to assess whether there are

opportunities to reduce the ASC and therefore reduce costs. The work with Entech identified a range of opportunities across these assets that could lead to savings of around £1.2 million per year. This mainly relates to stations, the potential savings for the HS1 route are circa £100k per year. We can only give up the agreed ASC with the agreement of DfT.

At this stage DfT believes the current ASC should be maintained as part of the asset condition at handback at the end of the concession. For this reason we are not pursuing this option further.

11.6.4. Opportunities for operators

The Energy Review considered two opportunities for operators that could significantly improve the energy burden they face - regenerative braking and the use of meters on trains to more accurately record energy usage and influence behaviour.

11.6.4.1. Regenerative braking

An initial study by UKPNS concluded that if regenerative braking on HS1 was enabled for both the LSER Class 395 fleet and the Eurostar Class 374s, modifications to the Sellindge feeder station would be required to handle the maximum power fed into the grid (with a preliminary cost estimate of £4.4 to 5.0m). Further analysis showed that regenerative braking could be enabled for the Class 395 fleet in isolation, without the need for modifications to the Sellindge feeder station. This is a low cost option to reduce electricity consumption and carbon dioxide emissions.

We therefore developed a business case for enabling regenerative braking for the Class 395 fleet. This does not preclude wider roll-out once the Sellindge feeder station has been modified.

Enabling regenerative braking for the Class 395 fleet would not require any physical changes to the HS1 infrastructure. It would require infrastructure and train safety approvals, further traction power system studies, a traction system monitoring strategy, software modifications to the Class 395 trains and proving trials.

The project is estimated to cost £1.49m plus 30% contingency, giving a total of £1.94m. The annual saving from reduced energy consumption is estimated to be £1.3m, resulting in a payback period of 18 months. The estimated saving in carbon dioxide emissions is 3,500Te per year.

We have presented the findings of the studies to stakeholders. In 2017, the business case for the Class 395s was presented to DfT. The project is currently on hold during the Southeastern refranchising process. We will continue to work with DfT and the domestic train operator to progress this project during the remainder of CP2 and CP3. In CP3, we will also develop a business case for enabling regenerative braking on the Class 374 fleet.

In the current refranchising process **we have included the business case in information available to bidders and expect DfT and the successful bidder will put in place the necessary requirements, so this opportunity can be taken forward in CP3.**

11.6.4.2. On-train metering

All EIL and LSER trains include the ability to meter their electricity usage although concerns have been raised about their accuracy. In addition to metering usage from the network the meters can also be used to understand the specific energy consumption of each trainset, including for example if they are being used economically. Metering can also be used to measure the benefits of regenerative braking noted above in terms of what each train is putting back into the system.

We currently pass through energy costs to customers based on a modelled approach to usage. **We remain open to a metered billing approach for each customer if there is sufficient evidence that meters are accurately reflecting usage and overall system usage is also taken into account.**

11.6.5. Energy Review summary

Table 53 summarises the findings of the Energy Review.

Table 53: Energy Review summary

Area	Review	Findings	Comment
Infrastructure design	SNCL	Potential opportunities to reduce system usage but agreement with operators that potential risks outweigh benefits	No further action
Infrastructure enhancements	UKPNS	Low carbon and emerging technology solutions which could be applied to HS1 route to reduce cost and carbon emissions	Review in the remainder of CP2 and CP3
Purchasing contract	UKPNS	Opportunity to consider other framework arrangements in 2025	Review with operators during CP3
Purchasing strategy	npower	Opportunities to hedge forward purchases not being taken	HS1 to review purchasing strategy with operators
Available Supply Capacity	Entech	Opportunities to reduce ASC	With DfT in the context of asset handback / asset requirements
Regenerative braking	HS1/UKPNS	Significant opportunity with short payback	With operators and DfT
Metered billing	HS1/operators	Opportunity to move away from modelled approach for traction electricity	With operators

12. Renewals

12.1. Overview

HS1 is now over 10 years old. As the asset ages, renewals volumes will increase and the challenge for us is to transform into a renewals delivery organisation. To meet our longer term asset stewardship obligations and keep the railway operating with high performance levels, we need to understand the long term renewals requirements and their potential impact on the railway and actively manage the risks associated with the delivery of renewals.

For our PR14 consultation we developed two renewals options. The Baseline option was developed on the basis of practice and knowledge at the time as set out in the ASPs. The Asset Stewardship option was more uncertain; it reflected the potential for moving towards a condition-based approach to renewals, used engineering judgement to extend asset life assumptions, anticipated future changes in technology that could lower unit cost rates and incorporated a broad "technology improvement" efficiency overlay. This resulted in a lower renewals annuity than the Baseline option. The Asset Stewardship option was used to calculate the renewals charge. We noted that this would be revisited at each periodic review as we develop a more detailed understanding of asset ageing.

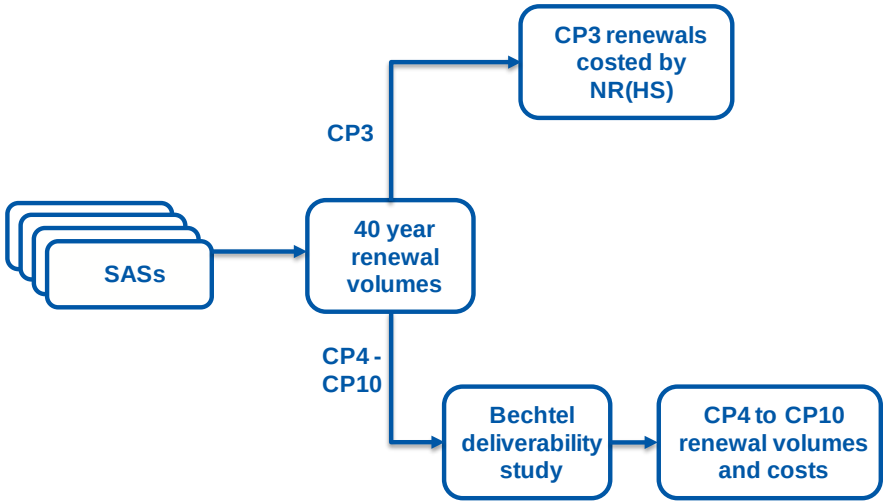
During CP2, NR(HS) has replaced the ASPs with SASs which represents a significant improvement in asset management maturity. The SASs include updated renewals volumes based on improved data collection and analysis to inform understanding of asset degradation and renewal timing.

Also in CP2, in preparation for the step change in renewals that will be required from CP4 onwards, we have commenced detailed upfront planning for the renewal of the HS1 railway infrastructure for the next 40 years. As a first step, we commissioned Bechtel to undertake a deliverability study to develop a costed plan for the 40-year renewals workbank. This study updates renewals volumes and costs taking into account the deliverability of renewals and enabling works; it identifies dependencies and includes plant, mobilisation, resources (labour and material), life extension of assets, integration of works (on and off network) and efficient use of access. This is a step-change in our capability and the sophistication of how we forecast future spend. By strategically planning this work ahead of time, we are in a unique position to challenge the industry to move high speed line renewals forward and make a real and lasting difference. Further detail is provided in Section 12.4 and the Bechtel report is provided as a supporting document to this 5YAMS.

This is part of our overall journey to asset management maturity. Our challenge for the remainder of CP2 and CP3 is to review and implement the recommendations in the Bechtel study and progress the renewal strategy to a development project.

The process we have used for developing the renewals volumes and costs for this 5YAMS is summarised in Figure 24.

Figure 24: Process for renewals volumes and costs



The 40-year renewal volumes (CP3 to CP10) are based on the NR(HS) SASs (see Section 12.2). NR(HS) has costed the CP3 renewals (see Section 12.3). The CP4 to CP10 renewals volumes were an input into the

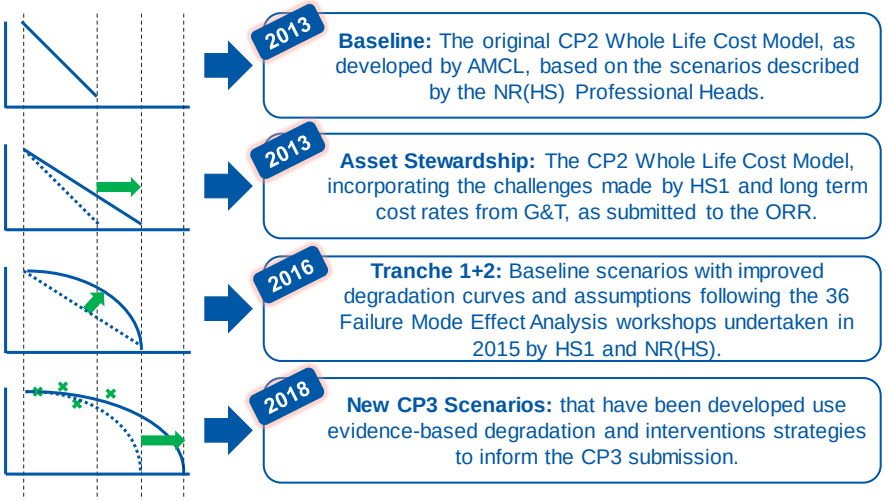
Bechtel study which looked at the deliverability of the renewals programme from CP4 onwards (see Section 12.4), providing updated renewals volumes and cost estimates from CP4 onwards (see Section 12.5).

Renewals costs are 'lumpy'; we use a renewals annuity arrangement to smooth the funding of renewals spend over time. The renewals annuity is calculated on a rolling 40-year basis and is reviewed in each periodic review. The methodology for the calculation of the renewals annuity and the level of the annuity proposed for CP3 are discussed in Section 12.6.

12.2. Renewal volumes

The first stage in the process is the review and update of the 40-year renewals volumes by NR(HS) in the SASs. Figure 25 summarises the improvements in renewals planning since PR14.

Figure 25: Improvements in renewals planning



For PR19, NR(HS) has revised asset service lives following engineering assessments which take into account the original design calculations, current performance and condition, historical failure rates, the age of the assets, obsolescence. operational context, environmental exposure and capability, research findings and experience from other infrastructure managers. These asset service lives form the basis for the 40-year renewal plan.

A summary of the renewals strategy by asset type is set out in Table 54. Section 6 of the SASs set out the details of the CP3 renewal plan and the 40-year renewal plan for each asset type.

Table 54: Renewal strategy by asset type

Asset type	Renewal strategy
Track	Renewals are largely condition-based, driven by tonnage, operational risk and deliverability.
Civils and Lineside Buildings	The primary driver for renewals is condition and/or predicted asset life based on asset performance. Where suitable for low risk, short life assets, a fix-on-failure strategy has been adopted. For specific assets, alignment to the trespass strategy is also taken into account.
Signalling and Communications Systems	Obsolescence is a major factor. ▪ Signalling system renewals are driven by obsolescence and/or condition and/or end of life. ▪ Control system renewals are driven by obsolescence. ▪ Communication system renewals are largely driven by obsolescence. Certain assets which degrade physically require condition-based renewal.
Overhead Contact System	The primary driver for renewal is asset condition. There is little or no redundancy and therefore intervention should take place before a failure. A large proportion of replacements/repairs are part of routine maintenance.
Traction Power Supply	In general, the renewal strategy is to replace assets when they fail, owing to the inherent redundancy in the system. AC/DC transformer compounds are subject to predictive renewals as a result of inspection.
Mechanical and Electrical	The primary driver for renewal is asset condition. For critical systems obsolescence is a key driver for renewal.

CP3 renewals are discussed in more detail in Section 12.3, CP4 -CP10 renewals are discussed in Sections 12.4 and 12.5.

12.3. CP3 renewals

12.3.1. CP3 renewals portfolio workbank and costs

The SASs set out the renewals workbank for CP3 for each asset discipline. NR(HS) adopted the NRIL approach to cost planning and engaged Mott MacDonald to estimate the pre-Gate 1 price, through the application of Cost Planning Principles and Rail Method of Measurement (RMM). The costs were validated by NR(HS) Professional Heads and included allowances for feasibility studies, design, procurement, project delivery, overheads, mark-ups and inflation. A risk allowance was applied to the base cost estimate for each project. We believe that this approach is reasonable and the use of Mott MacDonald to help in the preparation of the estimates is a significant improvement on the approach taken to the development of the CP2 renewals portfolio.

We met with NR(HS) three times to review the proposed renewals projects, considering the following:

1. **Evidence to support the scope of work:** in the SASs or in supporting documentation such as maintenance records. If evidence did not support the need for renewal, then the project was removed.
2. **Challenging the level of contingency:** the initial NR(HS) costings used standard levels of contingency based on gate stages from RMM. The review considered whether a lower level of contingency was appropriate for specific projects.
3. **Making use of CP2 experience:** the review challenged NR(HS) to make better use of experience from renewals projects in CP2 to inform CP3 renewals planning.

These reviews resulted in successive reductions in the CP3 renewals costs (as shown in Table 21 of the NR(HS) 5YAMS).

We consider the need for renewal is well evidenced for about 90% of the proposed projects but there are a number of projects where NR(HS) has not yet produced engineering evidence to support the proposed renewal:

- E&P: we have not seen any engineering evidence to support the proposed renewals for the tunnel ventilation M&E systems, HVAC equipment, IT compensation equipment and cross-passage doors. This is of particular concern for the tunnel ventilation systems where the minimum design life is 25 years.
- S&CS: there is insufficient evidence to support the proposed renewal volumes for modboxes, ERS/EZP and local release command and the proposed repair methodology for the fibre optic aerial earth cable.

We recognise that scope will be clarified as these projects progress through the project process.

The level of contingency that has been applied to each project follows the RMM proposed approach. NR(HS) is expecting to deliver 13 of the renewals projects early in 2019/20 so we would expect to see the contingency figures reducing as projects approach Gate 4.

Table 22 of the NR(HS) 5YAMS sets out NR(HS)'s cost estimates for 80 projects categorised as:

- Under Development;
- Enhancement;
- Innovation;
- Renewals (Provisional Sum);
- Infrastructure Renewals; and
- Plant Renewals.

The table also includes the costs of the NR(HS) High Speed Projects function, split into High Speed Projects function (Renewals) and High Speed Projects function (Other Projects).

We discuss each of these categories below.

Under Development: There are two projects in this category which we believe are an ITCS data preparation tool and works associated with the tunnel ventilation control system. We have agreed with NR(HS) that as the requirement for the data preparation tool is driven by project-related change to the railway then the project requiring the change will need to

fund this. We have identified that the work on the ventilation control system is a construction defect and are now pursuing this with the original construction contractor. We have therefore excluded these projects from our CP3 renewals portfolio costs.

Innovation and Enhancement: NR(HS) has proposed 17 innovation projects and one enhancement project. These are not renewals. We have reviewed the schemes and do not believe that there is a strong financial business case for any of the projects proposed. There may be some safety benefits to be realised for some of the schemes but our view, based on the information reviewed, is that not many of these schemes are likely to be taken forward. Whether these projects proceed and how they will be funded will be determined on a case by case basis in consultation with stakeholders. We have excluded these projects from our CP3 renewals portfolio costs.

Renewals (Provisional Sum): There are six projects in this category. These are projects where we have agreed with NR(HS) that the need for the work is likely to be driven by rapidly deteriorating condition or a sudden unexpected failure prompting the need for a renewal. There is currently no evidence that the renewal will be required in CP3, but NR(HS) is concerned that the asset might fail. We have agreed with NR(HS) that we will not seek funding for these projects through the renewals annuity and have excluded them from our CP3 renewals portfolio costs. Should the condition of the asset deteriorate such that renewal is justified during CP3, we will need to agree with ORR a mechanism to move these projects into the renewal portfolio.

Infrastructure Renewals and **Plant Renewals:** NR(HS) has identified 49 infrastructure renewals projects and five plant renewals projects and we have included the costs for all of these projects; the total cost for these projects, exclusive of risk, is £73.5 million including the 10% NR(HS) mark-up allowed under the Operator Agreement.

We are in discussion with NR(HS) about the right level of contingency to be applied to the CP3 renewals portfolio. The NR(HS) 5YAMS includes £37.2 million of risk for infrastructure and plant renewals (a 50% uplift on the base cost for the CP3 renewals portfolio).

The risk for the CP3 renewals portfolio has not been calculated in accordance with any recognised method of calculating portfolio risk. Risk uplifts of between 40% and 60% have been applied to almost every project and the NR(HS) risk figure of £37.2 million is simply the sum of the risk allowances for each project. We disagree that this outcome would materialise in practice. By comparison, the risk allocation model employed by NRIL as part of PR18 resulted in an average risk uplift of 8.5% for its portfolio of operations, maintenance and renewals.

The risk weighting of the portfolio is inconsistent with our experience of portfolio cost overrun in CP2. Where we have information from CP2 renewals and have been able to compare costs to similar CP3 costs provided by Mott MacDonald, the base project costs that have been provided appear overly cautious. The application of a 40% to 60% risk uplift to a high base cost figure will lead to the creation of a risk pot that will be higher than required.

High Speed Projects Function: We have included the element identified as Renewals but have excluded the element identified as Other Projects as it relates to Under Development, Enhancement and Innovation projects, all of which we have excluded.

The total cost for the 49 infrastructure renewal projects and five rail plant renewal projects, including NR(HS)'s 10% mark-up and the High Speed Projects function (Renewals) costs are summarised by asset discipline in Table 55. The 54 projects included and estimated costs are listed in Appendix 4.

Table 55: CP3 renewal projects and cost (February 2018 prices)

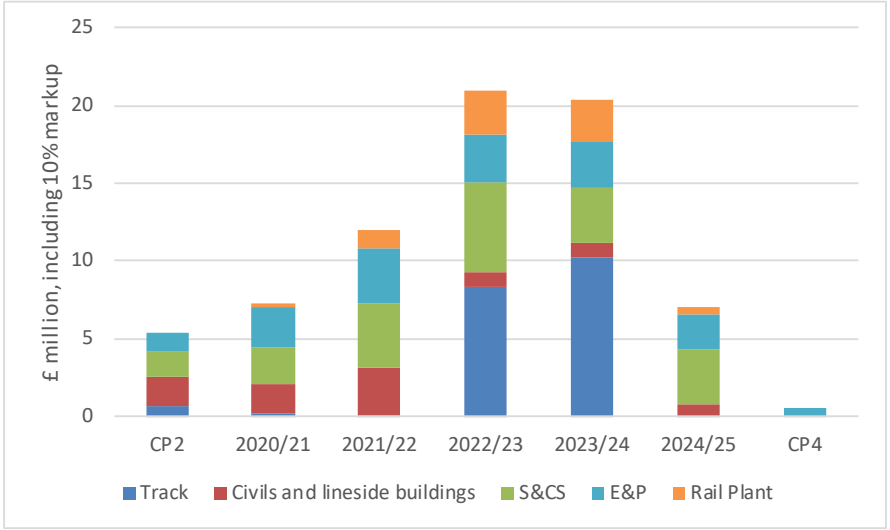
Asset discipline	Number of projects	Total cost exc. risk (£m)	Total cost inc. risk (£m)
Track	4	19.4	28.1
Civils and lineside buildings	13	9.6	15.4
S&CS	12	21.1	30.6
E&P	20	16.0	25.7
Rail Plant	5	7.4	10.8
Subtotal	**54**	**73.5**	**110.7**
PMO team		9.4	9.4
Total		**82.9**	**120.1**

In the calculation of the renewals annuity we have used the cost of projects categorised as Infrastructure Renewals and Plant Renewals excluding risk, i.e. £82.94m. NR(HS) is reviewing the CP3 renewals costs presented in the NR(HS) 5YAMS and will provide an update during the consultation period.

Figure 26 breaks down the NR(HS) forecast of CP3 renewals costs, excluding risk, by asset type and year.

It should be noted that NR(HS) is intending to bring forward 13 projects from the CP3 renewals workbank to CP2; these projects relate to assets which are failing earlier than expected and where the risk of failure is such that the work needs to be completed sooner.

Figure 26: CP3 renewals by asset type and year



NR(HS) will continue to work through the project process for the CP3 renewals, developing gate papers for the agreed workbank. By March 2020, the aim is to have more projects at Gate 4 and greater confidence in the portfolio price. This will form the price against which the CP3 renewals will be monitored. To ensure continuity of work through the CP2/CP3 transition, schemes identified as critical for implementation early in CP3 will have scope and delivery methodologies developed by the end of CP2.

12.3.2. CP3 project delivery

In CP2 to date, NR(HS) has made improvements to its projects capability and processes. It has improved its project controls function, brought in specialist rail project delivery expertise to help develop project scope and developed a new project process (similar to the HS1 process) which is to be rolled out in the near future.

In preparation for CP3, NR(HS) has developed a CP3 Project Delivery Strategy which forms part of the NR(HS) 5YAMS.

NR(HS) will continue to build the capability of its High Speed Projects function to provide management; programming of design; cost forecasting and financial arrangements; commercial processes; planning and scheduling of construction works; materials procurement and delivery; supervision of control of contractors and any in-house delivery staff; and contract management. The High Speed Projects function will consider the capacity and capability of internal, NRIL and supply chain resource in determining the appropriate delivery and contracting methodology for the CP3 portfolio.

To inform the Delivery Strategy, NR(HS) commissioned an independent deliverability review of CP3 asset plans which considered:

- Asset type/intervention and the complexity of the scheme;
- Access requirements;
- Logistics/engineering train requirements;
- Interfaces/dependencies with operators and other stakeholders;
- Integration with other asset interventions; and
- Capability of NR(HS) to undertake these schemes.

As a result of this review, the CP3 portfolio has been packaged into nine delivery packages.

NR(HS) recognises the need to change its approach to project delivery. To deliver a growing renewals workbank, NR(HS) will need to define a delivery strategy in readiness for CP3. Delivery of CP3 renewals will be by a combination of internal delivery, traditional approach (construction and design managed by separate parties) and design and build (construction and design managed by one supplier).

Given the changing nature of the workbank in CP3, NR(HS) recognises the need to develop a robust contracting strategy that recognises the nine delivery packages identified through the deliverability review and supply chain constraints. NR(HS) has assessed opportunities for reducing the number of contracts, and contracting organisations, to deliver the works. This would improve efficiency by reducing interfaces, management time and complexity and better incentivise the contracting organisations.

We recognise that NR(HS) is building its capability, and we are supportive of its approach, but we have yet to see firm plans for how NR(HS) will deliver in CP3. We have formally requested a plan which shows how NR(HS) will develop its project capability over the next six months against which we can measure them.

12.3.3. CP3 renewals governance

We appointed Arup to carry out an independent review of the renewals project governance and control processes for the HS1 route and stations and to provide recommendations for improvements in CP3.

Arup reviewed the existing processes, templates and reporting methods, and interviewed key stakeholders (HS1 Ltd, ORR, DfT, NR(HS), EIL, LSER and EMT) to understand their requirements, their views on what works well in the existing process and what could be improved.

The review noted the significant progress made in CP2 and this was recognised by stakeholders. There are some clear strengths with the current processes and there is unanimous agreement from stakeholders that recent improvements have set the correct course for the future.

Arup made recommendations for governance improvements which would preserve the existing strengths and deliver further enhancements. The recommendations broadly covered improvements to governance processes and reporting, greater transparency and increased involvement of operators. In addition to the Arup recommendations, ORR has suggested we consider the establishment of an independent review body; we will review this with ORR and agree whether to put in place for CP3.

The recommendations from the Arup review are set out in Appendix 5, along with our proposed responses and plans to take forward the recommendations. We intend to request feedback from stakeholders on both the Arup report and our proposed responses.

The Arup report “HS1 Renewals Programme: Governance Handbook Report” is included as a supporting document.

12.4. Deliverability of 40-year renewals

As the HS1 asset ages, there will be a step change in renewals requirements with large volumes of renewals required in later control periods. In preparation for this, we appointed Bechtel to help develop our renewals plan, in particular:

- To confirm that the renewals are deliverable with limited disruptive access;
- To develop the HS1 Plan – a high-level master plan for the renewals workbank with an estimated cost; and
- To make recommendations for further development.

We chose Bechtel as the preferred supplier on the basis of their knowledge and understanding of the HS1 route through construction, the database of cost and asset knowledge on which they can draw and their global experience of project and renewals activities. As part of the study, Bechtel engaged with international organisations to understand renewal volumes, plant, labour, training, engineering processes, productivity rates and procurement structures in high speed line renewals, particularly in France and Spain.

The building blocks for the renewals masterplan are three interconnected models: the Workbank Model, the Access Model and the Execution Model.

- The **Workbank Model** determines the optimum time for asset replacement to build up a complete workbank, taking into account asset design life, actual asset condition, railway performance and deliverability factors (access, activity duration, procurement, safety). The 40-year renewal plan and the SASs were provided by NR(HS) as inputs for the development of this model. NR(HS) is working on improving and developing the SASs and the 40-year renewal plan; Bechtel presented recommendations for improvement in the areas of standards, data collection, data analysis and process to allow optimisation of the Workbank Model in the future.
- The **Access Model** sets out a "base case" for the delivery of the renewals within the available access. It defines engineering access periods taking into account the optimisation of time and space, the duration of work periods, whether single-line working is possible, and any potential timetable impact post-possession. The philosophy of the 7-day railway provides the framework for the HS1 Plan incorporating renewals time into the timetable to enable revenue service every day.
- The **Execution Model** defines how the renewal works could be delivered by optimising the combination of labour, plant and construction method. The execution methodology for each asset type examines the optimal delivery of renewal works and presents detailed labour and plant requirements. This moves on from the 40-year plan developed by NR(HS), with renewals on an asset by asset basis, to present a campaign strategy for renewal activities with assets clustered together in the optimal execution method. This strategy focuses on exclusivity of plant and labour, and attracting the leading talent in the country.

The renewal methodologies were developed in line with the 2040 renewal mission which aims to implement renewals within the current available engineering access periods within the timetable, including and accounting for potential impacts of single line working. Access constraints defined the volumes, plant and labour requirements. The methodology focuses on using high output plant and methods to combine a safe, productive and efficient working environment with continuing record customer service. The study also proposed options for potential locations for conducting the logistics of the renewal operations.

The report includes an integrated programme and detailed possession plan for CP4 and a high level costed masterplan covering all disciplines and renewal activities from CP5 to CP10. It uses pessimistic volumes to build in contingency and allow flexibility in planning the works.

We challenged Bechtel to provide aggressive productivity assumptions in terms of how renewals would be delivered. **The proposed volumes and productivity rates are in line with international industry practice, which approximately triples the volumes traditionally achieved in the UK.** The study focused on providing innovative, but achievable, solutions that will allow us to implement the renewal programme with minimal disruption to operational service. It verified that performing the works without disrupting the service is largely achievable and defined the challenge to the supply chain for the elements of work for which this is not currently achievable.

The deliverability study also presents an approach for the operational and organisational changes required to support the successful optimisation and delivery of the HS1 Plan.

The Bechtel report presents the optimal execution approach based on the asset information available at this time. The models which form the building blocks of the renewals programme allow us to understand how the programme was built up, to test options and to update the high-level masterplan to reflect additional asset information, changes in asset performance and the operating model of the railway.

The deliverability study is the starting point for our long term renewals planning and preparation, setting out an integrated plan and building blocks for successful delivery. In CP3, we will continue to develop the elements of the detailed integrated plan in readiness for the execution of the works from 2025, engaging with stakeholders, shareholders and the supply chain. We will review the operating concept to ensure we have the right infrastructure to support renewals delivery, the right competencies and skills and the right plant. We will drive the rest of the industry to innovate to deliver ambitious productivity improvements and to address the key challenges identified in the deliverability study. We have made a provision of £5.6 million in our renewal costs forecast to fund this preparatory work during CP3.

12.5. 40-year renewals costs

12.5.1. CP4 to CP10 renewals costs

The **Rate Book** in the deliverability study uses the building blocks in the Workbank, Access and Execution Models (access requirements, volume of work, construction sequencing, plant and labour requirements) to develop bottom-up cost estimates for each renewal activity. These preliminary cost estimates are Class 5[1] estimates - indicative / conceptual estimates with a -50%/+100% level of accuracy.

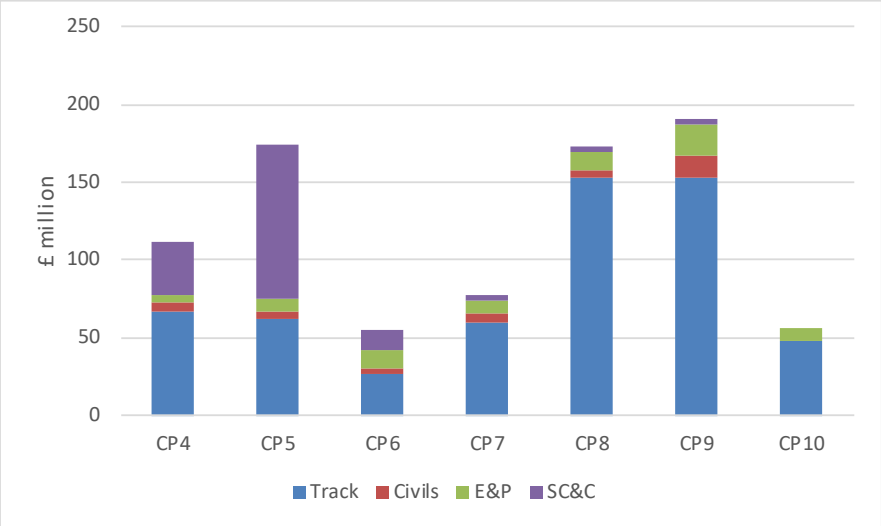
The deliverability study does not include ERTMS. In PR14, we categorised the transition to ERTMS as a Specified Upgrade. During CP2, we commissioned SNCL to undertake a study on the future train control system for HS1. The study concluded that replacement will be driven by obsolescence of the existing system, with continued support for this system closely linked to the plans for the French network. SNCL considered a variety of mainline signalling systems and communications based train control systems; the preferred option was to replace the existing system with ERTMS Level 3. As the train control system needs intervention because it is obsolete, this would be classed as a renewal and it has been included as such in our 40-year renewal plans (Section 14 explains how we determine whether works are classified as a Specified Upgrade, upgrade or renewal). We anticipate introducing ERTMS in CP5 with an estimated cost of £90m and have included this cost in our long term renewals costs.

In July 2018, we signed a collaboration agreement with Getlink, SNCF Réseau and Infrabel to coordinate the deployment of ERTMS on our respective networks. We have committed to a common strategy on ERTMS implementation with the aim of sharing information and expertise, selecting a uniform technical system and working to a common deployment schedule. This cooperation will deliver efficiencies by maximising economies of scale and an optimised final result, which will benefit train operators and ultimately passengers. Service introduction is anticipated by 2025 in France and the Channel Tunnel, by 2030 in Belgium and by 2032 on HS1.

Renewal costs by asset type and control period, including ERTMS, are summarised in Figure 27.

[1] In accordance with the guidelines published by the Association for the Advancement of Cost Engineering International (AACE) Recommended Practice (RP) 17R-97 “Cost Estimate Classification System” and 18R-97 “Cost Estimate Classification System”.

Figure 27: Renewals by asset type and control period



The deliverability study considered four delivery models:

- UK Base Case (current model);
- UK Major Projects model;
- UK Major Projects with delivery partner; and
- Integrator Model: removes Tier 1 suppliers, an experienced Delivery Partner with Principal Contractor Licence is responsible for integrating the work of Tier 2 suppliers.

The total cost estimate will depend on the delivery model we adopt for the execution of the works. **Bechtel recommended the Integrator Model as the most efficient model (Bechtel estimated that it is 33% more efficient than the UK Base Case)** and this model has been assumed in developing the CP4 to CP10 renewals costs.

The total costs for CP4 to CP10 renewals were built up as follows:

- **Direct costs:** plant, labour and materials to deliver the renewal volumes (the **Rate Book** in the deliverability study).
- **Tier 2 management and fee:** 10% of direct costs. The Tier 2 contractor is responsible for the delivery of the works. Includes management, engineering, accommodation etc.
- **Client contingency:** 30% of total contracted costs (Direct costs + Tier 2 management and fee). Covers regulatory/political changes, missing scope, escalation, currency depreciation etc. 30% is the figure recommended by Bechtel on the basis of its global cost database and infrastructure project experience. We agree that it is prudent to include this level of contingency to reflect forecasting uncertainty and the general bias towards underestimating rail project costs in the UK.
- **Delivery integrator:** based on estimated headcount to deliver the Integrator role (circa 60).
- **Planning and preparation in CP3**.

Table 56 shows the best estimate of total costs for CP4 to CP10, including ERTMS. Each of the cost elements has an associated level of uncertainty; we have worked with Bechtel to estimate the range for each element.

Table 56: CP4 to CP10 renewal costs (2018 prices)

Cost line	Best estimate	Variance
Direct costs	£837m	-30% to +50% £586m to £1,256m
Tier 2 management and fee	£84m	-50% to +100% £42m to £167m
Total contracted costs	**£921m**	
Client contingency	£276m	-30% to +50% £193m to £415m
Total managed costs	**£1,197m**	
Delivery integrator	£239m	-30% to +50% £167m to £358m

Cost line	Best estimate	Variance
Total CP4 to CP10	**£1,436m**	**Low: £989m** **High: £2,196m**
Preparation and planning in CP3	£6m	-30% to +50% £4m to £8m
Total including preparation and planning	**£1,442m**	**Low: £992m** **High: £2,204m**

12.5.2. 40-year renewals costs

The best estimate of total renewals costs for CP3 to CP10 is £1,524 million comprising £83 million for the CP3 renewals portfolio and £1,442 million associated with CP4 to CP10 renewals which includes direct costs, management fee, contingency, delivery integrator and preparation and planning in CP3.

The 40-year renewal cost estimate in our PR14 submission included direct costs only and covered the period CP2 to CP9. The cost of the Asset Stewardship option was £781m, indexed to February 2018 prices.

The PR19 forecast of direct costs for 40-year renewals (CP3 to CP10) is £920m. Figure 28 compares the direct costs in this PR19 submission with the Asset Stewardship option in the PR14 submission.

There is a difference of £139m between the two cost estimates. The reasons for this difference are:

- Inclusion of £90m for ERTMS as a renewal in CP5 (in PR14 ERTMS was classified as a Specified Upgrade, see Section 14.1);
- A net increase of £30m from excluding CP2 (-£26m) and including CP10 (+£56m); and
- An increase of £19m from all other changes in renewals scope, timing and costing between PR14 and PR19.

Figure 28: Renewals direct cost comparison (£m, Feb 2018 prices)

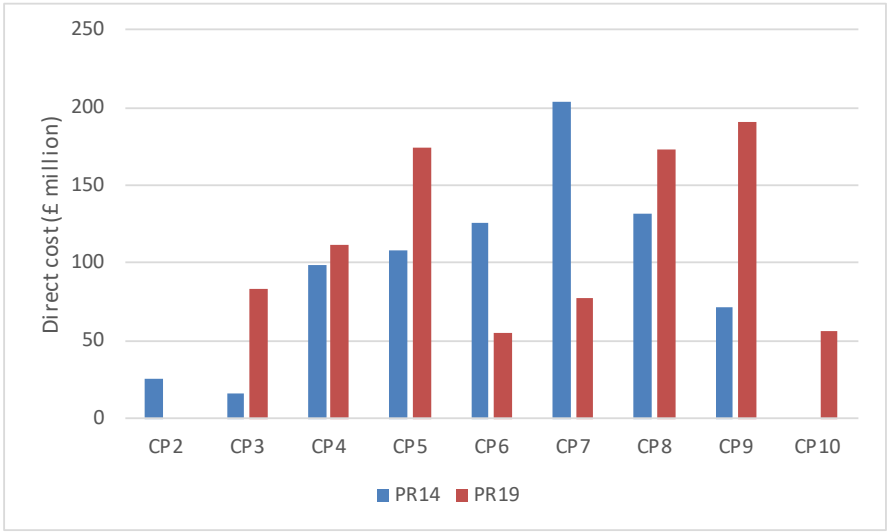
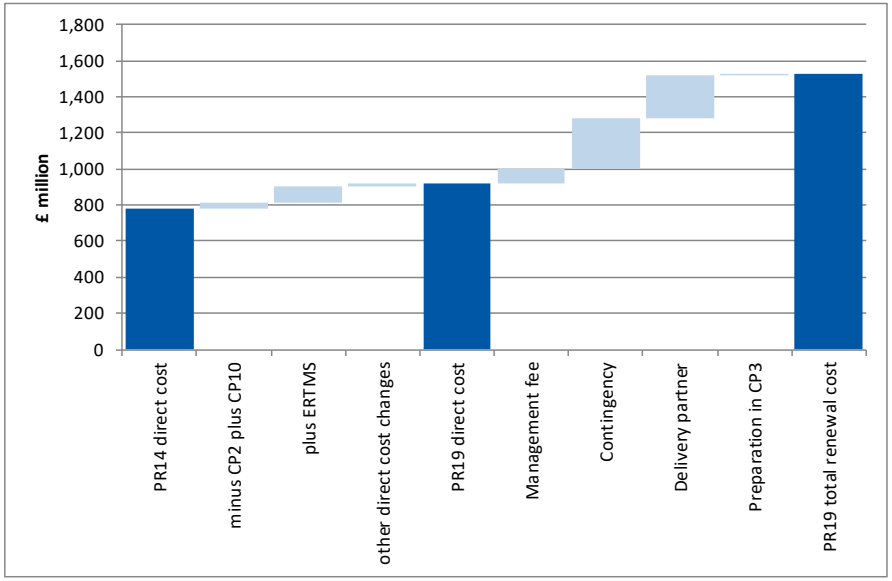


Figure 29 illustrates the change in total 40-year renewal costs between PR14 and PR19.

Figure 29: Change in 40-year renewal costs (£m, Feb 2018 prices)



12.6. Renewals annuity

The 40-year renewal costs are converted to an annuity which forms part of the OMRC paid by train operators. The funds collected from the renewals element of OMRC are paid into a separate escrow account each quarter which can only be used for the funding of renewals.

12.6.1. Context

Under the Concession Agreement we have a general duty in respect of asset stewardship which requires us to secure the operation, maintenance, renewal and replacement of the HS1 railway infrastructure in accordance with best practice; in a timely, efficient and economic manner; and as if we were responsible for the stewardship of the HS1 railway infrastructure for 40 years.

In its 2009 Regulatory Statement on HS1, ORR noted that *"charges relating to renewal will be calculated as an annuity based on the long term cost, with a fund, held in escrow, being built up to cover the cost of future renewals"*.

Unlike other regulated utility businesses, we do not have a regulatory asset base (RAB). Under a RAB-based approach, the infrastructure manager funds renewals investments upfront, and recovers costs and a return through user charges over time. By contrast, under the Concession Agreement, operators effectively pre-fund long-term HS1 renewal costs through an annuity which forms part of the OMRC charges. The current interpretation of the framework set out in the Concession Agreement and by ORR requires us to:

- Fully fund renewals over a 40-year period;
- Ensure we renew assets in accordance with best practice to ensure an equivalent handback of assets at the end of the concession; and
- Ensure the escrow account is fully funded beyond the life of the concession.

The Concession Agreement does not set out the methodology for calculating the annuity. In agreement with ORR in CP2, we calculated the annuity on the basis of 40-year renewals costs and such that the closing balance of the escrow account at the end of 40 years is zero

Before CP1, no detailed work was done to assess renewals requirements. As a result, an annuity of £5.9 million per annum was put into escrow.

In PR14, we recognised that long term renewal work had been significantly underestimated for CP1. We developed more detailed plans for each asset using manufacturers' recommendations, experience to date and lessons learned from other operators. This identified long term renewal costs over 40 years approximately quadruple those in the CP1 renewals model. The main drivers of this increase were:

- Higher volumes of work across all asset areas, particularly in civils and electrification and plant. The CP1 assumptions systematically excluded renewals driven by obsolescence, and classified items as

Specified Upgrades where we consider that it is more appropriate to classify them as renewals; and
- On-costs which were omitted from the original calculations.

This work formed our Baseline option and resulted in an annuity charge of £23.5 million per annum (February 2013 prices).

Using our engineering judgment and early experience of the assets we developed an alternative Asset Stewardship option which reduced volumes by extending asset lives as a result of a condition-based approach to renewals, lowered unit costs based on anticipated technological improvements and an assumed efficiency saving of 0.5% per annum. This resulted in an annuity of £16.4 million per annum in February 2013 prices, equivalent to £18.4 million per annum in February 2018 prices.

The Asset Stewardship option was used to calculate the renewals annuity. We made a clear caveat in our PR14 submission that the assumptions underpinning the Asset Stewardship option would need to be verified in CP2 and the annuity calculation may require an upward shift in future control periods.

The Asset Stewardship renewals annuity was still a significant increase from the CP1 renewals annuity and we agreed with train operators and ORR to profile this increase over time as shown in Table 57.

Table 57: PR14 renewals annuity profile (£m, February 2018 prices)

Control Period	Renewals annuity (Feb 2018 prices)	Comment
CP2	£12.5m p.a.	50% of the increase from CP1 is funded
CP3	£18.4m p.a.	100% of the increase is funded
CP4+	£19.6m p.a.	Adjusted to make up for reduced funding in CP2

12.6.2. Proposal for CP3

We have based our renewals annuity calculation on 40-year renewals costs. We have treated the two elements of these costs as follows.

CP3 renewals costs were developed by NR(HS) and Mott MacDonald. We have reviewed and challenged these costs, which has resulted in a reduction from NR(HS)'s original estimates. The annuity calculation is currently based on a total CP3 renewals portfolio cost of £82.9m which excludes project risk (see Section 12.3.1). NR(HS) is reviewing the CP3 renewals costs presented in the NR(HS) 5YAMS and will provide an update during the consultation period.

Table 58 shows total renewals expenditure during CP3 taking into account acceleration and deferment of elements of the CP2 and CP3 renewals portfolios and preparation and planning for long term renewals.

Table 58: Renewals expenditure in CP3 (£m, February 2018 prices)

Cost	£million
CP3 renewals portfolio total	82.9
CP3 renewals portfolio b/f to CP2	-6.0
CP3 renewals portfolio c/f to CP4	-0.6
CP2 portfolio deferred to CP3	6.2
Subtotal NR(HS)	**82.5**
Preparation and planning for CP4 to CP10 renewals	5.6
Total CP3 expenditure	**88.1**

Long term renewals costs for CP4 to CP10 were developed by Bechtel as part of the deliverability study. The deliverability study provides a strong engineering baseline for long term renewals volumes and costs. It assumes we will adhere to asset stewardship best practice and will hand back the asset in 2040 to an equivalent standard to which it was received. The proposed volumes and productivity rates are in line with international industry practice, which approximately triples the volumes traditionally

achieved in the UK, and the Integrator Model delivery structure we have assumed in developing the CP4 to CP10 costs is estimated to be 33% more efficient than the UK Base Case. The annuity calculation is based on the best estimate of £1,436 million as set out in Table 56, which includes direct costs, management fee, contingency and delivery integrator costs.

A renewals annuity is calculated from these 40-year renewals costs such that the closing balance of the escrow account at the end of 40 years is zero. This calculation takes into account payments into and withdrawals from the escrow account and interest received on the escrow account. This approach is the same as the approach adopted in CP2.

The resulting renewals annuity charge is £37.9 million per annum.

Figure 30 shows the renewals costs, annuity payments and resulting escrow balance over the 40 years from CP3 to CP10.

Figure 30: Renewals costs, annuity payments and escrow balance

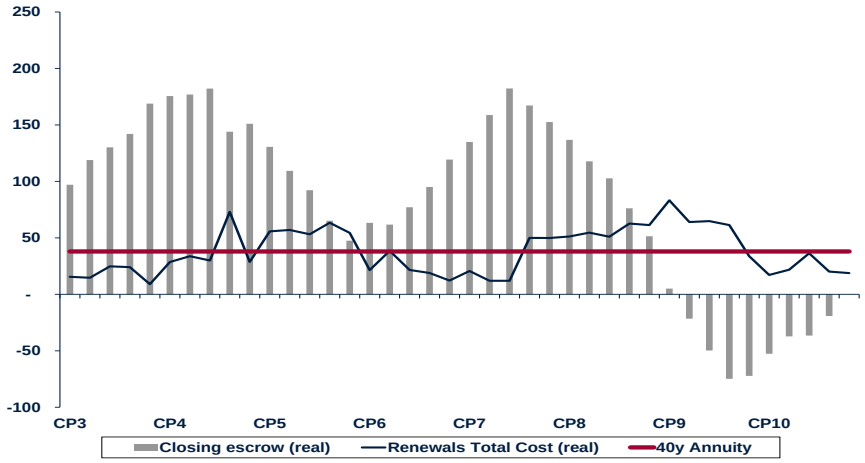
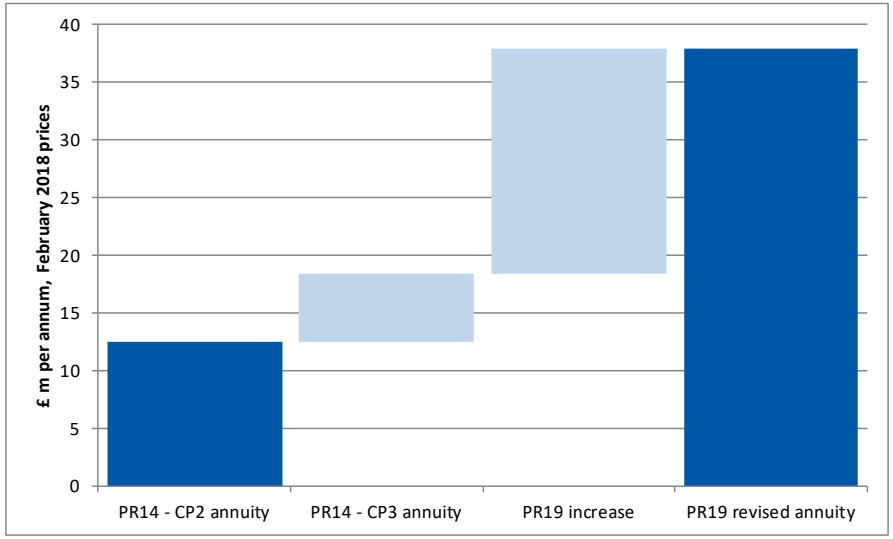


Figure 31 shows the renewals annuity charge for CP2, the step up to the full charge in CP3 as envisaged in the PR14 submission and the increased CP3 charge as a result of the renewals analysis undertaken for PR19.

Figure 31: Change in annuity charge CP2 to CP3



Our approach reflects the requirements set out in our Concession Agreement, full recovery of costs from operators (without Network Grant from government) and best practice asset management. It reflects the Asset Management Objectives tested through the CP3 stakeholder engagement sessions (see Section 9.4) which have informed the development of the SAMP and SASs. We also believe it is important not to delay cost recovery unduly and build up a bigger problem in the future as has been the case with other rail renewal activities in the UK. We therefore adopt this as our proposal for CP3.

We recognise that this is a significant increase and the challenge to affordability it presents. We have worked closely with DfT, ORR and train operators and have modelled a number of alternative options for calculating the renewals annuity which we have assessed against the following criteria:

- Sustainability: Manage the risk of under-funding of renewals, and deliver sustainability of the asset

- User pays: Users pay for wear and tear over time
- Affordability: Consider the ability of end users to fund renewals
- Stability: Avoid sharp fluctuations in annuity payments
- Efficiency: Incentivise efficient delivery of renewals

To make any change to the annuity calculation, we would need to have further discussions with DfT on our Concession Agreement obligations. We will continue to engage with stakeholders on annuity options during the consultation period.

13. CP3 charges

The final step is to convert the efficient costs into charges to be paid by train operators. The way we do this is important because operators should pay a fair proportion of the costs and the charges should send appropriate signals for the use of infrastructure.

Table 59 sets out the cost headings from the previous sections and summarises how each is treated in calculating charges.

Table 59: Converting costs to charges

Costs	Calculation of charges
NR(HS) O&M costs HS1 costs Pass through costs Freight-specific costs	Forms part of OMRC charge to operators CP3 costs are apportioned between operators on the basis of forecast train services
Renewals	Forms part of OMRC charge to operators 40-year renewals costs are converted to an annuity which is apportioned between operators on the basis of forecast train services
Traction electricity	Not part of OMRC Charged separately to operators on the basis of actual prices and train numbers/formations
Specified Upgrades	Investment recovered through Additional IRC. Calculated to allow investment cost recovery on the basis of recovery period and WACC assumptions agreed with ORR. We are not planning any specified upgrades in CP3.

13.1. Structure of charges

In Section 17, we set out the basis of our charging regime and how it complies with the provisions of the Railways (Access, Management and Licensing of Railway Undertakings) Regulations 2016. In summary, our operating, maintenance and renewals charges (OMRC) are made up of four elements:

OMRCA1: variable costs reflecting wear and tear caused by additional trains on the common track. This mainly relates to track costs.

OMRCA2: avoidable costs on a long run incremental cost (LRIC) basis where the costs of infrastructure specific to a class of operator, that would be avoided (i.e. not required) in the event that that class of operator ceased operating services, are allocated to that particular class of operator. Avoidable costs are net of the costs which would be incurred to mothball assets used solely by a specific class of operator if that class of operator ceased to operate on HS1. Mothballing costs are included in common costs.

OMRCB: common costs. OMRCB includes, for example, head office costs, and infrastructure costs that vary with the length of track but not the volume of traffic.

OMRCC: pass through costs. These are common costs that are largely beyond our control, such as insurance and business rates. For this category of cost there is an annual wash-up process to adjust for differences between actual and forecast costs.

Passenger train operators pay all four elements of OMRC. Operators of conventional freight services are charged only OMRCA1 and OMRCA2.

13.2. Access charging model

The access charging model calculates the cost components related to each of the four headings above and allocates them between train operators to produce a charge per train minute for passenger operators and a charge per train-km for freight operators. Appendix 6 summarises how the access charging model converts costs into charges and allocates them between train operators.

For PR19, we updated the PR14 model, verifying that the underlying methodology in the model remained appropriate and populated the model

with updated inputs. We are planning to commission an independent audit of the model before our 5YAMS submission in May 2019.

The main inputs required by the access charging model are:

- CP3 O&M costs by year by cost category;
- 40-year renewals costs by year and asset category;
- Traffic forecasts by operator and service group for each year of CP3;
- Train specifications for calculation of relative levels of wear and tear;
- Financial assumptions: discount rate, interest rates, inflation rate and escrow account opening balance at the start of CP3.

13.3. Charges for passenger train operators

The charges per train minute for OM&R costs excluding pass through costs (i.e. OMRCA1, OMRCA2 and OMRCB) are calculated for each passenger operator through a four-stage process:

- Stage 1: Split costs into cost apportionment categories
- Stage 2: Calculate an annuity for each cost apportionment category
- Stage 3: Allocate between passenger train operators
- Stage 4: Calculate charges by operator

Pass through costs (OMRCC) are allocated between passenger train operators in proportion to their train minutes on HS1. The OMRCC charge is an indicative charge only; train operators are charged an estimate of pass through costs with an annual wash up to actual, rather than estimated, pass through costs.

Table 60 shows the breakdown of CP3 OMRC per train per minute for current passenger operators on HS1. The figures in this table have been determined on the basis of the vehicle types currently used for these services; different vehicle types may give rise to a different OMRC.

Table 60: OMRC per train per minute (February 2018 prices)

	International passenger services	Domestic passenger services
Vehicles	Class 373 Class 374	Class 395
Charge per train per minute		
OMRCA1	£28.56	£8.84
OMRCA2	£15.81	£3.23
OMRCB	£24.44	£27.70
OMRCC	£10.14	£10.14
Total OMRC	**£78.95**	**£49.91**

Table 61 shows the chargeable journey time for passenger services currently operating on HS1 and the corresponding OMRC per train for each service group, based on the vehicle types currently in use.

Table 61: OMRC per train (February 2018 prices)

Service Group	Chargeable journey time (minutes)	OMRC per train
International (all services)	31.0	£2,447.45
Domestic		
Ashford - St Pancras (and vice versa)	31.0	£1,547.21
Springhead Jn - St Pancras (and vice versa)	16.5	£823.52
Ebbsfleet - St Pancras	14.0	£698.74
St Pancras - Ebbsfleet	15.0	£748.65

This represents a significant increase in OMRC. As shown in Table 62 and Figure 32, the O&M element of the charges reduces between CP2 and

CP3, the pass through element has increased, but the majority of the proposed increase in access charges is as a result of the increased renewals annuity.

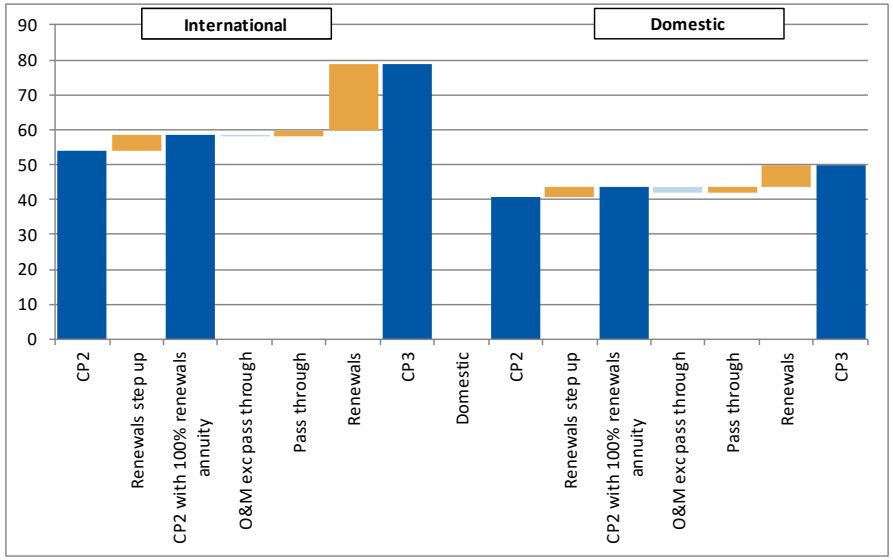
The CP3 charges represent a 46% increase in international charges and a 22% increase in domestic charges compared with CP2. As noted in Section 12.6.1 above, the full renewals annuity calculated in PR14 was £18.4 million per annum but train operators benefitted from a reduced amount of £12.5 million per annum payable in CP2. Table 62 also shows the CP2 charge calculated on the basis of the full renewals annuity. The CP3 charges represent a 35% increase in international charges and a 15% increase in domestic charges compared with CP2 charges with 100% annuity.

Track renewals account for around 68% of long term renewals costs (based on the requirements for ballast and track work due to increased wear and tear identified in the SASs and the Bechtel deliverability and costing work). This compares with track renewals accounting for 35% of the total cost of renewals in PR14. International operators use longer heavier trains that cause significantly higher wear and tear than domestic trains. This means that in addition to renewal costs increasing, international operators face a higher proportion of the increased charge.

Table 62: OMRC per train minute CP3 v CP2 (February 2018 prices)

	International			Domestic		
	CP3	CP2 100% annuity	CP2	CP3	CP2 100% annuity	CP2
O&M	£36.06	£36.31	£36.31	£25.03	£26.50	£26.50
Renewals	£32.76	£13.38	£9.09	£14.73	£8.26	£5.61
Pass through	£10.14	£8.68	£8.68	£10.14	£8.68	£8.68
Total OMRC	**£78.95**	**£58.36**	**£54.07**	**£49.91**	**£43.44**	**£40.79**

Figure 32: Change in OMRC between CP2 and CP3 (£m, Feb 2018 prices)



13.4. Charges for freight operators

Freight costs comprise:

- Freight variable costs (OMRCA1); and
- Freight avoidable costs (OMRCA2), made up of two elements;
    - Track-dependent avoidable costs (net of mothballing costs); and
    - Other freight avoidable costs e.g. staff costs.

One of the elements of freight costs is Ripple Lane exchange sidings. Ripple Lane is accessed by freight trains from the NRIL network as well as those from the HS1 network. The Ripple Lane element of freight costs is split between freight trains accessing Ripple Lane from the two networks in proportion to the forecast number of trains from each network.

The calculation of freight charges is summarised in Appendix 5.

13.4.1. Freight operators on HS1

Table 63 shows the charge calculated for CP3 for freight services on the HS1 network, broken down into variable and avoidable elements.

Table 63: CP3 freight charges (February 2018 prices)

Freight OMRC element	Charge per train-km	km per train	OMRC per train
OMRCA1 (variable)	£9.47	88.20	£835.25
OMRCA2 (avoidable)	£3.96	88.20	£349.27
Total	£13.43	88.20	£1,184.53

Table 64 compares the CP3 freight charge with the charge proposed in the PR14 submission and the actual charges over CP2. Changes during CP2 were as a result of changes in freight volumes triggering the reopener provisions. The proposed freight charge for CP3 is 78% higher than the current charge as a result of the increased renewals annuity.

Table 64: CP3 v CP2 freight charges (February 2018 prices)

Freight OMRC	CP2 5YAMS	2015/16[1]	2016/17	2017/18 2018/19	CP3
OMRC per train-km	£8.46	£6.02	£7.21	£7.54	£13.43
Number of trains	800	800	509	439	454

13.4.2. Ripple Lane charge

In CP2, we commenced charging freight operators accessing Ripple Lane from the NRIL network. This charge is termed the Ripple Lane charge and is levied on a per train basis. We first levied this charge in 2016/17. Table 65 compares the CP3 Ripple Lane charge with the actual charges over CP2. Changes during CP2 were as a result of changes in freight volumes triggering the reopener provisions.

Table 65: CP3 v CP2 Ripple Lane charge (February 2018 prices)

Ripple Lane charge	2016/17	2017/18	2018/19	CP3
Charge per train	£41.29	£52.93	£55.65	£54.49
Number of trains	3,700	2,886	2,745	2,745

13.5. Indexation

In CP2, OMRCA1, OMRCA2 and OMRCB are indexed by RPI. OMRCC (pass though costs) is passed through to train operators at cost so is not indexed.

The Johnson Review 2015 reviewed inflation indexes and recommended a move away from the retail price index (RPI) to the consumer price index (CPI). The ORR's approach to PR19 notes that ORR intends to consider the choice of inflation index used for HS1 access charges, and how it affects the overall settlement.

We strongly recommend that RPI should continue to be the inflation index for the remainder of our concession.

In its approach to PR19 document, ORR notes that:

- IRC paid by train operators is indexed by RPI under the terms of the Concession Agreement. IRC is unregulated, and the Concession Agreement can only be changed with the consent of the SoS and HS1 Ltd; and
- Regulated passenger train fares are currently RPI-indexed, so moving away from the RPI index could cause issues for train operators and franchising authorities.

[1] After Ripple Lane adjustment

The certainty provided by the linking of our IRC income to RPI for the length of our concession has meant that contracts that support the concession have RPI as the inflation basis and has enabled us to plan our business with a reasonable degree of assurance. The NR(HS) Operator Agreement is one of several RPI-linked contracts building up our costs and is a key component of our OMRC charges. In addition, we have entered into long term RPI-linked financing arrangements such as RPI-linked bond debt (to 2038) and IRC revenue swaps (to 2040).

In principle, OMRC allows us to recover the efficient costs of operating, maintaining and renewing the HS1 route. NR(HS)'s Annual Fixed Price accounts for circa 77% of our O&M costs (excluding pass through costs) in CP3; under the terms of the Operator Agreement the Annual Fixed Price is RPI-linked and we cannot change this in CP3. If OMRC were to be indexed by CPI, there would be a mismatch between the costs of managing the concession and OMRC income.

A change to CPI midway through the concession would also mean two different inflation indices for the IRC and OMRC elements of access charges and add unnecessary complexity to efficient budget management without making a significant improvement to our incentives or the accuracy of our cost forecasting.

We would recommend that the potential change from RPI to CPI is reviewed at the end of the concession. This would allow new contracts, with a focus on CPI, to be agreed at the start of the next concession.

13.6. Traction electricity charge

Charges for traction electricity do not form part of OMRC. Train operators are charged separately for traction electricity on the basis of actual prices and trains operated.

Indicative charges for CP3, based on our forecast of electricity costs in Section 11.5, are an average of £509 per train for EIL and £197 per train for LSER.

14. Upgrades

Under the Concession Agreement, we may implement a Specified Upgrade or other upgrade to HS1 and may recover the costs through an Additional Investment Recovery Charge (Additional IRC). The Concession Agreement defines a Specified Upgrade as a major upgrade of the signalling system, control systems or trackform, including any such upgrades required in connection with the implementation of a TSI requirement. The Concession Agreement does not define an upgrade.

In determining whether to classify specific works as Specified Upgrade, upgrade or renewal we have considered the scope of works and the reason why they are being undertaken. For example:

- If a control system needs intervention because it is obsolete this would be classed as a renewal or replacement;
- If the same control system needs intervention as a result of a TSI requirement this would be classed as a Specified Upgrade;
- If we added new assets to the HS1 infrastructure for any other reason than a TSI requirement, this would be classed as an upgrade.

14.1. Specified Upgrades

No Specified Upgrades are planned for CP3.

In PR14, we categorised the transition to ERTMS as a Specified Upgrade. During CP2, we commissioned SNCL to undertake a study on the future train control system for HS1; the main findings of the SNCL study were:

- The primary drivers for replacement are obsolescence and capacity;
- The existing system is expected to be supported until 2035-2040;
- The capacity of the existing system will not be reached until around 2046 - obsolescence will drive earlier replacement of the system;
- There is no business case to replace the existing system until it is obsolete; and
- The preferred option is to replace with ERTMS Level 3.

As the train control system needs intervention because it is obsolete, this would be classed as a renewal and it has been included as such in our 40-year renewal plans (see Section 12.5).

14.2. Other upgrades

The upgrade planned for CP3 is the enabling of regenerative braking on the HS1 route. As set out in Section 11.6.4.1, we have developed a business case for enabling regenerative braking for the Class 395 fleet. The estimated cost is £1.49m plus 30% contingency, giving a total of £1.94m. This cost includes software modifications to the trains and rolling stock safety approvals.

The estimated saving to the domestic train operator from reduced energy consumption is estimated to be £1.3m, resulting in a payback period of 18 months. As the benefit of this upgrade is passed through to the domestic train operator, the business case and funding would need to be agreed with them before moving to the implementation phase.

There is potential for wider roll-out of regenerative braking but this would require modification of the Sellindge feeder station. We plan to develop a business case for enabling regenerative braking on the Class 374 fleet during CP3.

Part 3: Regulatory & Incentive Framework

15. Overview

The regulatory framework is the set of rules and incentives governing interaction between the parties on a day to day basis which is designed to encourage efficient operation of the railway and drive the right behaviours.

The existing framework was extensively reviewed as part of PR14 and is working well. We therefore propose largely rolling over this framework to CP3. Other than debate around the renewals annuity, there has been limited appetite from stakeholders to change the framework.

Section 16: As part of a periodic review, the Concession Agreement requires us to provide details of any proposed changes to:

- The track access performance regime (other than the cap on liability);
- The possessions regime (other than the cap on liability).

In addition, the HS1 Passenger Access Terms and HS1 Freight Access Terms specify that the periodic review should cover any proposed changes to the following items:

- Wash up provisions;
- Carbon costs;
- Capacity Reservation Charge; and
- Pass through cost categories.

We have reviewed these provisions and propose the following for CP3:

- To suspend the Capacity Reservation Charge; and
- To add potential market test costs as a new pass through cost category for CP3.

Work on the recalibration of the track access performance regime is ongoing. We present preliminary results. We will continue to progress this work and engage with stakeholders during the consultation period.

Section 17: Structure of charges

The structure of charges determines how we apportion the costs of running the railway between the operators using the railway. We have reviewed our structure of charges against the Railways (Access, Management and Licensing of Railway Undertakings) Regulations 2016. We propose to amend our cost category definitions to align with the Regulations but this does not have an impact on how we have calculated charges for CP3.

We propose to undertake a comprehensive Structure of Charges Review during CP3.

Section 18: Escrow investment strategy

For CP3, we have developed an enhanced escrow investment strategy and Escrow Cash Management Policy (ECMP), incorporating learning from CP2. Our plans are based on maintaining the current Concession Agreement provisions.

We plan to consult stakeholders on the draft escrow policy and the application of the Concession Agreement prior to finalising the CP3 investment policy.

Section 19: Volume reopener

For CP3, we propose to maintain the current approach to both the passenger and freight volume reopeners. To implement this approach, we will correct erroneous drafting in the current PAT to clarify the baseline against which the volume reopener levels are set.

Our proposals for CP3 are summarised in Table 66.

Table 66: Regulatory Framework proposals

Area	Proposal	Justification/ reasoning
Performance regime	The recalibration of the performance regime is underway. We will engage with stakeholders during the consultation period.	
Possessions regime	No change	The current regime works well for the small number of disruptive possessions likely to occur
Wash up provisions	No change	The current provisions are working well
Carbon costs	No change	We need to recover costs related to the CRC Energy Efficiency Scheme. Costs to train operators are subject to ORR approval
Capacity Reservation Charge	Suspend the charge	There is currently spare capacity on the route Response to stakeholder concerns about the charge
Pass through cost categories	Add potential market test costs	The purpose of a market test would be to secure greater OMR cost efficiency which would benefit train operators. As no decision has been made on market test, it would not be appropriate to include a provision in HS1 costs.
Structure of charges	Limited change at present Full review during CP3	Limited appetite for changes during PR19. Given some of the regulatory changes and additional data, we propose a more comprehensive Structure of Charges Review during CP3
Escrow investment strategy	Enhanced strategy within the current Concession Agreement provisions	Optimise escrow interest income
Volume reopener	Maintain current approach but correct drafting in PAT	Clarification of baseline volumes needed

16. Performance and possessions regimes and other access provisions

16.1. Performance regime

16.1.1. Current provisions

The Regulations require infrastructure managers to establish a performance regime to encourage the infrastructure manager and the train operators to minimise disruption and improve performance of the network.

Our performance regime is structured so that payments are made only in the event of major delays and cancellations. A key principle in the development of the performance regime was that the regime should incentivise all parties to minimise the impact of delays and cancellations and not be a revenue generating mechanism for any party.

The performance regime is defined in the HS1 Passenger Access Terms and HS1 Freight Access Terms. Payment rates and the thresholds at which payments are triggered are set out in the individual operators' Track Access Agreements. The Access Terms include a cap on performance payments which is not subject to periodic review. Performance is monitored using NRIL's TRUST system, as on the national rail network.

There are three categories of delay:

- HS1 delay: HS1 Ltd is responsible for, and pays compensation to, TOCs for disruption resulting from such incidents;
- TOC-on-TOC delay: TOCs are responsible for incidents caused by them and pay compensation to other TOCs for disruption resulting from such incidents; and
- TOC-on-Self delay: TOCs are responsible for incidents caused by them and any resulting disruption is their own responsibility.

Table 67 describes the performance regime parameters which are set out in each operator's Track Access Agreement.

Table 67: HS1 performance regime thresholds, benchmarks and payment rates

HS1 Poor Performance Threshold (minutes)	HS1 Ltd pays a penalty to the TOC if performance is worse than the HS1 Poor Performance Threshold and the TOC pays HS1 Ltd a bonus if performance is better than the HS1 Good Performance Threshold. No payments are made for performance that falls in the band between these two thresholds.
HS1 Good Performance Threshold (minutes)	
Payment Rate (per minute)	The rate at which payments are made to the affected TOC by HS1 Ltd and other TOCs
Bonus Payment Rate (per minute)	The rate at which bonus payments to HS1 Ltd are made. This rate is 25% of the Payment Rate.
Cancellation Minutes	The factor by which a cancellation is converted to delay minutes for performance regime calculations
TOC on TOC Receipt Benchmark	TOC on TOC payments are made if the performance experienced by the affected TOC is worse than its TOC on TOC Receipt Benchmark
Train Operator's Performance Benchmark	These benchmarks are not payment triggers but are used to determine when a performance improvement plan is required.
HS1 Ltd Performance Benchmark	

Key points to note are:

- The HS1 Poor Performance Threshold was calculated as the average HS1 caused delay per train plus 1 standard deviation and the HS1 Good Performance Threshold was calculated as the average HS1 + TOC-on-TOC delay per train minus 1 standard deviation. This creates a "neutral zone" within which no performance payments are incurred.

- The Train Operator's Performance Benchmark was calculated as the average TOC-on-TOC delay per train caused by the train operator plus 1 standard deviation.
- The payment rate was calculated as 60% of the Marginal Revenue Effect (MRE). The purpose of this was to limit the expected liability to all parties under the regime. 60% was chosen as the proportion which ensured that payments would only exceed 1/13 of the annual cap in a very extreme period.
- A review was carried as part of PR14. Thresholds and payment rates were recalibrated using the latest performance, demand and revenue data. The results were largely consistent with the existing regime. It was agreed to retain the existing regime in CP2 as it better incentivised all parties to minimise delays and cancellations on HS1.

Figure 33 and Figure 34 show HS1 performance in CP2 compared with the HS1 Poor Performance Threshold.

Figure 33: EIL – HS1 delays v HS1 Poor Performance Threshold

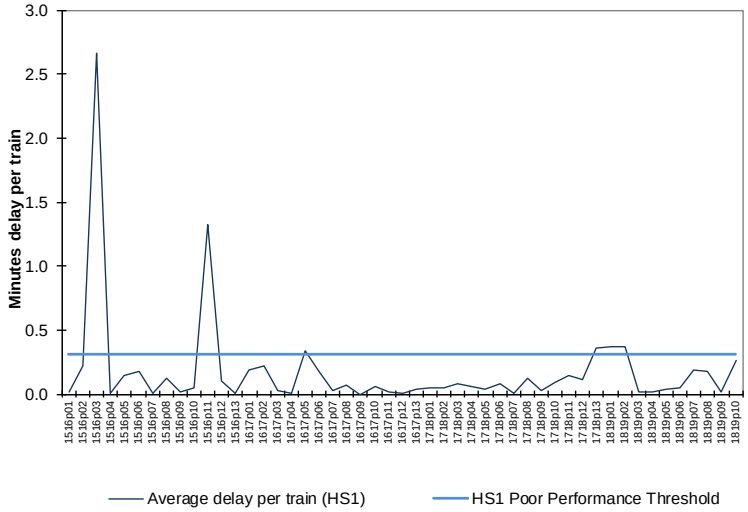
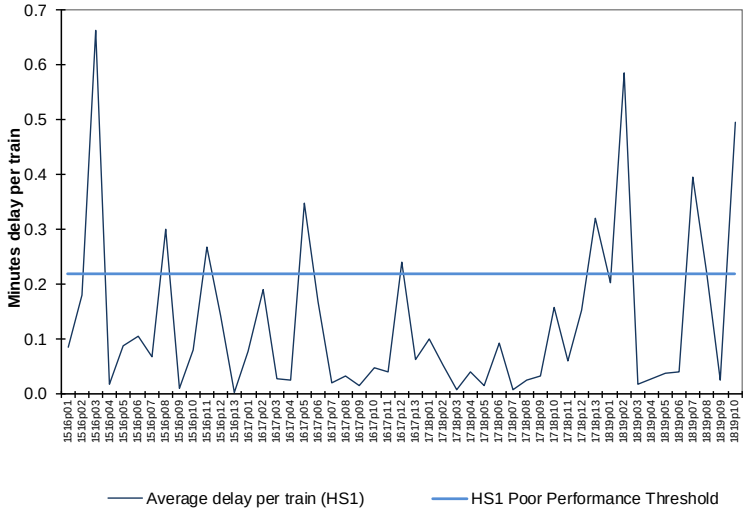


Figure 34: LSER – HS1 delays v HS1 Poor Performance Threshold



16.1.2. Recalibration of the performance regime

The Concession Agreement requires us to review the performance regime as part of the periodic review. For PR19, we appointed Oxera to review and recalculate the performance regime thresholds and payment rates based on recent data.

In this section we present the results of preliminary analysis undertaken by Oxera. We will continue to progress this work and engage with stakeholders during the consultation period.

16.1.2.1. Thresholds

The recalibration exercise used the same methodology as previous calculations and almost five years of data from Period 1 2014/15 to Period 10 2018/19.

Preliminary results are shown in Table 68 which compares the recalibrated HS1 performance thresholds with those currently in use for CP2.

Table 68: Comparison of HS1 performance thresholds

	Poor performance threshold	Good performance threshold
EIL		
Recalibrated	0.56	0.00 *(See Note)*
Current (CP2)	0.31	0.13
LSER		
Recalibrated	0.26	0.01
Current (CP2)	0.22	0.03

Note: The calculated value is -0.16

The recalibrated thresholds in this table have been calculated on the basis of all delays in the five year period except those related to UKPNS power supply-related faults.

As noted in Section 11.4.2, we are proposing to introduce a new, separate performance regime for UKPNS power supply-related faults. We propose that all incentive and penalty payments under the UKPNS performance regime flow through to train operators as a pass through. To implement this change and avoid double-counting, we propose that the UKPNS-related elements of the main performance regime described here are 'turned off'.

16.1.2.2. Payment rates

Payment rates for the HS1 performance regime are based on a Marginal Revenue Effect (MRE) calculation, following the standard approach used for the national rail network. Delay multipliers and generalised journey time (GJT) elasticities are based on PDFH.

The payment rates in the HS1 performance regime were originally set at 60% of MRE in order to limit the expected liability of all parties under the regime. 60% was chosen as it ensured that payments would only exceed 1/13 of the annual performance payment cap in a very extreme period.

We will work with operators to obtain passenger and revenue data to inform the recalibration of the performance regime payment rates.

16.2. Possessions regime

The HS1 Passenger Access Terms and HS1 Freight Access Terms contain a possessions regime by which we compensate train operators for the direct costs they incur as a result of possessions taken outside the possessions allowance. The purpose of the possessions regime is to incentivise efficient planning of possessions.

Direct costs include bus and taxi hire costs, publicity costs, train planning and diagramming costs and other costs directly related to the organisation and management of the train operator's response to a restriction of use. The compensation is adjusted by adding any increase in costs which results from increases in train mileage and deducting any decrease in costs which results from decreases in train mileage. Our liability is capped and the cap is not subject to periodic review.

Our proposal for CP3 is to retain the existing possessions regime as the current regime works well for the small number of disruptive possessions likely to occur in CP3.

16.3. Wash up provisions

Under the HS1 Passenger Access Terms the IRC, OMRC and Capacity Reservation Charge elements of the track access charges are invoiced quarterly in advance on the basis of the number of trains in the New Working Timetable (formerly the First Working Timetable) and an estimate of the Pass Through Costs for the year.

The HS1 Passenger Access Terms provide for a wash up:

- At the end of each quarter, to take into account additional train paths operated as a result of spot bids or reductions in the number of train paths operated as a result of HS1 cancellations; and
- Annually, to allow us to recover the actual, rather than estimated, pass through costs.

Under the HS1 Freight Access Terms, freight operators are invoiced in arrears on the basis of actual trains operated and there is therefore no wash up for freight.

We do not propose to make any changes to these provisions for CP3.

16.4. Carbon costs

The HS1 Passenger Access Terms and HS1 Freight Access Terms contain a provision for us to recover costs incurred in relation to the Carbon Reduction Commitment (CRC) Energy Efficiency Scheme.

The scheme excludes energy used by trains and network services such as signalling systems but includes energy used for heating, lighting and power in buildings. The majority of our costs in relation to the CRC Energy Efficiency Scheme are therefore related to stations and there are provisions to recover them in the Station Access Conditions. The elements of CRC Energy Efficiency Scheme costs which are included in the track access charges include costs related to the office at the Singlewell infrastructure maintenance depot and the HS1 office.

The CRC payment related to track access charges is approximately £10,000 per annum.

We believe it is important that we retain the ability to recover costs related to meeting our CRC Energy Efficiency Scheme requirements. The HS1 Access Terms require that any costs borne by the train operators as a result of meeting our commitments will be subject to approval of the ORR.

Our proposal for CP3 is to leave the current provisions unchanged.

16.5. Capacity reservation charge

16.5.1. Current provisions

The Regulations allow an infrastructure manager to levy a charge for capacity that is requested but not used. The imposition of such a charge must provide incentives for the efficient use of capacity.

The Capacity Reservation Charge on HS1 applies to capacity which is reserved but not used in the New Working Timetable. It is set out in the HS1 Passenger Access Terms and HS1 Freight Access Terms as follows:

- For passenger services, the charge is 25% of the full IRC per train (i.e. ignoring any IRC discount);
- For freight services, the charge is 25% of the avoidable costs element of the Freight OMRC per train; and
- If a train operator surrenders reserved capacity it will be entitled to a rebate of part of its Capacity Reservation Charge if the surrendered capacity is utilised by another train operator.

The Capacity Reservation Charge acts as a disincentive to the reservation of large amounts of capacity which a train operator does not realistically intend to use. It supports the promotion of competition on HS1 by helping to ensure the efficient utilisation of capacity by train operators.

For freight services the Capacity Reservation Charge is much lower and, on its own, may not be sufficient to incentivise efficient use of capacity. However, this charge works in tandem with the Use-It-Or-Lose-It provisions in Part J of the HS1 Network Code. Part J enables us to alter access rights where they are not being used. It sets out a mechanism whereby capacity can be made available to other users if the train operator fails to exercise its access rights as part of a timetabling process and requires the surrender of train slots where they are not being utilised and such non-use exceeds certain thresholds.

16.5.2. CP3 proposal

We note that there is currently spare capacity on the HS1 route and recognise train operator concerns about the Capacity Reservation Charge.

In response to these concerns, we propose to suspend the Capacity Reservation Charge but to keep this suspension under review, particularly in relation to the following situations:

- A potential new entrant planning to operate train services on HS1;
- Any material change in capacity usage; or
- A material increase in capacity reservation in comparison with the current levels.

16.6. Pass through cost categories

16.6.1. Current provisions

The Concession Agreement provides for us to recover in full, from train operators, the elements of cost considered as pass through costs, providing they have been efficiently incurred. The Concession Agreement provides an initial list of pass through cost categories but allows for ORR to determine which elements of cost are suitable for inclusion as pass through costs at periodic review.

For CP1 and CP2, the relevant cost categories are defined in the HS1 Passenger Access Terms as:

- Rates;
- Insurance;
- Non-traction energy costs;
- Any sums payable by us in connection with the provision of dispute resolution services; and
- Operations, maintenance, renewal and replacement costs of the UKPNS assets.

Other than costs in connection with dispute resolution services, these cost categories are identical to the initial list of pass through costs in the Concession Agreement.

There is no pass through cost element of OMRC for current freight traffic.

16.6.2. CP3 proposal

There have been no issues in relation to the provisions which have been in place for CP1 and CP2. We believe that the cost categories currently identified as pass through costs are appropriate. Section 4.4.4 discusses the work we have undertaken to minimise pass through costs in CP2 and we will continue to pursue any further opportunities to reduce the level of pass through costs in CP3.

As discussed in Section 2.2.3.1, we may undertake a market test in CP3 for all or part of the services provided under the Operator Agreement. The purpose of a market test would be to secure greater operations, maintenance and renewals cost efficiency which would benefit train operators by reducing the level of OMRC payable.

The decision on whether to market test will be made during CP3 in consultation with our stakeholders. As no decision has yet been made, we have not included any provision for the costs associated with a potential market test in our CP3 cost forecasts.

If, following stakeholder consultation, we decide to undertake market testing, we propose to treat costs associated with this process as pass through costs, which would allow costs to be charged as incurred. Under the Concession Agreement, we would need to produce reasonable evidence to the ORR that the market test costs were efficiently incurred.

If the ORR declines to treat market testing costs as suitable for inclusion as pass through costs, we would wish to agree with ORR a specific review mechanism which would allow us to recover these costs if we proceed with the market test, subject to ORR determining that they have been efficiently incurred.

17. Structure of charges

The structure of charges determines how we apportion the costs of running the railway between the operators using the railway. It is important in terms of establishing a fair allocation, and to incentivise efficient use of the network. The structure of charges needs to be, as a minimum, consistent with the charging framework set out in the Concession Agreement; this in turn requires compliance with the relevant European directives.

This section:

- Highlights the changes to the European directives;
- Outlines amendments we have made in order to maintain compliance with the Regulations; and
- Sets out some issues that we propose to revisit in a Structure of Charges Review during CP3. There has been limited appetite for changes to the structure of charges during PR19. However, given some of the regulatory changes and additional data, we believe that a more comprehensive review during CP3 is appropriate.

The structure of charges framework set out in this section underpins the calculation the charges for CP3 shown in Section 13.

17.1. Regulatory requirements

The Railways (Access, Management and Licensing of Railway Undertakings) Regulations 2016 (the Regulations) give effect to European directives on the allocation of railway infrastructure capacity and the levying of charges for the use of railway infrastructure.

In relation to the recovery of an infrastructure manager's costs, the Regulations require charges to be set at "the cost that is directly incurred as a result of operating the train service". This will be substantially lower than the total costs of providing the infrastructure services so, in order to allow for the recovery of total costs incurred, the Regulations set out two exceptions to the charging principles:

1. The infrastructure manager may levy mark-ups, the effect of which must not be to exclude the use of infrastructure by market segments which can pay at least the cost that is directly incurred, plus a rate of return which the market can bear; or

2. For specific investment projects, the infrastructure manager may set higher charges on the basis of the long term costs of the project. For this to apply the project (i) must increase efficiency or cost-effectiveness; and (ii) could not otherwise have been undertaken without the prospect of such higher charges.

Since PR14 there have been a number of legislative changes. The 'recast' Directive 2012/34/EU provides further detail on what charges are and are not permitted under the Directly Incurred Costs principle. These have been supported by a number of Commission Implementing Regulations (CIRs) including the 'Modalities CIR': 2015/909 concerning modalities for the calculation of the cost that is directly incurred as a result of operating the train service.

The changes introduced by the recast Directive were implemented into UK legislation by the Railways (Access, Management and Licensing of Railway Undertakings) Regulations 2016 which replace the 2005 Regulations. Among other things, the 2016 Regulations require infrastructure managers to set charges by reference to the Modalities CIR from no later than 2 August 2019. The 4th Railway Package was also introduced in 2016 but this has not had an impact on the approach to charging. The changes within the Modalities CIR include:

- A list of 'non-eligible' costs that may not be included in Directly Incurred Costs. This includes fixed costs relating to the provision of a stretch of line which the infrastructure manager must bear even in the absence of train movements;
- A requirement that the infrastructure manager calculates average direct unit costs for the entire network by dividing the direct costs on a network-wide basis by the total number of vehicle kilometres, train kilometres or gross tonne kilometres;

- Modulations to the average direct unit costs to take account of different levels of wear and tear caused to the infrastructure, based on certain vehicle characteristics, or any other cost related parameters where the infrastructure manager can demonstrate to the regulatory body that values for each parameter, including variation to each such parameter where relevant, are objectively measured and recorded; and
- Directly incurred costs may be calculated by means of a robustly evidenced econometric or engineering cost model.

17.2. Statement of compliance with the Regulations

17.2.1. Full cost recovery

We recover our full costs using the second exception in the Regulations. We satisfy the requirements for this exception on the following basis:

- The project must increase efficiency or cost-effectiveness: HS1 has enabled substantial efficiencies in terms of reduced journey times on international routes and for Kent commuters. The project created enhanced transport hubs at King's Cross/St Pancras and Stratford and a new hub at Ebbsfleet and contributes to wider economic efficiency by enabling the regeneration of land at those locations. The cost-effectiveness of the project is demonstrated by its delivery in accordance with the planned timetable and budget. Furthermore, we are subject to periodic reviews of our costs and charges under the Concession Agreement.
- The project could not have been undertaken without the prospect of such higher charges: the nature of the construction of HS1 and the private sector risk taken was possible only with the prospect of recovering the full costs of running the railway. This applies to both the construction phase and the current phase with HS1 Ltd as operator under a Concession Agreement.

17.2.2. Structure of charges

The structure of our charges is based on the considerable work and industry consultation in the lead up to the sale of HS1 and is set out in our Network Statement. As per the Regulations, a distinction has been drawn between (i) costs directly incurred as a result of operating the train service (the charges for which are levied under the general charging principle); and (ii) avoidable and common costs (the charges for which are levied on the basis of the long term costs of the operational phase of the HS1 project).

During PR14 we debated whether OMRCA2 – the 'avoidable costs' – met the definition of Directly Incurred Costs. We concluded that they did and have been charging on that basis. We have been monitoring the evolution of the Regulations, as set out in Section 17.1. Because of the changes to the Regulations, we propose for CP3 that Directly Incurred Costs refer only to OMRCA1. OMRCA2 will be recovered as part of the long term costs of the operational phase of the HS1 project, as allowed under the second charging exception. For completeness, our OMRC categories are:

- Directly incurred costs:
  - OMRCA1: the variable costs reflecting wear and tear of additional trains on common track. This mainly relates to track costs.
- Avoidable and common costs
  - OMRCA2: the avoidable costs on a long run incremental cost (LRIC) basis where the costs of infrastructure specific to a class of operator (e.g. international passenger train operators) that would be avoided (i.e. not required) in the event that that class of operator ceased operating services are allocated to that particular class of operator. An example is the section of infrastructure from Ashford International to the Channel Tunnel which is used only by international passenger operators. Under our Concession Agreement we must continue to look after and hand back assets in line with our asset stewardship obligations. Avoidable costs are therefore net of the costs which would be incurred to mothball assets if a specific class of operator ceased to operate on HS1. The mothballing costs are instead added to common costs.
  - OMRCB: the common costs. OMRCB includes, for example, head office costs, and infrastructure costs that vary with the length of track but not the volume of traffic.

- OMRCC: the pass through costs. These are common costs that are largely beyond our control, such as insurance and business rates. For this category of cost there is an annual wash-up process to adjust for differences between actual and forecast costs.

Charges to passenger train operators comprise all four elements of OMRC. Freight operators are charged only variable and avoidable elements (OMRCA1 and OMRCA2).

17.3. Structure of Charges Review during CP3

As noted at the start of this section we think there will be benefit in a more in-depth review of charges (and other incentive elements) during CP3. We would expect the charging issues to include:

- **The extent to which we modify charges according to vehicle characteristics**. Our proposed charges distinguish between international and domestic traffic. There are questions about whether we should further distinguish between rolling stock types (for example the Class 374s v Class 373s); and also whether we should modify the fairly simple term in the charging model that drives such charging differences. The review will benefit from ongoing experience with the railway, including the impact of introducing the Class 374s. We will also review experience on NRIL and other networks where changes to the charging structure have been successful in driving vehicle modifications to improve the wheel-rail interface and whole system costs. The key question is whether such a detailed approach is helpful given the relatively few types of rolling stock currently using HS1;
- **Treatment of freight costs**. Our proposed charges continue to apply our existing methodology. We need to review available evidence around the extent to which freight traffic drives renewal spend, and what is the most appropriate methodology to reflect this in the ultimate freight charges. Given the uncertainty in freight volumes over time the analysis also needs to examine whether the relationship changes with different volumes of traffic;
- **Charging OMRCA1 on a per minute basis**. Consistent with the way the HS1 charging regime was established, we continue to propose that charges be levied on a per minute basis, i.e. according to the Chargeable Journey Time. We consider that this makes best use of the infrastructure and helps us optimise capacity on the network – key drivers of the construction and establishment of the HS1 concession. There is some uncertainty about whether per minute charges are permitted under the Modalities CIR which refers predominantly to train-km or vehicle-km. We consider that per minute charges are 'a cost related parameter' which is 'objectively measured and recorded' as required by the Regulations. However, it will be worthwhile reviewing this provision in light of any emerging experience and clarifications about how the Regulations are intended to work;
- **Any other issues raised by stakeholders.**

18. Escrow investment strategy

This section discusses our escrow investment strategy for CP2 and how we propose to modify it for CP3.

18.1. CP2 escrow investment strategy

At the time of the CP2 submission our forecast of interest income on escrow cash was based on a simple yield curve. The yield curve was established over a year before the start of CP2. The forecast interest income on escrow cash for CP2 (as shown in Section 4.6.4) has been not achieved in full because:

- Reduction in market interest rates by the time CP2 commenced and throughout the Control Period; and
- Following the 2008 financial crisis, we agreed changes to the Concession Agreement to meet the requirements of the current banking market. Whilst this was complete by the start of CP2, a detailed investment strategy reflecting the amended provisions was not agreed in advance of CP2.

The amendments to the Concession Agreement allowed cash that was not needed to fund renewals in the Control Period to be locked away in Authorised Investments. The deposit rules within the Concession Agreement are:

- Acceptable Banks must have a credit rating no lower than A- from S&P or A3 from Moody's. The deposit rates offered by Acceptable Banks will vary according to their respective credit ratings;
- No more than £40m may be invested with any one bank;
- At least 10% of available escrow cash above what is needed for renewals must be held in instant access accounts;
- Deposits cannot run more than 12 months past the end of the Concession Agreement; and
- Banks sign up to Schedule 4 of the Concession Agreement on operational rules for the escrow deposits.

18.2. Proposals for CP3

Our investment strategy for CP2 was agreed with DfT and EIL. For CP3, we have developed an enhanced investment strategy and Escrow Cash Management Policy (ECMP), incorporating learning from CP2 and based on our forecasts of the CP2 outturn escrow cash balance, CP3 renewals spend and CP3 track access income. Our plans are based on maintaining the current Concession Agreement provisions as they meet the requirements that cash is available to meet renewals funding requirements and build up the escrow pot in a smooth way over the funding cycle. These rules also:

- Manage the security of cash by limiting the maximum amount deposited with any one bank;
- Manage liquidity by balancing short term instant access cash with long term Authorised Investments; and
- Maximise yield through Authorised Investments (after satisfying the Concession Agreement limits and the priorities of security and liquidity of cash).

The highlights of the ECMP and investment strategy are:

- Establishing the CP3 forecast for escrow interest income based on the application of the ECMP and a yield curve profile based on deposit interest rates currently on offer and reflecting the investment strategy rather than a simple yield curve for five year period. Our plans for the execution of the investment strategy will be finalised in advance of CP3.
- Establishing a distinction between core operational escrow cash (to fund immediate renewals spend) and non-core escrow cash (cash not required to fund renewals in the relevant Control Period) to determine the maturity profile for deposits placed from these two cash pools and thereby optimise the interest income.
- Policy limits to manage the deposit maturity profile and interest reset risk exposures (for instance at the start of CP3 when the majority of the CP2 Authorised Investments mature) but at the same time allowing

the flexibility to optimise interest income in a changing market environment.

- A more pro-active management of escrow cash by depositing cash needed in the Control Period but not within the next year on shorter dated three month deposits. This will ensure the cash in low interest instant access current accounts is limited to close to the 10% covenant limit, while providing the flexibility to deposit more cash more regularly to achieve better rates than the current account. This will mean that Authorised Investments will be placed more frequently than the current six monthly cycle.

Table 69 shows the draft escrow account movements forecast for CP3, compared with CP2. Actual outcomes will depend on market rates at the time, the level of CP3 renewals spend and the renewals track access income actually received.

Table 69: Escrow account movements (£000, nominal)

	CP2 outturn	CP3 forecast
Opening balance	33,635	77,816
Transfers in	61,845	211,427
Withdrawals	(21,587)	(98,123)
Interest	3,923	7,545
Closing balance	77,816	198,665

We plan to consult stakeholders on the draft escrow policy and the application of the Concession Agreement prior to finalising the CP3 investment policy.

19. Volume reopener

OMRC is set on the basis of forecast traffic levels. As the majority of our costs are fixed, and because the intent of our regulatory framework is that we neither over- nor under-recover our costs, there are volume reopener provisions to reapportion costs between train operators if changes in train numbers exceed certain thresholds. These reopener provisions are set out in the HS1 Passenger Access Terms (PAT) and HS1 Freight Access Terms (FAT).

For CP3, we propose to maintain the current approach to both the passenger and freight volume reopeners. That is, the volume reopeners would be triggered in the following cases:

- For passenger services:
    - Where the anticipated number of total timetabled train services in a given year differs by at least +/-4% from the annualised forecast in the ORR's PR19 Final Determination; or
    - Where the anticipated number of timetabled train services for an individual passenger service operator in a given year differs by at least +/-4% from the annualised forecast in the ORR's PR19 Final Determination; or
- For freight services:
    - Where the anticipated number of timetabled train services in a given year differs by at least +/-12.5% from the annualised forecast in the ORR's PR19 Final Determination.

We have considered adjusting the volume reopener levels, from +/-4% for passenger services and +/- 12.5% for freight. There appears to be limited appetite among stakeholders for such a shift; further, we consider the volume reopeners are currently operating as intended.

To implement the above approach, we intend to correct erroneous drafting in the current PAT. This would see the baseline against which the volume reopener levels are set to be the forecast train services in the ORR's Final Determination, rather than those prevailing at the start of the relevant Track Access Agreement (as may be inferred from the current drafting). We will include this change in preparing the updated contractual suite to implement the outcomes of PR19 and consult on the specific wording as part of that process.

We will review the impacts of Brexit on train service volumes in accordance with the PAT. The PAT, as currently drafted, applies to anticipated changes in the timetable prevailing at the next Principal Change Date. In the case of 2019, the Principal Change Date is 9 December 2019. We expect to receive EIL's access proposal at D-22, which falls on 30 March 2019 (the day after the UK is expected to leave the European Union). At this time, we will work with EIL to understand whether the volume reopener may be triggered and agree OMRC allocation changes as appropriate. We will follow the same approach for any subsequent Brexit-related volume change events during CP3.

Part 4: Conclusions

20. Concluding remarks

This 5YAMS sets out our plans for CP3 and beyond. Our proposals are ambitious, respond to operators' needs so that they can most effectively serve passengers, and deliver on our obligations to act as the long-term asset steward of HS1 infrastructure, ensuring it remains a world-class asset long into the future. Our plans have been developed in collaboration with NR(HS), train operators, ORR and DfT.

The ORR approach to PR19 sets out the outputs of the ORR periodic review. These are:

- Whether HS1 Ltd has had regard to, and fulfilled, the **requirements and obligations set out in the Concession Agreement**

The Concession Agreement sets out our General Duty concerning the stewardship of the HS1 network. This is to secure the operation, maintenance, renewal, replacement and upgrade of the HS1 railway infrastructure in accordance with best practice; in a timely, efficient and economical manner; and, save in the case of the UKPNS assets, as if we were responsible for the stewardship of the HS1 railway infrastructure for 40 years following the date that any such activities are planned or carried out.

Our CP3 plans set out how we will continue to act as a strategic partner and intelligent client to deliver a safe, high performing and sustainable asset in accordance with our Concession Agreement obligations.

In CP2, we have delivered on our commitment to improve our asset management maturity, and that of our supply chain, building capability to ensure we meet our long term asset stewardship obligations. We have driven a transformation in NR(HS) capability, particularly in terms of asset management and long term planning. We improved our ability to plan and deliver renewals and introduced a project governance framework that has delivered major benefits in terms of scoping and costing of renewal projects.

As the asset ages and renewals volumes increase, our challenge is to transform into a renewals delivery organisation. In preparation for this step change in renewals, we commenced detailed upfront planning for the renewal of the HS1 railway infrastructure for the next 40 years, commissioning a deliverability study from Bechtel. This study confirmed that renewals are deliverable with limited disruptive access and developed a high level costed plan.

- The **outputs** HS1 Ltd will deliver in CP3

For CP3, we have developed a set of outputs based on our consultation with stakeholders. We have used these outputs to inform the development of our plans for CP3 and beyond.

We will ensure appropriate management focus on delivering against these outputs, including improving the Line of Sight process we began with operators in CP2, supported by improved operational metrics and a heightened focus on strategic challenges facing HS1 Ltd and operators. We will work with operators to agree a new approach for CP3, using the last year of CP2 to test and embed the changes.

- HS1 Ltd's **asset management plans** for CP3 and beyond

Our excellent safety and operational performance demonstrates that we are operating and managing the asset well.

In CP3, we will build on the systems put in place during CP2, continuing to improve our asset management capability, and that of our supply chain, and our understanding of our assets to ensure we deliver maintenance and renewals interventions at the best whole life cost.

We will continue to evolve our renewals delivery capability in CP3 and introduce enhanced governance processes and reporting, greater transparency and increased involvement of operators.

The Bechtel deliverability study is the starting point for our long term renewals planning and preparation, setting out an integrated plan and building blocks for successful delivery. In CP3, we will continue to develop

the elements of the detailed integrated plan in readiness for the execution of the works from 2025, engaging with stakeholders, shareholders and the supply chain. By strategically planning this work ahead of time, we are in a unique position to challenge the industry to move high speed line renewals forward and make a real and lasting difference.

- The **regulatory framework** for HS1 Ltd in CP3

The existing framework is generally working well and we propose a limited number of changes in the following areas.

We propose to suspend the Capacity Reservation Charge for CP3 but to keep this suspension under review, particularly in relation to:

- A potential new entrant planning to operate train services on HS1;
- Any material change in capacity usage; or
- A material increase in capacity reservation in comparison with the current levels.

We propose to add potential market test costs as a new pass through cost category for CP3. If, following stakeholder consultation, we decide to undertake market testing, this would allow us to recover the associated costs, subject to demonstrating to the ORR that they were efficiently incurred.

We propose to maintain the current approach to volume reopeners, as agreed in PR14, and to clarify the drafting of the HS1 PAT to ensure that it correctly reflects the agreed approach.

Work on the recalibration of the track access performance regime is ongoing. We will continue to progress this work and engage with stakeholders during the consultation period.

- The **structure** of HS1 Ltd's charges

We have reviewed our structure of charges for compliance with the Railways (Access, Management and Licensing of Railway Undertakings) Regulations 2016. We propose to amend our cost category definitions to align with the Regulations but this does not have an impact on how we have calculated charges for CP3.

We propose to revisit a number of issues in a Structure of Charges Review during CP3. There has been limited appetite for changes to the structure of charges during PR19. However, given some of the regulatory changes and additional data, we believe that a more comprehensive review during CP3 is appropriate.

- The **level** of HS1 Ltd's regulated access charges

Our proposed charges for CP3 are based on our forecast of efficient O&M costs over CP3 and renewal costs over the next 40 years. We have shared these costs with stakeholders through the PR19 stakeholder consultation process.

In developing the O&M costs for CP3, our focus has been on what we need to do to deliver our asset management obligations, continue to operate a safe, sustainable and high-performing railway and manage our concession at the most efficient cost. We have built CP3 costs bottom up, based on our experience in CP2. Costs have been subject to a robust process of internal review and challenge. We forecast a 3% reduction in O&M costs between CP2 exit and CP3 exit as shown in Table 70.

Table 70: CP3 exit v CP2 exit O&M costs (£m, February 2018 prices)

	CP2 exit – outturn	CP3 exit	Difference	% difference
NR(HS) costs	41.1	40.0	-1.1	-3%
HS1 costs				
- subcontract	3.9	3.8	-0.2	-5%
- internal	9.6	8.0	-1.6	-17%
Pass through costs	18.5	19.1	+0.6	+3%
Freight costs	0.6	0.4	-0.2	-37%
Total O&M cost	**73.7**	**71.2**	**-2.5**	**-3%**

We will continue to pursue opportunities to improve efficiency throughout CP3, challenging NR(HS) to outperform its Annual Fixed Price, identifying opportunities to reduce HS1 costs and working to minimise costs which are passed through to train operators.

The Bechtel deliverability study provides a strong engineering baseline for renewals volumes and costs over the next 40 years, based on ambitious productivity and efficiency assumptions. However, long term renewal costs have increased significantly compared with the PR14 estimates, largely as a result of the inclusion of indirect costs and ERTMS. Our best estimate of 40 year renewals costs has increased from our PR14 estimate of £781 million to £1,524 million including direct costs, management fee, contingency and delivery integrator costs.

This has driven a significant increase in the renewals annuity to £37.9 million per annum compared with £18.4 million per annum for CP3 calculated on the basis of the PR14 estimate of renewals costs. While we recognise that this presents a challenge to affordability for train operators, our approach reflects the requirements set out in our Concession Agreement, best practice asset management and fully funding the cost of renewals over 40 years.

We have worked with DfT, ORR and train operators and have modelled a number of alternative options for calculating the renewals annuity. To make any change to the annuity calculation, we would need to have further discussions with DfT on our Concession Agreement obligations. We will continue to engage with stakeholders on annuity options during the consultation period.

The increase in the renewals annuity has driven a significant increase in OMRC. Our proposal for the level of OMRC payable in CP3 is shown in Table 71.

Table 71: OMRC per train per minute/per train-km (Feb 2018 prices)

	International passenger services £ per minute	Domestic passenger services £ per minute	Conventional freight services £ per train-km
Vehicles	Class 373 Class 374	Class 395	Class 92
OMRC			
OMRCA1	£28.56	£8.84	£9.47
OMRCA2	£15.81	£3.23	£3.96
OMRCB	£24.44	£27.70	
OMRCC	£10.14	£10.14	
Total OMRC	**£78.95**	**£49.91**	**£13.43**

These charges represent a 46% increase in OMRC for international passenger services, a 22% increase in domestic OMRC and a 78% increase in freight OMRC compared with CP2. The full renewals annuity calculated in PR14 was not charged to train operators in CP2. Compared with the CP2 charge calculated on the basis of the full renewals annuity the CP3 charges represent a 35% increase in international charges and a 15% increase in domestic charges.

21. Next steps

The timeline for PR19 has been revised since the previous periodic review to allow more time for HS1 Ltd to plan and develop the 5YAMS, and for ORR to evaluate the 5YAMS and prepare the final determination. The revised timetable is reflected in the Concession Agreement and was summarised in the ORR's approach to PR19.

This draft 5YAMS has been submitted to ORR, along with the supporting documentation listed in Appendix 3, and launches our formal public consultation. A separate stations consultation is being run in parallel.

We will hold a **Stakeholder Briefing Session** to discuss our proposals from 10:00 to 16:00 on **Tuesday 12 March 2019** at our offices:

HS1 Limited
5th Floor
Kings Place
90 York Way
London N1 9AG

We are seeking responses to this consultation by **Wednesday 10 April 2019**.

We welcome feedback on any aspect of our proposals and have formulated the following questions to stimulate debate and draw attention to the areas we see as important.

No	Question
1	Do you agree with our asset management approach and the development of our long-term renewals plans (including our proposals for funding ERTMS as a renewal)? Do you support the recommendations of the Bechtel report?
2	We welcome your feedback on our O&M proposals, including your views on whether they appropriately respond to the proposed CP3 outputs previously agreed with stakeholders.
3	We welcome your views on our proposals to improve governance for CP3 renewals. Specifically, do you support our proposals for increased operator engagement in decision-making on renewals projects?
4	Do you agree with the criteria we have adopted for calculating the renewals annuity, specifically: ▪ sustainability; ▪ user pays; ▪ affordability; ▪ stability; and ▪ efficiency?
5	Do you agree with our approach to calculating the renewals annuity? Does it demonstrate consistency with our asset stewardship obligations in the Concession Agreement while satisfying the commercial requirements of your business?
6	If you have concerns with our approach to calculating the renewals annuity, how would you propose that we modify our proposals? Do you support the following options, noting each will have different implications for existing and future stakeholders: ▪ Revising contingency levels for future renewals projects? ▪ Moving to a zero escrow account balance at concession handback (2040) rather than at 2060? ▪ Modifying HS1 Ltd's obligations in the Concession Agreement? Is there anything else which would address your concerns?
7	Do you agree with our proposals to make minor changes to the regulatory regime for the HS1 route (including suspension of the Capacity Reservation Charge)?
8	Is there anything missing from the document(s) that would help your business or organisation over the course of CP3?
9	Are you satisfied with how we have engaged with you to date as part of the PR19 process?
10	Is there any other area of the document you would like to comment on that was not raised as a specific question?

Please send your responses to:

James Mackay
Head of Regulation and Customer Relationships
email: James.Mackay@highspeed1.co.uk

Following receipt of consultation responses, we will update the 5YAMS and follow the process set out below:

Milestone	Date
HS1 Ltd submits the Final 5YAMS to ORR	By 31 May 2019
ORR issues Draft Determination and commences public consultation	By 30 September 2019
If required, HS1 Ltd revises the Final 5YAMS including making changes needed to address deficiencies identified by ORR, submit additional information or revise existing information	By 30 November 2019
ORR issues Final Determination	7 January 2020

We will also reflect ORR's final determination in changes to the following regulatory documents:

- HS1 Passenger Access Terms;
- Track Access Agreements – Passenger;
- HS1 Freight Access Terms;
- Track Access Agreements - Freight; and
- HS1 Network Statement.

Appendix 7 summarises the consequential changes to these documents as a result of the proposals contained in this 5YAMS.

The new charges and changes to our regulatory framework will take effect from 1 April 2020.

Part 5: Appendices

Appendix 1 Glossary

5YAMS	Five Year Asset Management Statement
ADST	Asset Decision Support Tool
AMEM	Asset Management Excellence Model
AMAS	Asset Management Annual Statement
AMO	Asset Management Objective
ASC	Available Supply Capacity
ASP	Asset Specific Policy
ATP	Automatic Train Protection
BTP	British Transport Police
BTPA	British Transport Police Authority
CA	Concession Agreement
CIRs	Commission Implementing Regulations
CP	Control Period
CP1	Control Period 1 (October 2009 to March 2015)
CP2	Control Period 2 (April 2015 to March 2020)
CP3	Control Period 3 (April 2020 to March 2025)
CP4	Control Period 4 (April 2025 to March 2030)
CPI	Consumer Price Index
CSR	Cab Secure Radio
CTR	Cost Time Resource
DfT	Department for Transport
DTN	Data Transmission Network
eAMs	Electronic Asset Management System
ECMP	Escrow Cash Management Policy
EIL	Eurostar International Limited
EMGTPA	Equivalent Million Gross Tonne-km Per Annum
EMMIS	Electrical Mechanical Management and Information System
EMT	East Midlands Trains
ERTMS	European Rail Traffic Management System
FAT	HS1 Freight Access Terms
FOAEC	Fibre Optic & Aerial Earth Cable
FOC	Freight Operating Company
FON	Fibre Optic Network
FWI	Fatalities and Weighted Injuries
GBRf	GB Railfreight
Getlink	formerly Group Eurotunnel
GSM-R	Global System for Mobile Communications – Railway
HSMS	Health & Safety Management System
HPSS	High Performance Switch System
IECC	Integrated Electronic Control Centre
Infrabel	Infrastructure manager for the Belgian rail network
IRC	Investment Recovery Charge
ITCS	Integrated Train Control System
KPI	Key Performance Indicator
LAN	Local Area Network
Lisea	The private company with the concession for the Sud Europe Atlantique LGV (LGV SEA) between Tours and Bordeaux
LSER	London & South Eastern Railway Limited
LTIFR	Lost Time Injury Frequency Rate

M&E	Mechanical and Electrical
MAA	Moving Annual Average
MRE	Marginal Revenue Effect
NR(HS)	Network Rail (High Speed) Limited
NRIL	Network Rail Infrastructure Limited
NRPS	National Rail Passenger Survey
O&M	Operations and Maintenance
OA	Operator Agreement
OCS	Overhead Contact System
OMA	Operations and Maintenance Agreement (covers the interface assets between the NRIL network and HS1)
OMR	Operations, Maintenance and Renewal
OMRC	Operation, Maintenance and Renewal Charge
ORR	Office of Rail and Road
PAT	HS1 Passenger Access Terms
POE	Points operating equipment
PR14	2014 Periodic Review of HS1
PR19	2019 Periodic Review of HS1
RCCS	Route Control Centre System
Regulations	The Railways (Access, Management and Licensing of Railway Undertakings) Regulations 2016
Regulations 2005	The Railways Infrastructure (Access & Management) Regulations 2005
RIDDOR	Reporting of Injuries, Diseases and Dangerous Occurrences Regulations
RLE	Rail Link Engineering
RM3	Risk Management Maturity Model
RMM	Rail Method of Measurement
ROGS	Railways and Other Guided Transport Systems (Safety) Regulations 2006 (as amended)
RPI	Retail Price Index
RSSB	Rail Safety and Standards Board
S&CS	Signalling and Communication Systems
SAMP	Strategic Asset Management Plan
SAS	Specific Asset Strategy
SEAR	Safety, Environment Assurance Report
SEHS	Southeastern High Speed
SMS	Safety Management System
SNCF Réseau	Infrastructure manager for the French rail network
SoS	Secretary of State for Transport
SVoP	Single View of the Plan
TAA	Track Access Agreement
TOC	Train Operating Company
TPS	Traction Power Supply
TSC	Transport Systems Catapult
TSIs	Technical Specifications for Interoperability
UKPNS	UK Power Networks Services
UPS	Uninterruptible Power Supply
VCS	Ventilation Control System
VHME	Vehicle Health Monitoring Equipment
WLC	Whole life cost

Appendix 2 CA requirements for periodic review

CA Sch10 Section 2 paragraph	Requirement	5YAMS section reference
8.1.1	A performance and infrastructure quality plan, which sets out the condition, capability and capacity of the assets, for CP3	9
8.1.2	Details of any proposed changes to the possessions regime (other than the cap on liability) and any related provisions of the HS1 PAT, HS1 FAT and TAAs	16.2 Appendix 7
8.1.3	Details of forecast demand and traffic levels (with supporting evidence) for CP3	7.1
8.1.4	A proposal with respect to the level of OMRC for CP3	13
8.1.5	Details of any other proposed changes to the provisions of the HS1 PAT, HS1 FAT and TAAs relating to OMRC, its apportionment between train operators and the freight supplement charge payable by franchised train operators	15 Appendix 7
8.1.6	Any proposed changes to the asset management strategy and details of the operations, maintenance, renewal and replacement that HS1 Ltd proposes to carry out in CP3	9, 10, 12
8.1.7	A detailed record of the cost of operations, maintenance, renewal and replacement for CP2 and plans for the remainder of CP2	4.4, 4.5
8.1.8	Details of any additional OMRC that the ORR has determined is required by HS1 Ltd in any subsequent Control Period (pursuant to paragraph 10.4 of CA Schedule 10)	n/a
8.1.9	Details of any Specified Upgrades or other upgrades that have been implemented in CP2	4.8
8.1.10	Details of any Specified Upgrades or other upgrades which HS1 Ltd proposes to implement in CP3 or which the Secretary of State has requested that HS1 Ltd implement	14
8.1.11	Details of any amount that has been withdrawn from the escrow account to make an Authorised Investment	4.6.4
8.1.12	A cost efficiency plan for CP3	11
8.1.13	Details of amounts withdrawn from the escrow account to fund any additional renewals and replacements	4.6.4
8.1.14 & 15	Details of any Costs Savings and any Performance Incentive Share to which HS1 Ltd believes it is entitled (with evidence) (relates to renewal and replacement	n/a
8.1.16 & 17	Details of any Additional Share to which HS1 Ltd believes it is entitled (with evidence) (relates to renewal and replacement)	n/a
8.1.18	Details of any proposed changes to the track access performance regime (other than the cap on liability) and any related provisions of the HS1 PAT, HS1 FAT and TAAs	16.1 Appendix 7

Appendix 3 Supporting Documents

Supporting documentation	ORR/DfT	All consultees
NR(HS) Five Year Asset Management Statement for Control Period 3, December 2018, including: ▪ Appendix A: Strategic Asset Management Plan ▪ Appendix B: Specific Asset Strategy: Civils & Lineside Buildings ▪ Appendix C: Specific Asset Strategy: E&P Mechanical & Electrical ▪ Appendix D: Specific Asset Strategy: E&P Overhead Contact System ▪ Appendix E: Specific Asset Strategy: E&P Traction Power Supply ▪ Appendix F: Specific Asset Strategy: Signalling & Control Systems ▪ Appendix G: Specific Asset Strategy: Track ▪ Appendix H: NR(HS) Operations Strategy ▪ Appendix I: NR(HS) Safety Strategy ▪ Appendix J: NR(HS) Rail Plant Strategy ▪ Appendix K: NR(HS) Possessions Strategy ▪ Appendix L: NR(HS) CP3 Project Delivery Strategy	✓	✓
HS1 Asset Management Policy	✓	
HS1 Asset Management Objectives	✓	
Whole Life Cost Documents – Track, Civils, E&P, Signalling	✓	
Review of CP3 Plans, 28 September 2018, Vertex Systems Engineering	✓	
HSR OMR Effectiveness Study Final Report, 15 November 2018, RebelGroup	✓	✓
Determination of an appropriate management fee for Network Rail (High Speed) Limited, 23 May 2018, Oxera	✓	
CP3 QCRA Workbook FINAL 311218	✓	
High Speed 1 Limited Energy Strategy - Project Report, January 2019, UKPNS	✓	✓
HS1 Phase 2 Master Plan, June 2018, Bechtel	✓	✓
HS1 Renewals Programme: Governance Handbook Report, 18 December 2018, Arup	✓	✓

Appendix 4 CP3 renewals portfolio

The table below lists the projects in the CP3 renewals portfolio by asset type and the estimated cost of each project, **excluding** the NR(HS) mark-up of 10% and risk allowance.

Renewal project	Estimated price (£000)
Track	
Ballast mid-life refurbishment	16,580
New road rail access points	490
Switchblade design, development and deployment	510
Under-sleeper pads	30
Subtotal - Track	***17,610***
Civils & lineside buildings	
Access roads gates and stairs	920
Acoustic barriers	330
Boundary fencing	570
Camley Street heritage structures – bridges	80
Corsica Street headhouse	150
Earthworks – shotcrete	620
Lineside buildings doors and locks	910
Long tunnel drainage	1,160
Open route drainage	1,980
Passive drainage systems	1,160
Road expansion joints	450
Road waterproofing	300
Relining of culverts	70
Subtotal – Civils & lineside buildings	***8,700***
Signalling & Communications Systems	
HPSS St Pancras upgrades	3,240
Modbox	450
ERS/EZP	2,960
Local Release Command	550
Local Area Network	130
MCEM91 Point Operating Equipment	1,470
Fibre optic signals at St. Pancras	870
FOAEC replacements	3,520
ITCS test bench obsolescence	3,920
VHME equipment (hot box obsolescence)	1,520
GSM-R handsets	280
Renewal marker board ID	300
Subtotal - Signalling & Communications Systems	***19,210***
E&P	
Thames tunnel fan controls	150
Building depressurisation fans	120
Fire suppression gas bottles	230
Static switches	470
Cross-passage doors	1,570
Building Management Systems (for air con at headhouses and portals)	230
Borehole pumps (Stratford dewatering system)	290

Renewal project	Estimated price (£000)
Ashford nadir pump station controls	60
Minor air conditioning (split units)	510
Replacement of electrical section status detection equipment	180
Inverter drives for pumps and non-tunnel ventilation fans	170
Replacement of UPS, integral rectifiers and batteries	7,710
DIOM (Digital Input Output Module) chargers/rectifiers and batteries	240
Damper mesh	170
Attenuators	90
Major air con (water/chiller-based units)	660
Inverter drives for main axial fans	410
Pumps and valves	610
Local rectifiers	150
Damper actuators	510
Subtotal – E&P	***14,530***
Rail Plant	
Hybrid auxiliary power unit	280
Renewal of 2 x MPV pairs or 2 x control system overhaul	4,650
Windhoff access platform module replacement (x2)	410
SRS (Sjolanders) 9m 12m mobile elevated working platforms (MEWPs) replacement	880
Windhoff jet fan handler module	550
Subtotal – Rail Plant	***6,770***
Total	**66,820**

Appendix 5 Governance improvement plan for CP3

No	Arup Recommendation	HS1 response	Next steps	When
1	Invite operators to be part of the route and station quarterly route review meetings with the DfT and the ORR. Use these meetings to involve them in the management of the portfolio of renewals projects. At the meetings, undertake a review of if the portfolio of projects is operating in line with expectations. Any exceptions will be reported.	Agreed	Set up the quarterly meetings with HS1, NR(HS) and the regulator and invite EIL and LSER to the route renewals and EIL, LSER, and EMT to the station renewals meetings.	31/01/19
2	Operators and regulator approve the 5YAMS and also the AMAS.	The operators already approve the 5YAMS. We send the operators the AMAS for information. We are not proposing to change this. We would, however, be happy to seek TOC approval on the projects-related sections of the AMAS	Send the route and stations projects section of the AMAS for operators to approve.	31/03/19
3	Create a simple/complex project status for renewals projects, that can be used to drive reporting and project governance	This is a good idea as it allows governance and reporting to be tailored to increase efficiency of the governance process whilst maintaining its effectiveness.	Develop a proposal (working with NR(HS)) based on the recommendations in the report and issue to the TOCs, ORR and DfT for approval with a view to having this approach in place for the start of CP3. Proposal to be issued before the end of February 2019	28/02/19
4	Change the governance arrangements to simplify the existing system and focus attention on key significant projects and operate at more of a portfolio view.	We will develop a proposal on how the governance could be simplified	Develop a proposal (working with NR(HS)) and seek approval from the ORR and DfT. In conjunction with item 3 above. Once agreed include the details in the Governance Handbook.	28/02/19
5	Introduce standardised templates and gateway documents across HS1 Ltd and NR(HS) for both stations and route projects	This is a good idea. In the main our templates are aligned but we will check to ensure full alignment	Work with NR(HS) to develop a common set of templates.	31/07/19
6	Design and introduce a single dashboard for project/portfolio reporting across HS1 Ltd and NR(HS) for both stations and route projects	We are already putting this approach in place.	Ensure new dashboard is available for the operators and regulator to review at June quarterly meeting.	30/06/19
7	Add requirement for NR(HS) to share pipeline/potential candidate projects that are outside of 5YAMS on a regular basis	This is partly in place in that the information is contained in the SAS. We will include details in the AMAS as well.	Ensure that the quarterly meeting contains an agenda item that covers new renewal projects and that the AMAS gives a five year forward view (in years when the 5YAMS is not also being issued).	31/03/19

No	Arup Recommendation	HS1 response	Next steps	When
8	Formalise stations reporting and governance, including Qx and candidate project visibility for all stakeholders	The stations reporting and governance is already formalised. Inviting the TOCs to the station quarterly review meetings will give them more visibility of this process	No further action	-
9	Adopt standard methodology across stations and route projects for project cashflow and “value of work done” (VOWD)	We have introduced a VOWD approach	VOWD reports to be shared with the regulator and the operators at the next meeting	31/03/19
10	Introduce shared KPIs across HS1 Ltd and NR(HS) to support the common gateways and reporting outlined above	Agreed	KPIs to be developed with NR(HS)	31/07/19
11	Introduce full benefits mapping to consider asset condition and the HS1 asset management objectives, including any asset enhancement process as necessary. Ensure the impact on operating and maintenance costs is defined in the business case.	We will implement this	Update the business case template to include benefits mapping, asset condition, and asset management objectives	31/07/19
12	Consider the use of a shared document portal and workflow tool between HS1 Ltd and NR(HS) managed projects	We will review this	Undertake a review of the benefits of adopting a shared document portal and workflow tool and report back to the regulator and TOCs by the end of December 2019	31/12/19
13	Risk - map out risk management against the project process and share with the regulator and TOCs	We will implement this	Map out the process, agree it with the ORR, DfT and TOCs and include the process in the Governance Handbook	31/03/19
14	Investigate any benefits from a shared PMO function	We will review this	Undertake a review of the benefits of adopting a shared document portal and workflow tool and report back to the regulator and TOCs by the end of December 2019	31/12/19
15	Develop a rolling five year renewals plan	Agreed	Include through the 5YAMS and also the AMAS	31/03/19
16	Mechanism for capturing passenger feedback and feed this back into project delivery	We are not proposing to take this forward as we can see little benefit	No further action	-
17	Independent review body (not an Arup recommendation but mooted by the ORR)	We will investigate this further	Review how the role of an independent reviewer might work with the ORR and the HS1 Ltd regulation team and then agree with ORR whether to put this in place for CP3.	31/07/19

Appendix 6 Calculation of access charges

This Appendix summarises how the access charging model converts costs into charges and allocates them between train operators.

Calculation of charges for passenger operators

O&M (excluding pass through costs) and renewals

The charges per train minute for O&M (excluding pass through costs) and for renewals are calculated for each passenger operator as set out below.

Stage 1: Split costs into cost apportionment categories

Each of the functional cost categories is allocated across the following four cost apportionment categories depending on how the cost varies with the network layout and level of train service:

- **Track and traffic dependent costs**: costs that would be expected to vary according to the length of the track and the volume of traffic over the track;
- **Track dependent, traffic independent costs**: costs that would be expected to vary according to the length of the track but to be independent of the volume of traffic;
- **Operator dependent costs**: costs that would vary if there were more or fewer operators using HS1; and
- **Fixed common costs**: the remainder of the cost base (excluding pass through costs).

The allocation of O&M and renewals costs to these cost apportionment categories is based on the experience of HS1 Ltd and NR(HS) management and their knowledge of the drivers of costs in each category. The allocation for CP3 is based on that used for CP2, with only minor changes, and is set out in Table 1.

Table 1: Allocation of costs to cost apportionment categories

Cost apportionment category	O&M costs	Renewal costs
Track and traffic dependent costs	90% of direct track maintenance costs 80% of tamping costs 80% of grinding and track measurement costs	100% of track renewals 50% of OLE renewals
Track dependent, traffic independent costs	The remainder of the NR(HS) O&M costs except Managing Director	100% of track-related civils assets 50% of bridgeworks 50% of OLE 50% of M&E assets and rail plant 50% of SC&C
Operator dependent costs	None	None
Fixed common costs	NR(HS) Managing Director HS1 costs	50% of bridgeworks 100% of civils-other 50% of M&E assets and rail plant 50% of SC&C

Stage 2: Calculate an annuity for each cost apportionment category

For **O&M costs** a constant annual payment for CP3 is calculated such that the present value of the annual payment is equal to the present value of the CP3 O&M costs (excluding pass through costs).

A **renewals annuity** is calculated such that the closing balance of the escrow account (at the end of 40 years) is zero. This calculation takes into

account payments into and withdrawals from the escrow account and interest received on the escrow account.

Stage 3: Allocate between passenger train operators

The annual payments calculated in Stage 2 are allocated between train operators on the basis shown in Table 2.

Table 2: Allocation of costs between passenger train operators

Cost apportionment category	Basis of allocation between operators
Track and traffic dependent costs	Allocated between all operators (passenger and freight) on the basis of: No. of trains x EMGTPA weighting per train
Track dependent, traffic independent costs (net of mothballing costs)	
- International track	Train minutes on international track
- Domestic track	Train minutes on domestic track
- Common track	Train minutes on common track
Operator dependent costs	Each active operator has an equal share
Fixed common costs (including mothballing costs)	Total train minutes on all types of track

Stage 4: Calculate charges by operator

The model then calculates the total OMRCA1, OMRCA2, OMRCB for each operator by adding costs in each of the categories above:

- OMRCA1 = Traffic dependent costs
- OMRCA2 = Track dependent - international track + Track dependent - domestic track + Operator dependent costs
- OMRCB = Track dependent - common track + Fixed common costs

These are converted into a price per minute for each operator and a price per train service for each operator and service group.

Pass through costs

Pass through costs (OMRCC) are allocated between passenger train operators in proportion to their train minutes on HS1. These are converted into a price per minute and a price per train service for each operator and service group.

This is an indicative price used in the advance billing of train operators throughout the year. The annual washup process ensures that train operators are charged actual costs for the pass through costs.

Calculation of charges for freight operators

Freight costs comprise:

- Freight variable costs (OMRCA1); and
- Freight avoidable costs (OMRCA2), made up of two elements;
    - Track-dependent avoidable costs (net of mothballing costs); and
    - Other freight avoidable costs e.g. staff costs.

One of the elements of freight avoidable costs is the cost of operating and maintaining Ripple Lane exchange sidings (net of mothballing costs). This cost is split between freight trains accessing Ripple Lane from HS1 and freight trains accessing Ripple Lane from the NRIL network on the basis of the number of trains forecast to be operated.

Charges for freight trains on HS1

Freight variable costs for each freight operator are calculated as a percentage of total track and traffic dependent cost. The percentage is calculated on the basis of the number of trains x EMGTPA weighting per train.

For the calculation of track-dependent **freight avoidable costs**, the concept of equivalent track-km is used; this normalises freight-only track-km for the level of spend on these lightly used areas compared with the rest of the network. The freight-only parts of the network are assumed to attract 10% of the normal level of spend per track-km.

Freight track-dependent avoidable costs are calculated as total track dependent costs multiplied by the percentage of equivalent track-km that is freight only.

For freight avoidable costs a constant annual payment for CP3 is calculated such that the present value of the annual payment is equal to the present value of the freight avoidable costs.

Total freight charges are converted into a price per train-km for each operator.

Charges for freight trains accessing Ripple Lane from the NRIL network

A charge per train is calculated by dividing the portion of Ripple Lane costs allocated to freight trains accessing Ripple Lane from the NRIL network by the forecast number of such trains.

Appendix 7 Changes to HS1 regulatory documents

Regulatory document	Area	Scope of change
Passenger Access Terms	Part 1 (Interpretation) to Section 7	Update the definition of "Review Event" to reflect proposed volume reopener arrangements (see Section 19)
	Part 1 (Interpretation) to Section 7	Update the definition of "Pass Through Costs" to clarify that costs associated with market testing Operator Agreement related services fall within the definition (see Section 16.6.2)
	Part 2 (Track Charges) to Section 7	Modify the Capacity Reservation Charge provisions to reflect the suspension of the charge and the circumstances for re-activating the charge (see Section 16.5.2)
	Section 7 (Track Charges)	Update Section 7 to reflect that OMRC avoidable costs will be recovered as part of long term project costs (see Section 17.2.2)
	Section 8 (Performance Regime)	Modify Section 8 to introduce the new UKPNS power performance regime and to exclude the UKPNS power related elements from the existing performance regime (see Section 16.1)
Track Access Agreements - Passenger	Schedule 4 (Track Charges)	Update OMRC values
	Schedule 6 (Performance Regime)	Update values to reflect recalibration of the existing performance regime and the introduction of the new UKPNS power performance regime (see Section 16.1)
Freight Access Terms	Part 1 (Interpretation) to Section 7	Update the definition of "Review Event" to reflect proposed volume reopener arrangements
	Part 1 (Interpretation) to Section 7	Update the definition of "Pass Through Costs" to clarify that costs associated with market testing Operator Agreement related services fall within the definition (see Section 16.6.2)
	Part 2 (Track Charges) to Section 7	Modify the Capacity Reservation Charge provisions to reflect the suspension of the charge and the circumstances for re-activating the charge (see Section 16.5.2)
	Section 7 (Track Charges)	Update Section 7 to reflect that OMRC avoidable costs will be recovered as part of long term project costs (see Section 17.2.2)
	Section 8 (Performance Regime)	Modify Section 8 to introduce the new UKPNS power performance regime and to exclude the UKPNS power related elements from the existing performance regime (see Section 16.1)

Regulatory document	Area	Scope of change
Track Access Agreements – Freight	Schedule 4 (Track Access Charges)	Update OMRC values
	Schedule 6 (Performance Regime)	Update values to reflect recalibration of the existing performance regime and the introduction of the new UKPNS power performance regime (see Section 16.1)
Network Statement	Paragraph 1.11: Periodic Review - Control Period	Update information on the Control Period 3 periodic review process
	Paragraph 6.1: Charging Principles	Update information to reflect the Modalities CIR and outcome of periodic review process
	Paragraph 6.2: Charging System Paragraph 6.3: Tariffs Annex 1	Update information to reflect changes to the charging arrangements and the updated figures for OMRC and other charges
	Paragraph 6.5: Performance Regime Annex 2	Update information to reflect changes to the existing performance regime and the introduction of the new UKPNS power performance regime
	Paragraph 6.6: Changes to Charges	Update information to refer to outcome of Control Period 3 periodic review process