high speed one

# FIVE YEAR ASSET MANAGEMENT STATEMENT FOR CONTROL PERIOD 4

**Draft for Consultation**
**29 February 2024**

# Foreword

This submission sets out HS1's plans for the next control period (CP4) to encourage passengers to fall back in love with high-speed rail. Our success is dependent on our ability to work collaboratively with our partners. Central to this is presenting a compelling proposition that delivers good value to our users - a safe, reliable, high performing service at a reasonable price, while safeguarding the railway and stations infrastructure for the future and playing an important role in the green transition of our economy.

Our plans for the previous control period (CP3) were developed against a backdrop of economic optimism and growth – but the circumstances that materialised were very different. We started developing our plans for CP4 in 2022 when the HS1 system was under stress from a number of factors:

- The Covid-19 pandemic presented all parts of the HS1 system with substantial, existential challenges, including long term changes in travel patterns, that we are still recovering from and adapting to;
- Significant movements in electricity costs, which increased more than aviation fuel and petrol costs, as well the cost of living crisis making it more difficult for passengers to absorb travel cost increases;
- Post-Brexit changes to border arrangements reducing capacity at the border;
- Potent competition faced by our international operators from a resurgent aviation industry.

HS1 needs our operators to be successful and the challenges of CP3 put renewed emphasis on delivering our asset stewardship obligations set out in the Concession Agreement and Stations Leases in the most efficient way possible. At the same time, the HS1 infrastructure is reaching the level of maturity when larger asset renewals will start to become necessary, adding costs to the system.

These factors have shaped our approach to our PR24 strategy and plans. To plan our asset management in an uncertain environment, we started by establishing clear recovery scenarios which we used to develop and assess our asset strategies. Furthermore, through CP3 we have worked to deliver targeted asset interventions and more efficient costs for CP4 and beyond, such as:

- We have invested in the development and validation of an advanced track deterioration model. This has enabled us to improve our understanding of our assets and to adopt a more sophisticated approach to the asset renewals that are the largest driver of cost.
- We have developed a structured framework for pricing the more uncertain, long-term route renewals.

- We have driven the implementation of a new Target Operating Model for NR(HS) to facilitate the delivery of route O&M cost savings and improved asset management.
- We have scrutinised our contracts and delivered important savings for example, through British Transport Police Authority (BTPA).
- We have worked hard to address rises in pass through costs, including business rates, and are implementing a range of energy consumption reduction initiatives (including regenerative braking and the "N-1" energy saving scheme in CP3).
- We are proposing an updated approach to modelling how our route renewals are funded by reflecting the traffic forecast that was used to develop our asset management plans in the annuity charge.

We will continue to review contracts and the way we do things to try and achieve further efficiencies in CP4 and beyond.

Throughout the process of developing these plans we have sought feedback regularly and implemented a process of progressive assurance. This has included taking colleagues from the ORR and train operators to sample our assurance activities and see the assets.

This ultimately resulted in robust asset management plans delivering net reductions in overall costs to be recovered from operators in CP4.

This document sets out:

- Our outputs for CP4, based on stakeholder aspirations and engagement;
- Our plans to deliver and fund our asset stewardship obligations over the next 40 years;
- The detailed work needed to deliver these outputs and the resulting costs and charges.

I am pleased to present a set of proposals that will deliver real-terms savings to most operators. This Draft Five Year Asset Management Statement sets out these proposals for your consideration. We look forward to working with customers, suppliers and stakeholders through 2024 as the ORR prepares its determination.

**Mark Farrer**
Interim Chief Executive Officer

# Executive Summary

HS1's vision is to make people fall in love with high-speed rail - it shapes everything we do. Our ambition is to encourage more users, which drives more train paths, lowering the costs per train, driving better utilisation of the asset at lower cost and supporting the UK's ambition to be net zero carbon. To help achieve this we set high standards for our route and stations asset performance for the best passenger experience.

Since PR19, the world in which we operate has become significantly more challenging as a result of the Covid-19 pandemic, energy market volatility and price increases, changes to border arrangements post-Brexit, high inflation and industrial action. HS1 has taken a leading role in bringing the system together to find solutions to these challenges, driving change and managing costs, while also our pursuing vision.

**Performance in CP3**

Despite these challenges, HS1 has continued to deliver strong operational and safety performance, meet our asset stewardship purpose and seek cost efficiencies wherever possible. Where there have been operational difficulties, HS1 has taken active steps to mitigate the impact quickly and learn from them.

We have delivered in our role to ensure the HS1 network remains a high performing railway with very good underlying performance. Infrequent high impact events have a large effect on overall performance. We monitor performance carefully and have taken action to address emerging trends. Operational challenges in CP3 have related mainly to points failures and trespass incidents; to address these areas we required NR(HS) to develop an asset resilience plan for Signalling & Communication Systems and introduce a trespass mitigation strategy. We also put in place a formal performance improvement plan with NR(HS). Evidence is growing that these interventions are having a positive impact on performance.

Stations performance has generally been good in CP3. The exception is lifts, escalators and travelators, where assets are now reaching or operating beyond their design life. Industry-wide supplier issues in CP3 affected the recovery from a small number of sudden significant failures and from planned outages. This had negative impacts on performance in the past two years. HS1 and NR(HS) have taken appropriate action to address these issues. NR(HS) has challenged its supplier to respond and increased its stock of critical spares to improve resilience and response to asset failure. These actions have improved performance back to target. NR(HS) has also improved its asset condition data and understanding of necessary interventions which is informing its LET renewals approach for PR24. Our work to deliver efficiencies in key service contracts at the stations have supported overall efficiencies in stations O&M costs of c.£5.6m over CP3 across the four stations, relative to the best estimates.

For safety, we have fully embraced the ORR Risk Management Maturity Model (RM3) to benchmark and evaluate improvement activities; a recent independent audit showed significant maturity improvements over CP3. Following a decline in safety performance in 2021/22, HS1

raised concerns with NR(HS). In response, NR(HS) changed the way that safety is managed within the organisation and developed locally owned safety improvement plans to address function-specific risk. The increase in assaults on station staff (a trend seen across the rail industry) is being addressed within the station team's locally owned safety plan, with initiatives such as the introduction of body worn cameras and conflict avoidance training.

Reducing energy consumption is important not only in the face of volatile energy prices but as a core component of HS1's sustainability strategy. The introduction of regenerative braking for the domestic train fleet and the N-1 Energy Saving Scheme have together delivered a 5.4% reduction in traction energy use, with cost savings passed on to operators. We have invested in power quality monitoring equipment to better understand power consumption and identify potential areas for optimisation. For non-traction energy, we are planning a number of schemes including the replacement of station gas boilers with heat pumps. The HS1 Route Energy Action & Carbon Reduction Team (REACT) and Stations Energy Action Group (EAG) consider smaller scale energy reduction initiatives to complement larger schemes, bringing in expertise from across the HS1 system. We have procured our first Power Purchase Agreement with a renewable generator for c.40% of total volume for 10 years; subject to TOC agreement, we intend to secure a further 40%. These are key elements of HS1's Sustainability Strategy, launched at the start of CP3. We have published annual ESG reports since 2021 which highlight the progress we have made against this strategy.

In 2020, we had an opportunity to market test the Operator Agreement with NR(HS). Following consultation with ORR and other key stakeholders, we waived the right to market test until 2035 in return for a long-term partnership with NR(HS) built on strategic alignment of objectives. During CP3 we have driven big changes in the NR(HS) organisation. NR(HS) has introduced a new Target Operating Model (TOM), an important enabler for the delivery of long-term operations, maintenance, and renewals efficiencies. The TOM introduction was planned for CP4; however, HS1 pushed for this to be accelerated into early CP3 to deliver benefits sooner, supporting the TOCs in a time of unprecedented cost pressures from external factors. NR(HS) outperformance under the Operator Agreement was shared with the train operators from 2023.

We have continued to improve our asset management capability, delivering against the ORR's PR19 asset management recommendations and driving NR(HS) to deliver a step change in capability. We introduced an HS1 Strategic Asset Management Plan (SAMP) across all assets, both route and stations, to set direction and drive consistency in approach and methodology across all assets. We have continued to improve our asset information to strengthen our asset management decision making, moving away from using manufacturers' recommendations to condition-based data-driven renewals, and increased the use of remote condition monitoring. One of the key challenges was to improve our understanding of track, our most expensive asset. NR(HS) has developed a deterioration model, using actual wear data, to assess future track renewal and maintenance options and support strategic decision making. For other assets we have developed risk-based models that build a totex output. To assure ourselves that the plans put forward by NR(HS) are appropriate, we implemented a progressive assurance process for PR24, in which we involved the ORR, and systematically reviewed the NR(HS) strategies and plans.

We have made significant improvements in the way we plan and deliver renewals, improving our use of asset data in renewals decision making and continuing to mature renewals

governance and assurance. Route renewals delivery in the first two years of CP3 was heavily impacted by the challenges noted above. In year 3, we reviewed the remaining projects in the CP3 route renewals workbank and developed a revised workbank for the remainder of CP3. We are currently on track in delivering against this revised plan. Delivery of stations renewals has been good over CP3 with forecast outturn broadly in line with the plan. The exception is Ashford International station, where Eurostar services have not operated during CP3 and the majority of renewals have therefore been deferred.

The PR19 determination allocated R&D funding to support improvements to asset management. In CP3, we implemented an R&D governance procedure to ensure targeted spending of funds, identified our highest priority areas (automated inspection, cross-domain integration and efficient possessions) and built a substantial pipeline of R&D projects. CP3 R&D initiatives have improved data collection and quality across asset types and contributed to deterioration modelling. For CP4, we have developed a joint HS1 and NR(HS) R&D Strategy building on lessons learned in CP3.

Despite the significant challenges in CP3, HS1 has worked hard to keep outturn costs within the CP3 efficient budget. The concession cost structure was built around a stable environment; increases in HS1 costs during CP3 were driven largely by costs incurred in managing our recovery from Covid-19 and the greater complexity in system management. This increase was absorbed by HS1. We have undertaken a comprehensive review of our organisational structure and other HS1 costs. As a result of which we forecast that HS1 costs will reduce to below the CP3 budget level in the final year of CP3. CP3 pass through costs are forecast to be 2% lower than budget, with all savings passed on to operators. We have also taken opportunities to reduce other costs to operators, such as delivering savings from retendering our electricity supply contract and the new Ashford International station management contract.

**Our proposals for CP4**

For CP4, we have carried forward our HS1 system thinking and learning from CP3 to develop proposals that will continue to deliver high standards and support our customers. We have set out our commitments to continuous improvement in CP4 in HS1 asset management capabilities and other areas to drive better outcomes for our customers and their passengers.

Events over CP3 have introduced more uncertainty and complexity into the HS1 system; and the potential entry of a new international operator adds to this. This has presented additional challenges in preparing our proposals compared to previous periodic reviews. We have based our proposals on a number of assumptions that aim to balance the range of risks and opportunities the system faces, based on evidence and good judgement. Most notably, we assume that a second operator does not start operation until CP5; we consider a change to this assumption would be a material and significant change to the circumstances on the basis of which the CP4 OMRC was determined in accordance with Schedule 10 of the Concession Agreement. This would need to be addressed by means of reopening the PR24 determination through an Interim Review.

The challenges of CP3 have not gone away. In developing the route O&M costs for CP4, our focus has been on the most efficient cost to support operator affordability, while meeting our asset stewardship obligations. At the start of this process, HS1 and NR(HS) undertook a sprint

initiative with the aim of giving stakeholders early sight of a likely cost envelope for CP4. It was based on a top-down view of potential efficiencies and outcomes that could be achieved. As part of this, NR(HS) projected a top-down gross O&M efficiency target for CP4 of 7.5% and identified several efficiency initiatives it could pursue to achieve this target. Alongside NR(HS)'s O&M target, we set upfront a high-level ambition for 10% route renewals efficiencies and to hold HS1 internal costs flat.

NR(HS) then built its CP4 O&M costs bottom up, further developing and validating the potential efficiency initiatives; the proposed NR(HS) Annual Fixed Price delivers a 10% gross efficiency (7% net) from CP3 exit (2024/25) to CP4 exit (2029/30); this equates to a 4% reduction when comparing costs for the five years of CP4 with CP3. HS1 also built its CP4 O&M costs bottom up, based on experience in previous control periods. Our review of the HS1 organisational structure and costs has enabled us to start CP4 in an efficient steady state position and meet our ambition to drive efficiency into HS1 costs. We have achieved an 8% reduction in HS1 costs for CP4 relative to CP3 efficient budget, delivering significant efficiencies in the face of cost headwinds and increasing complexity in managing the system. Both NR(HS) and HS1 costs have been subject to a robust process of assurance, internal review and challenge and, where appropriate, costs have been benchmarked. In addition, elements of NR(HS) costs have been assured by HS1.

Significant improvements in asset management capability in CP3 have underpinned NR(HS)'s approach to developing plans for CP4 and beyond. To navigate the uncertainty around the rate of recovery from the pandemic, the HS1 SAMP set out a range of recovery scenarios against which NR(HS) evaluated different life cycle costs by varying the time to renewals interventions and maintenance requirements. This work informed NR(HS)'s development of the Specific Asset Strategies (SASs) and the 40-year renewals volumes that were subject to extensive assurance by HS1.

As a result of improved asset management capabilities and HS1 leadership, reductions in route renewals volumes have been achieved both in CP4 and across the 40-year period. Compared with the PR19 estimates, there are significant volume reductions across track assets (between 18% and 43% over 40 years) which account for the majority of costs, reductions in OCS and some signals volumes, partially offset by some new interventions for civils and plant assets.

CP4 volumes have been smoothed to continue the successful delivery model and strategies employed in the latter years of CP3 for both route and station works. Within CP4, the renewals capability development programme will resume to support the ballast cleaning programme and the delivery of renewals volumes from CP5 onwards.

NR(HS) pricing for CP4 route renewals has used RMM1 methodology (developed by NRIL in collaboration with the wider industry) and benchmarked to NRIL direct rates where possible. However, wider macroeconomic developments have had a significant impact on the pricing of renewals, particularly in ballast cleaning unit rates (a major CP4 renewal; with achievable productivity rates also driving price increases), rail plant and other core renewal components. The HS1 challenge to NR(HS) volumes and pricing has removed £108 million of costs but there is still an increase in CP4 renewals costs of £65 million, more than offsetting the reduction in volumes.

Extending the CP4 renewals pricing to the 40-year workbank would give renewals costs of £2.3 billion. However, for PR24, HS1 has funded and developed a renewals Cost Policy which provides a structured and transparent approach to pricing long term (CP5 to CP11) renewals, recognising the inherent uncertainty of forecasting so far into the future. HS1's application of the Cost Policy and adjustments to some of the NR(HS) indirect cost estimates gives an efficient price for the 40-year workbank of £1.7 billion. We have explored with NR(HS) an approach to the delivery of some minor renewals works with streamlined governance that would deliver efficiencies; we are proposing to trial this over CP4.

For stations, this is the first periodic review to be overseen by the ORR since the transfer of regulatory oversight of the HS1 station assets from DfT to the ORR in July 2022. The stations SASs have progressed significantly during CP3, having started from a less mature asset management approach compared with the route SASs. Totex models have been developed for station assets, which consider both opex and capex, allowing us to optimise life cycle costs. Compared to PR19, the station SASs are now developed and owned by NR(HS), allowing HS1 to undertake more independent assurance of the proposals.

The stations 40-year renewals workbank costs have increased, mainly due to higher expenditure on civils and mechanical, electrical and plumbing renewals, while efficiencies have been achieved in data and communications renewals. For CP4, St Pancras roof interventions have been brought forward from CP5 for more efficient delivery while data cabling renewals have been deferred. Overall CP4 station renewals costs are £56 million, 6% lower than PR19 estimates. However, with the higher costs and some additional interventions, 40-year stations renewals costs have increased to £732 million, with an impact on charges for operators. HS1 and NR(HS) will undertake further work to fully understand the drivers of the variance relative to PR19.

**Proposed charges for CP4**

Our proposed CP4 route charges are based on robust asset management, an assured renewals workbank, efficient pricing of O&M and renewals and updated annuity modelling assumptions. Table 1 sets out the proposed route OMRC per train for CP4 compared with both the current OMRC (from the December 2023 volume reopener adjustment) and the CP3 OMRC determined at PR19. Our proposed CP4 OMRC per train for passenger operators is 13 to 18% lower than current charges. The CP4 charges differ by less than 1% from the PR19 charges, with international charges slightly lower and domestic charges slightly higher. We consider this a good outcome given the lower traffic volumes expected on the network compared to PR19. There is an increase in freight charges due to the large reduction in forecast freight train paths.

Table 2 sets out the proposed CP4 stations Long Term Charge (LTC) per annum by operator compared with the CP3 charge determined at PR19. The increase in the 40-year renewals costs has resulted in a significant increase in LTC compared with CP3. There are larger percentage increases for SETL because of a change in the zone allocations between operators to reflect current usage of floor space.

**Table 1: CP3, current and CP4 route OMRC (£ per train, February 2023 prices)**

| | CP3 OMRC at PR19 | Dec 2023 OMRC | CP4 OMRC | CP4 vs PR19 | CP4 v Dec 2023 |
|---|---|---|---|---|---|
| International | 2,605 | 3,168 | 2,594 | (0.4%) | (18.1%) |
| Domestic (St Pancras - Ashford) | 1,935 | 2,234 | 1,948 | 0.7% | (12.8%) |
| Freight (Dollands Moor) | 981 | n/a | 1,313 | 33.9% | n/a |

**Table 2: CP3 and CP4 stations LTC (£m p.a., February 2023 prices)**

| | CP3 | CP4 | Increase |
|---|---|---|---|
| EIL | 6.31 | 7.74 | 23% |
| EMR | 1.55 | 2.10 | 36% |
| SETL | 3.72 | 5.72 | 54% |
| Total | 11.58 | 15.56 | 34% |

We recognise the increased importance of affordability for train operators while noting the challenge of meeting the HS1 asset stewardship obligations. We are confident our CP4 proposals meet our asset stewardship obligations while delivering affordability for operators. This is notwithstanding the further work HS1 and NR(HS) will do to understand more fully the drivers of the large cost variance in stations renewals and to explore if the Cost Policy approach can be applied to long term stations renewals pricing; we will incorporate any findings into our Final 5YAMS submission.

**Next steps**

Engagement and input from stakeholders across the HS1 system in the periodic review process was more important than ever given the challenging environment post-Covid. HS1 and NR(HS) have undertaken a proactive, open and collaborative stakeholder engagement programme with one-to-one meetings with key stakeholders and industry-wide workshops.

This Draft 5YAMS launches our formal public consultation on our plans and associated costs for the HS1 system for CP4 and beyond. We welcome feedback by 18 April 2024 which will be taken into account in preparing our Final 5YAMS submission for the end of May 2024.

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# Part 1:

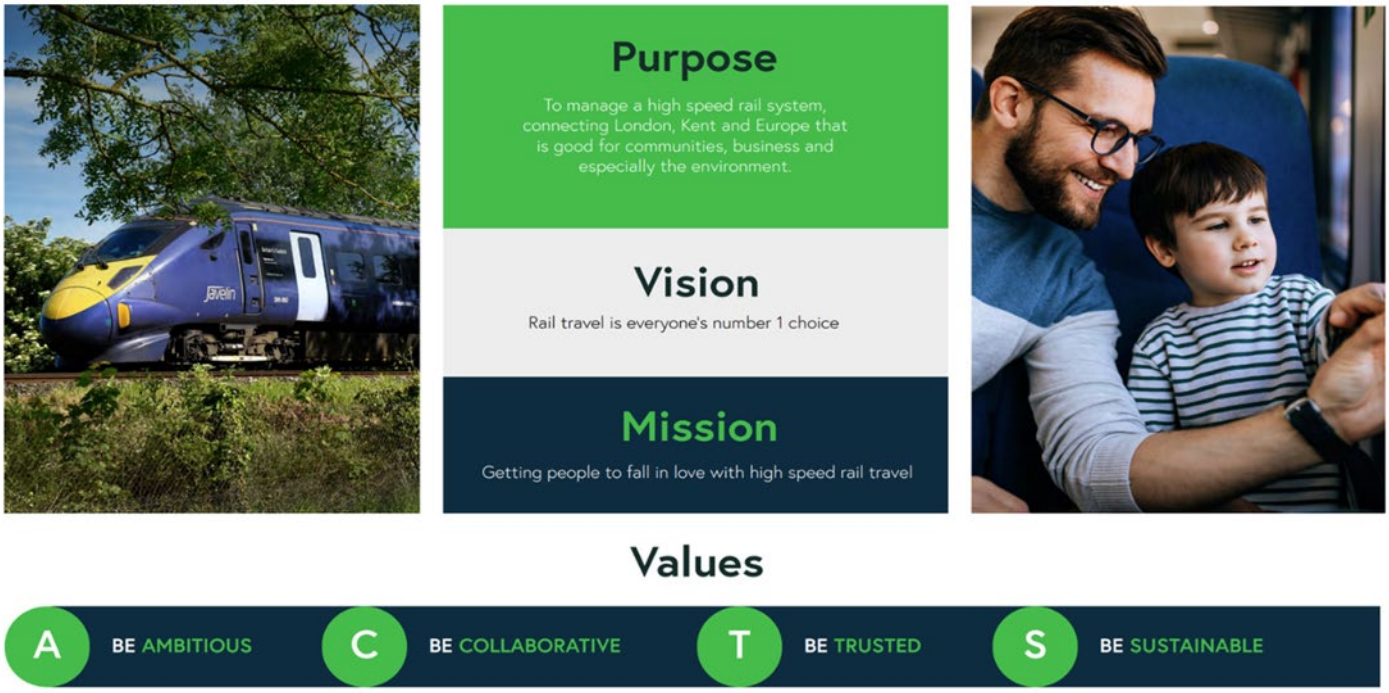
# CONTEXT AND APPROACH

# 1 HS1

## 1.1 Our vision and our journey

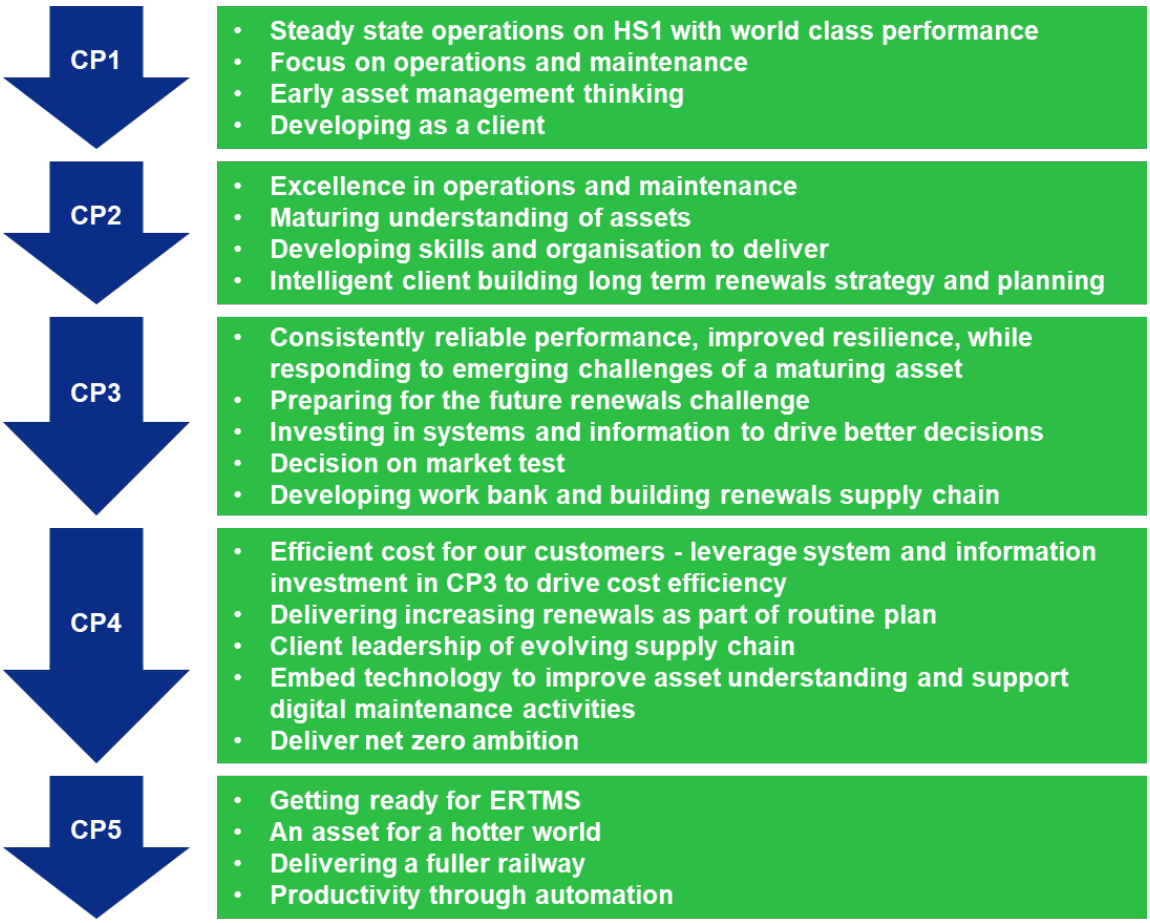
HS1 is operating in an uncertain macroeconomic, geopolitical and rail industry environment; we have updated our strategy to reflect this, to focus on our core operations and drive modal shift to rail, supporting our customers and future growth. More trains on the infrastructure drive a lower cost per train to the benefit of our customers and their passengers. Our vision, purpose, mission and values, set out in Figure 1, set our strategic direction for CP4.

**Figure 1: HS1 purpose, vision, mission and values**




HS1 has evolved over time, from a concept to a construction project to a railway with world class performance while managing the emerging challenges of a maturing asset. To deliver our vision, we will continue to evolve in CP4 and beyond. 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**




### Our objectives for 2030

As a good asset steward, we are looking after the long-term sustainability of the HS1 assets. This entails setting the strategy to:

- Keep the system in balance – lowest cost now / system safety / operational performance / sustainable renewals;
- Provide the service our customers want to encourage modal shift; availability, affordability, predictability;
- Reduce the climate impact on our assets and be ready for climate change;
- Embrace technology and be leading in the rail industry, balancing predictive analytics with engineering capability, while maintaining corporate memory; and
- Create a valuable concession for our shareholders and the DfT.

## 1.2 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.

HS1 is owned 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. Collectively they bring significant financial and operational expertise to HS1 through the range of skills within the shareholder and non-executive directors. These skills were leveraged during the Covid-19 pandemic and lockdowns with the introduction of a new Board sub-committee, the Covid Recovery Committee, to ensure the business was ready as passengers returned in greater numbers, and that the business's finances were robust. We have since returned to business as usual engagement with the shareholders.

### 1.2.1. The HS1 System

The lasting impact of the Covid-19 pandemic, coupled with significant geopolitical and macroeconomic pressures during CP3, highlighted the importance of HS1 Ltd working with all parties in the HS1 system to find system solutions for the challenges faced by all parties. HS1 cannot act alone, all stakeholders have an important role to play.

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 high speed passenger services, international high speed passenger services and conventional freight services. Our major strategic partners (customers) are:

- SE Trains Limited (SETL);
- Eurostar International Limited (EIL);
- East Midlands Railway (EMR);
- 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 under a finance lease with HS1 Ltd and DfT;
- NRIL: is the parent company of NR(HS) and provides technical and operational depth to NR(HS). NRIL also has physical interfaces with our assets and operates and maintains Ripple Lane exchange sidings on our behalf;

- ABM: operates, maintains and renews Ashford International station (this role was performed by Mitie until 30 September 2023);
- 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 and have developed our in-house capability to engage, oversee, direct and challenge our supply chain to deliver more efficiently and effectively.

### 1.2.2. Regulation

**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[1] sets out, for the route assets, 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 2016 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.

**HS1 Leases**

Our interest in the land and rights required for the operation and maintenance of HS1 is conferred under four leases with the SoS, referred to together throughout this document as the Station Leases.[2]

[1] supplement-to-concession-agreement-july-2022.pdf (highspeed1.co.uk)
[2] This is not a defined term referred to anywhere else outside of this document but is used in this document for ease of reading.

- The HS1 Lease, which includes all the HS1 track, the stations (excluding Ashford International) and Temple Mills depot;
- The HS1 Underlease of Ebbsfleet International station forecourt and car parks;
- The Ashford International Station Lease of the international station and car park at Ashford; and
- The Ashford Island Platforms Lease of the island platforms at Ashford International station.

The leases covering St Pancras International, Ebbsfleet International and Stratford International are for the same term as the Concession Agreement (to 31 December 2040), the lease covering Ashford International Station currently runs to 2028 with an option for the SoS to extend and the lease covering the Ashford Island Platforms runs for the same term as the Concession Agreement but with the option to terminate should the SoS not renew the Ashford International Station lease past 2028.

Under the Station Leases (specifically Schedule 10 of the HS1 Lease and the Ashford Deed[3]), we have a number of asset stewardship obligations, including keeping the stations in "good and substantial repair" at all times during the concession, including on handback to the government at the end of the concession. The Station Leases also set out the provisions governing the periodic review of the Long Term Charges.

In July 2022, regulatory oversight of the HS1 station assets was transferred from DfT to the ORR. The Station Leases were amended to reflect this transfer and to update the provisions relating to asset stewardship to reflect best practice. The ORR published a second regulatory statement[4] and guidance on how HS1 should meet the regulatory requirements with regard to HS1 stations which aligns with those for route. HS1 has been supporting the ORR to develop its knowledge of the HS1 station assets.

### 1.2.3. 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 our 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 which we have continued to strengthen during CP3. Our key suppliers have contractual obligations to deliver to either best practice or good industry practice.

**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

[3] The original Ashford leases contained repair and renewal obligations that were different to those contained in the HS1 Lease and so the SoS and HS1 entered into a supplemental deed, known as the Ashford Deed, to confirm that the obligations under Schedule 10 of the HS1 Lease would apply to HS1's asset stewardship obligations.
[4] Second regulatory statement in respect of the HS1 network (orr.gov.uk)

original Operator Agreement was agreed before the sale of HS1 and runs from 2002 to 2047. At a potential market test opportunity in 2012, we renegotiated the Operator Agreement to include obligations for NR(HS) to provide operational and maintenance standards and procedures which could be used to conduct a market test for all or part of the services provided under the Operator Agreement.

In 2020, we had a further opportunity to market test. Following consultation with ORR and other key stakeholders, we waived the right to market test until 2035 in return for a long-term partnership with NR(HS) built on strategic alignment of objectives and improvements to the terms of the Operator Agreement relating to the periodic review, efficiency and outperformance and the management of reopeners. We have seen a positive impact from this strategic partnership and objectives demonstrated by the outputs of the PR24 process.

For CP4, the Operator Agreement has a fixed price for operations and maintenance which will be determined through the PR24 process, similar to CP3. NR(HS) is involved in, and bound by, the periodic review process. The Operator Agreement contains separate provisions for renewal and replacement activities.

**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 currently in use 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 with the restated contract in 2017 enabling a more collaborative relationship. During CP3, UKPNS has supported HS1's sustainability objectives, particularly energy management schemes.

The UKPNS assets were designed to meet the stringent power quality requirements in the grid connection agreement with National Grid Connections (NGC). This includes static VAR compensators (SVCs) and other assets which are responsible for system losses; without these assets NGC could disconnect HS1.

**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. It does not have a fixed term and can only be terminated upon written agreement from both parties.

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 commissioned Vertex to undertake a technical review of the OMA, focusing on ownership and maintenance, which concluded in 2021. The review concluded that both sides of the interfaces with NRIL were being maintained and that responsibilities for asset maintenance were known.

Following recent dewirements at interfaces (not on HS1 infrastructure), NR(HS) is working with NRIL to improve operations and resilience at interfaces.

**Station Concession Agreement with NR(HS)**

NR(HS) operates, maintains and renews St Pancras International, Stratford International and Ebbsfleet International stations on our behalf. Our relationship with NR(HS) is governed by a Station Concession Agreement which commenced before the start of the concession and expires in 2086 with no break clauses (except in the event of default). Under the Station Concession Agreement, NR(HS):

- Holds the safety authorisation as the Station Facility Operator;
- Delivers the Services, discharging the obligations of HS1 under the Station Access Conditions;
- Is reimbursed for the cost of supplying the Services; and
- Must provide an outline repair programme.

There is no formal scope to terminate or change the terms of the Station Concession Agreement. However, we will continue to work with NR(HS) to deliver better outcomes for our customers.

**Station Management Agreement with ABM**

ABM operates, maintains and renews Ashford International station on our behalf. Our relationship with ABM is governed by a Station Management Agreement. ABM was appointed following a competitive tender and took over from the previous contractor, Mitie, on 1 October 2023. The contract is for an initial term of three years with the potential for three one-year extensions. This will depend on whether Ashford International is brought back into use for international services.

The role of ABM at Ashford International is different to that of NR(HS) at the other HS1 stations. NR(HS) is responsible for asset management and railway operations at the stations whereas ABM is responsible only for asset management at Ashford International with EIL responsible for railway operations. This operating model may change in future.

### 1.2.4. 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 2024;
- A Framework Track Access Agreement with SETL, 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;
- A Track Access Agreement with GB Railfreight; and
- A Track Access Agreement with Freightliner for Ripple Lane only.

We enter into Station Access Agreements (SAAs) with train operators, which set out the rights, charging mechanisms and obligations for access to HS1 stations. The SAAs are based on ORR model forms and incorporate a standard set of conditions but are not subject to ORR approval. The train operators with SAAs at each station are:

| Station | EIL | SETL | EMR |
|---|---|---|---|
| St Pancras International[5] | ✓ | ✓ | ✓ |
| Stratford International | | ✓ | |
| Ebbsfleet International | ✓ | ✓ | |
| Ashford International | ✓ | | |

### 1.2.5. 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. Examples of where we are working with other infrastructure managers to improve services to our existing and potential customers are:

- Providing input into the conventional network's Timetable Redesign initiative and the Great British Railways Transition Team's development of strategic priorities and proposals to help ensure these do not have unintended consequences for HS1 operators and those that operate over both conventional and high-speed systems;
- NR(HS)'s Operations Strategy Steering Group included representation from NRIL Kent Route, providing input and access to industry good practice;

[5] There is also an SAA with Govia Thameslink Railway which relates to diversionary access only

- On safety, we are actively involved in the EIM Safety Working Group and the RSSB Asset Integrity Group and for sustainability we are involved in several RSSB working groups including the Rail Environment Forum;
- Regular engagement with NRIL East Coast Digital Programme and NRIL Kent route to understand ERTMS rollout and challenges on the NRIL network;
- Working with Getlink and SNCF Réseau 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;
- NR(HS), SNCF and Infrabel formed the High-Speed Club to share asset knowledge and experience. Activities have included sharing of best practice on inspection and maintenance of swing nose crossings, comparison of approaches to managing ballast compaction following renewal activities and sharing of best practice on hot weather resilience and infrastructure risk assessment;
- Ongoing and regular senior strategic coordination between HS1 and SNCF-Réseau on capacity planning, interoperability, best practice exchange and route development;
- Route planning for potential new services between London and Frankfurt with Eurotunnel, Infrabel and DB-Netz. Milestones have included track capacity studies demonstrating sufficient capacity for new services and a feasibility study on the creation of a juxtaposed border control at key stations;
- Route planning for potential new services between London and Switzerland with Eurotunnel, SNCF-Réseau and SBB/CFF. Milestones have included train path studies and initiation of feasibility work exploring the potential to create a new juxtaposed rail borders in Switzerland;
- Participation in the Eurolink initiative, a pan-European project to create a reference timetable for cross-border services; and
- Regular participation in the European (Rail) Infrastructure Managers association (EIM).

# 2 PR24 approach and process

The HS1-NR(HS) joint PR24 programme vision is *"to provide sustainable choices to the HS1 system stakeholders, that generate opportunities for growth"*. This is underpinned by three commitments:

- Demonstrate and recommend the quantified trade-offs between optionality and cost;
- Demonstrate delivery and efficiency credibility; and
- Demonstrate that the high-speed system is delivering in accordance with net zero responsibilities.

Holding a strong vision allowed HS1 and NR(HS) to remain focused and aligned during the PR24 programme, initiating the PR24 sprint concept (see Section 2.2.1) which brought forward key topics for consideration early in the process.

ORR has been in discussion with HS1 Ltd and train operators throughout CP3 and consulted formally on its approach and process for PR24 in late 2022. Following this consultation, ORR published its PR24 Approach and Process in January 2023.

**PR24 Programme Values**

**Do what we say**
We will be open and transparent about what is achievable and be adaptable when we need to change course.

**Be curious, constructive and challenging**
We will promote honesty and trust, providing a friendly challenge in order to test thinking.

**Focus on value and efficiency**
We listen, are open to new ideas and look forward, continuously improving how we do things

**Make it easy**
We will avoid overcomplicating, by considering how we can deliver the best solutions more simply

## 2.1 Scope of PR24

Under the Concession Agreement and the Station Leases the ORR has a role in relation to the periodic review of asset management plans, costs and charges. These agreements set out the purpose of and the process for conducting periodic reviews. Each periodic review covers a five-year control period; the 2024 Periodic Review (PR24) covers the period from 1 April 2025 to 31 March 2030, Control Period 4 (CP4).

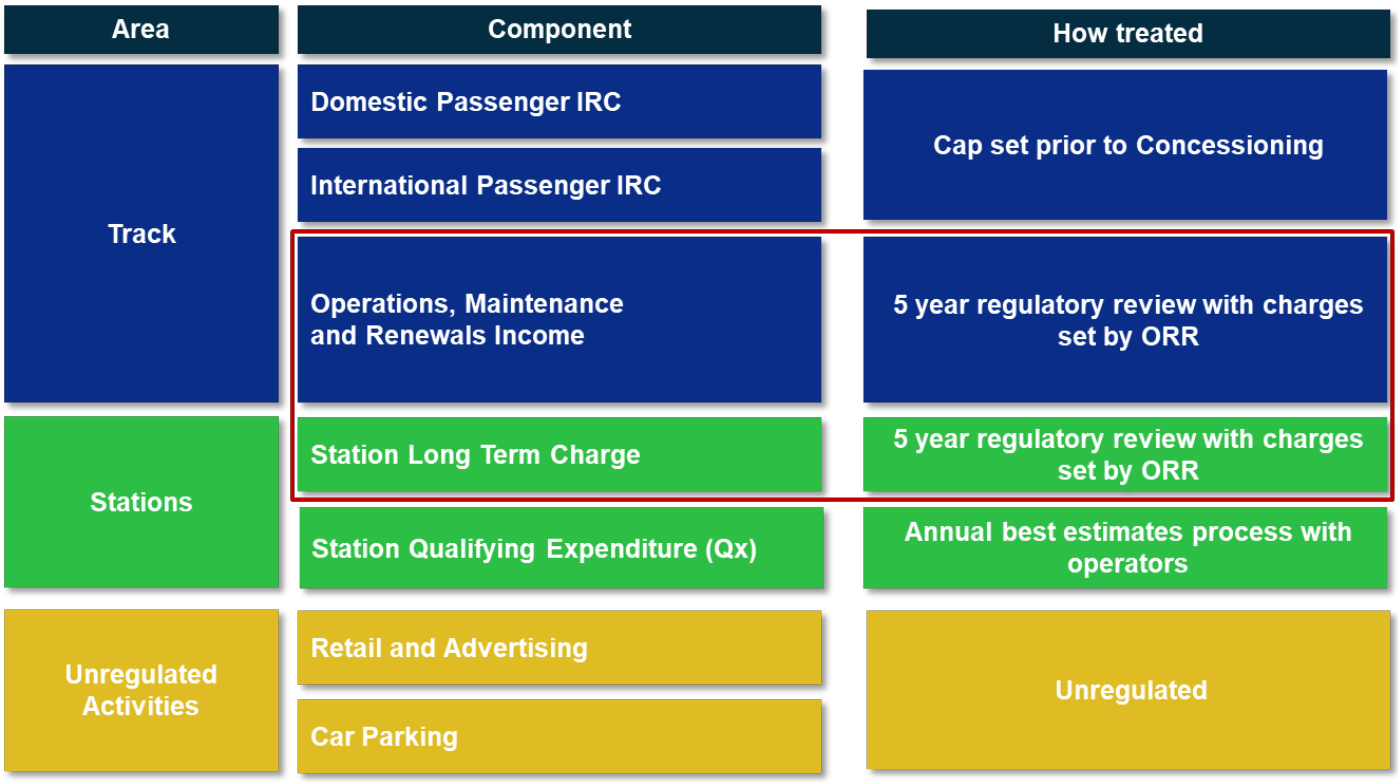
Under the terms of the Concession Agreement, the periodic review for the HS1 route covers the efficient costs for the operation, maintenance and renewal of the HS1 route infrastructure, and how these costs are recovered via charges to train operators. Under the Station Leases, the periodic review for the HS1 stations covers the efficient costs of renewal of the HS1 stations and how these costs are recovered from train operators via the Long Term Charge. This is the first periodic review of stations to be overseen by the ORR since the transfer of regulatory oversight of the HS1 station assets from DfT to the ORR in July 2022.

The periodic review **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.
- Station qualifying expenditure (Qx), designed to recover the cost of operations and maintenance at stations. Qx is set through the separate annual 'best estimate' process in consultation with train operators, as governed by the Stations Access Conditions.
- 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. For the HS1 stations, we are required to propose an efficient level of cost for the renewal of the stations infrastructure and the corresponding Long Term Charge (LTC) for the control period. The ORR will either approve or determine the costs and level of OMRC and LTC.

Appendix A2 shows the specific Concession Agreement requirements for periodic review of the HS1 route and where each is addressed in this Draft 5YAMS; Appendix A3 shows the specific

HS1 Station Leases requirements for periodic review of the HS1 stations and where each is addressed in this Draft 5YAMS or in the Life Cycle Report (LCR) for each station.

This Draft 5YAMS is the principal input into the periodic review; supporting documentation is listed in Appendix A4.

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

There is no contractual process for approval of enhancements to the station assets. In CP3, HS1 established the Station Enhancements Policy to be used for these projects. We have summarised potential station enhancements in Section 16.4.1.

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 for CP4. There are no material changes to the organisation or method of service delivery within the cost categories and the methodology and allocations are therefore largely unchanged from CP3. The exceptions are:

- Staff, where allocations have been updated to reflect changes in the HS1 organisation; and
- BTP, where allocations have been updated to reflect a reduction in staff and a change in the policing plan.

The cost categories which have been split and the way in which the split has been determined for each category are summarised in Table 3.

**Table 3: Split of costs between route, stations, unregulated activities**

| Cost | Route / stations / unregulated allocation | Explanation |
|---|---|---|
| BTPA | 23% / 68% / 8% | Based on staff cost and location of duties provided by BTPA. |
| Staff | 70% / 12% / 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.<br><br>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, since when the business has not fundamentally changed. 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 CP3. |
| 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.*

## 2.2 How we put this plan together

### 2.2.1. Sprint approach

For PR24, HS1 followed a 'sprint' approach. In response to operator feedback, we worked in partnership with NR(HS) to set out at the start of the PR24 process a top-down funding envelope ambition for CP4 for the route infrastructure – the largest cost for operators. The purpose of this was to give operators an indication of the likely costs for CP4 as early as possible which was important for operators in the uncertain and challenging macroeconomic environment post-Covid. It also allowed us to highlight where strategic system decisions could be made about the future of the HS1 asset if further cost reductions were needed to support operator affordability.

As part of the sprint approach, we set out four scenarios for train volumes in the HS1 Strategic Asset Management Plan (SAMP) (see Section 10.5) and challenged NR(HS) to consider the asset management approach and performance outcomes under each scenario for both route and stations. From this, NR(HS) delivered a top-down target of a 7.5% reduction in route O&M costs in real terms for CP4 and identified several efficiency initiatives it could pursue to achieve this target. Alongside NR(HS)'s O&M target, we set upfront a high-level ambition for 10% route renewals efficiencies and to hold HS1 internal costs flat which, all else held equal, gave an indicative 5% reduction in average OMRC charge per train in CP4 relative to CP3 exit prices in real terms.

This framed the bottom-up validation and challenge of HS1 and NR(HS)'s asset management plans and pricing undertaken as part of the typical periodic review process for route and stations.

### 2.2.2. Progressive assurance

The NR(HS) Route 5YAMS and NR(HS) Stations 5YAMS, with supporting strategies, are key elements of our PR24 submission. To assure ourselves that the plans put forward by NR(HS) are appropriate, we implemented a progressive assurance process, in which we involved the ORR, and systematically reviewed the output from NR(HS).

NR(HS) has a three-level assurance framework which includes NR(HS) management review and NRIL corporate oversight in addition to HS1 assurance.

HS1 worked collaboratively with NR(HS), undertaking extensive assurance of the asset management documentation and renewals workbanks as they were developed, commencing with reviews of the emerging draft documents in August 2022. Our assurance included review meetings with NR(HS) Heads of Asset and review of supporting documentation; we provided detailed comments on each version resulting in continuous refinement of strategies. We challenged each version of the renewals workbank, requesting additional asset information and undertaking an extensive programme of site visits to review, discuss and challenge the assets proposed for renewal. As a result, there has been a significant reduction in intervention volumes in the 40-year plan and, to a lesser degree, in CP4 for key asset classes and high-cost items.

NR(HS) developed a track deterioration model during CP3 to assess future track renewal and maintenance options and support strategic decision making for track assets. HS1 appointed an independent consultant to undertake an assurance review of the track data, deterioration model and strategy. This comprehensive assurance did not identify any reason to challenge the track renewal volumes proposed by NR(HS).

For CP4 renewals pricing, HS1 scrutinised and challenged the NR(HS) estimating methodology. HS1 focused on the 18 renewals that were over £3m in value (c. 85% of the workbank). HS1 analysed the NR(HS) cost build up considering issues such as the type of renewal or replacement (component replacement v full renewal); the methodology for estimating indirect costs; comparisons of total indirect costs (as a percentage of direct costs) for each renewal; design requirements for repetitive and standardised work; and the use of known recent costs. HS1 also reviewed where volumes could be smoothed where they spanned control periods, considering the total volumes required to be delivered and market interest. Given the cost and complexity of the ballast cleaning programme HS1 has requested NR(HS) to provide a separate strategy document including a costed worked example.

We were consulted on and provided input into the development of the NR(HS) Operations Strategy and Engineering Access Strategy.

For NR(HS) route O&M costs:

- We have challenged NR(HS) to improve cost efficiency and commissioned route and stations benchmarking studies from Rebel to identify potential areas of efficiency.
- We have challenged NR(HS) O&M costs. Evidence provided by NR(HS) is not yet sufficient for HS1 to be able to support the NR(HS) submission. We will provide an update in the Final 5YAMS.
- On contract risk, we have been through an iterative process of clarification, validation and challenge of NR(HS)'s contract risk pricing. The review identified c. £3.7m of risk that can be removed as there are other mechanisms in place to protect NR(HS).
- The 8% management fee proposed by NR(HS) is based on a study commissioned by NR(HS) from Oxera. We have challenged the justification of the management fee. As the copy of the Oxera report provided to HS1 was redacted, HS1 has only been able to review that information contained within this version. HS1 commissioned Frontier Economics to undertake a critical review which suggested possible improvements to the Oxera analysis.

### 2.2.3. Components of the review

Figure 4 and Figure 5 summarise the framework for the development of costs and charges for CP4 in the context of a 40-year view of the HS1 route and station assets respectively.

Figure 4: How we get to route charges

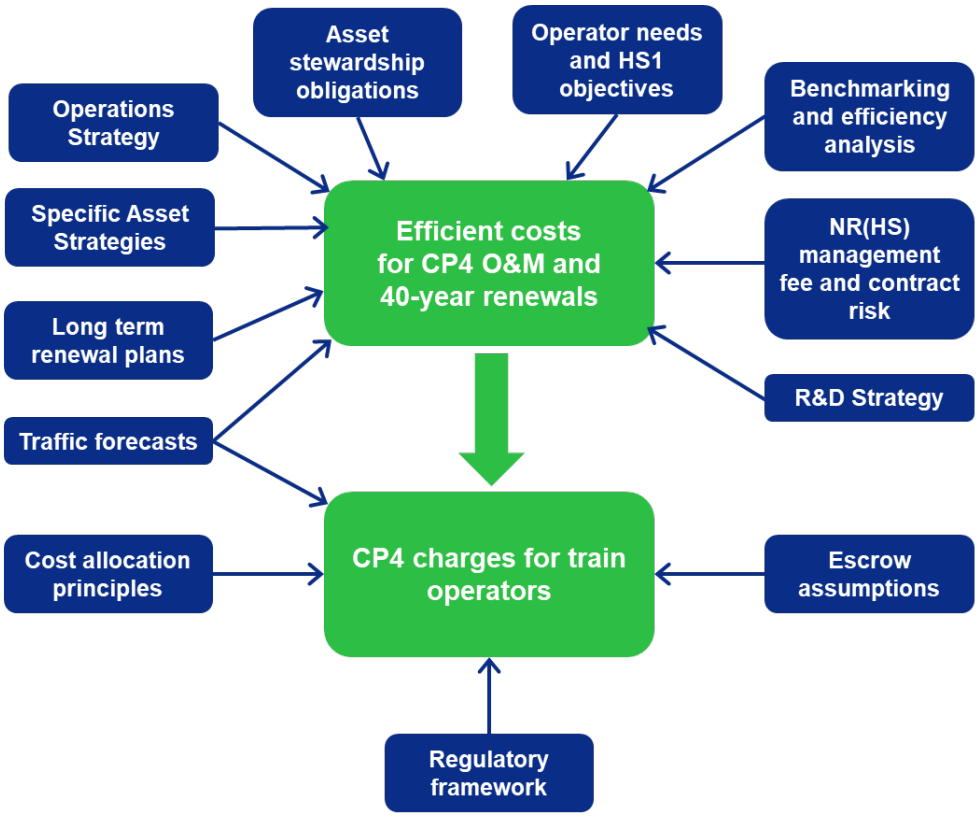
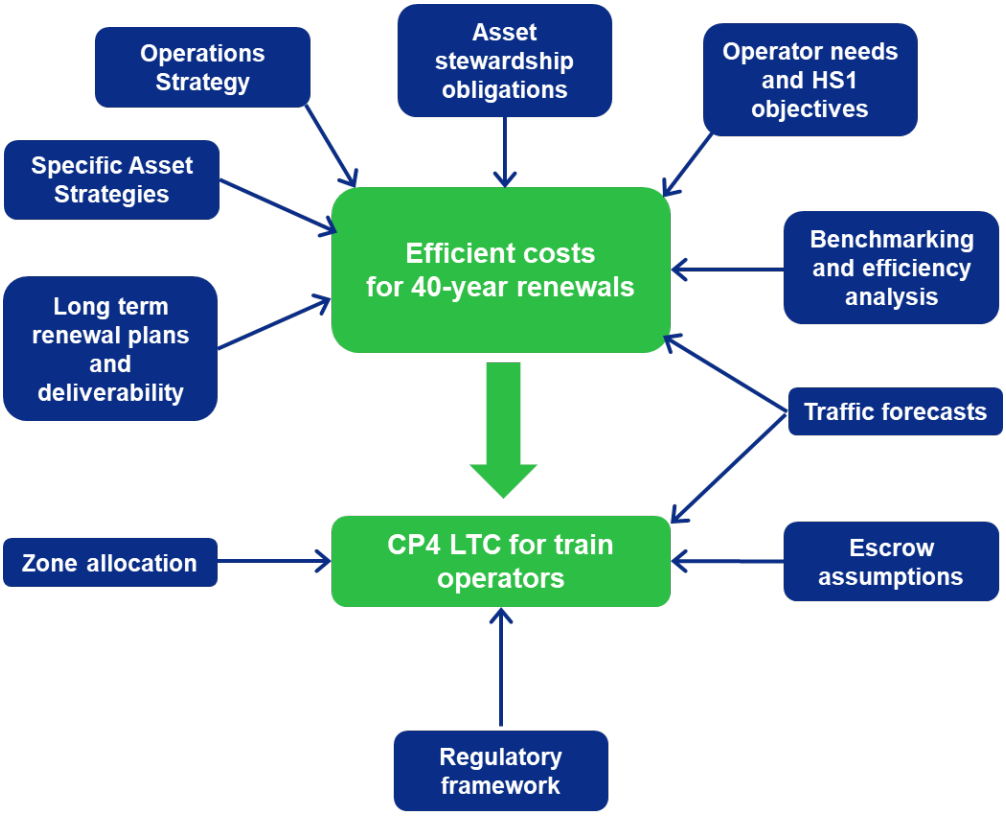



Figure 5: How we get to station charges

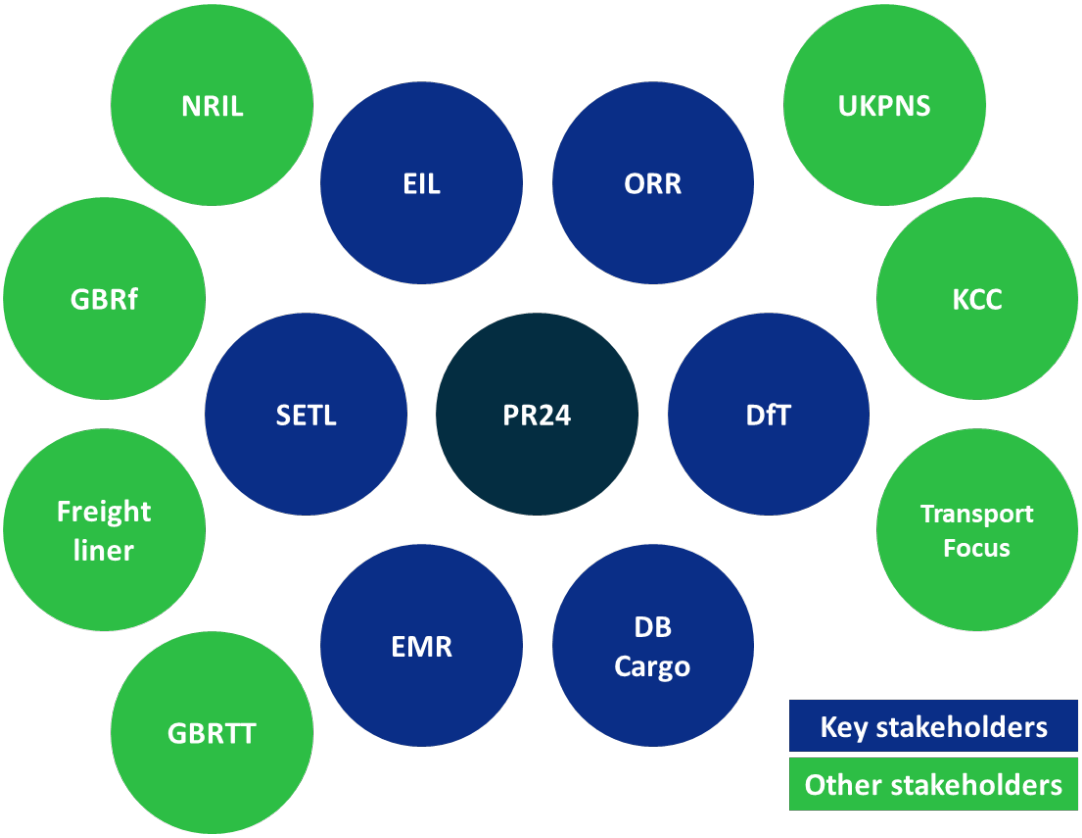


### 2.2.4. Stakeholder engagement

Engagement and input from stakeholders across the HS1 system in the periodic review process was more important than ever given the challenging environment post-Covid. There was also important feedback and lessons learned from PR19 about starting engagement with stakeholders early in the process.

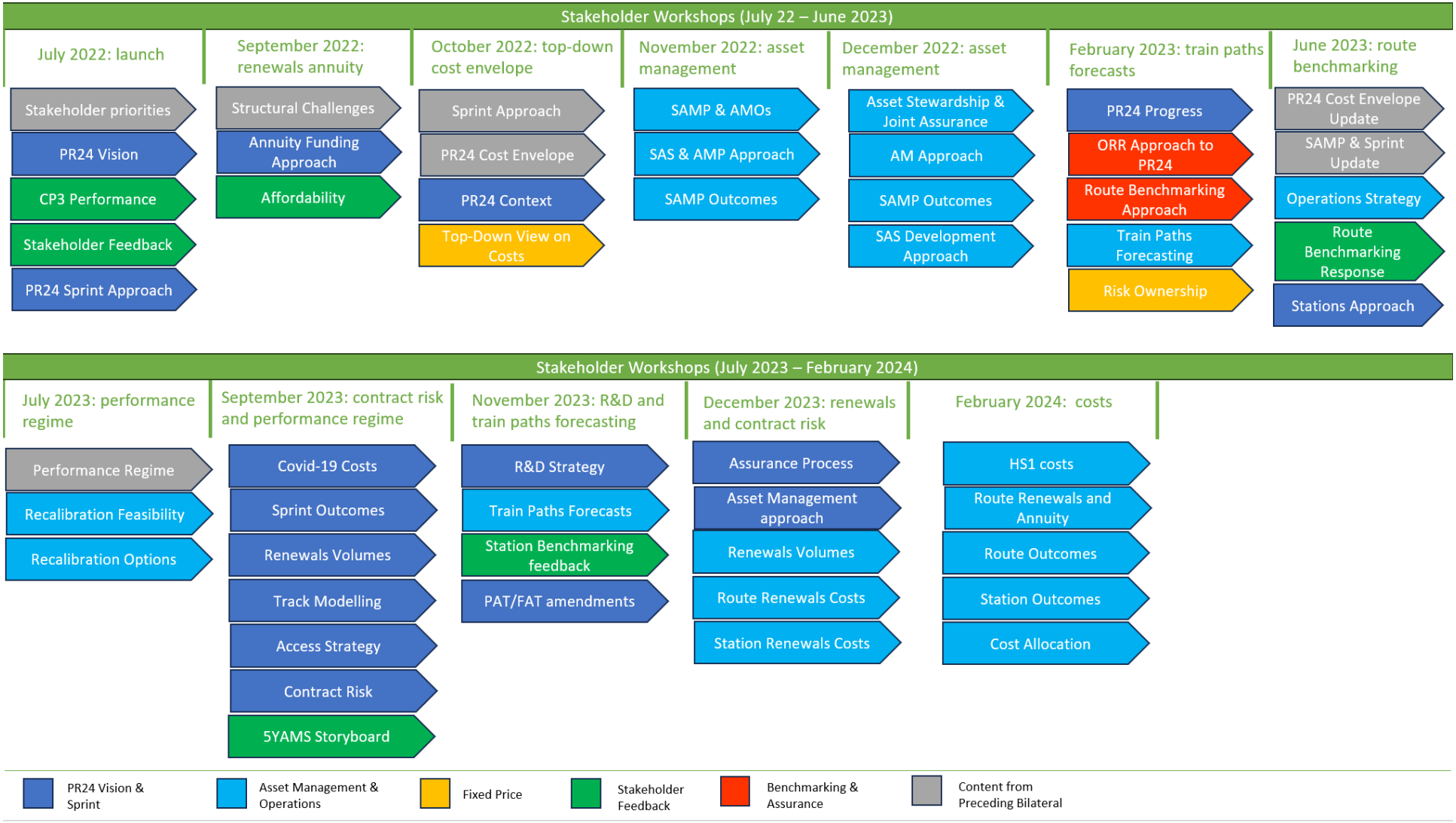
For PR24, HS1 and NR(HS) undertook a proactive, open and collaborative stakeholder engagement programme; our stakeholders are shown in Figure 6.

**Figure 6: PR24 stakeholders**




We started the programme in May 2022, with the official launch of PR24 in July 2022. The programme involved regular rounds of one-to-one meetings with key stakeholders followed by industry-wide workshops, held mostly on a quarterly basis. This approach allowed us to keep stakeholders regularly updated on progress and capture their feedback and input in a timely manner to help ensure the best outcomes for the HS1 system. We also held targeted workshops on more detailed topics to make sure we had the right people in the room. Our stakeholder engagement timeline and topics discussed are shown in Figure 7.

## Figure 7: PR24 stakeholder engagement timeline



# Part 2:

# CP3 OUTTURN

# 3 CP3 outturn: Route

## 3.1 Overview

This section of our Draft 5YAMS discusses our performance in CP3 to date. Figures shown represent performance to P8 2023/24, which is consistent with the 2023/24 Draft Asset Management Annual Statement (AMAS).

Since PR19, the world in which we operate has become significantly more challenging as a result of:

- The Covid-19 pandemic, which presented all parts of the HS1 system with substantial challenges. Indications are that while leisure travel has recovered, the pandemic brought about a fundamental change in commuting and business travel;
- Energy market volatility and price increases caused by the war in Ukraine;
- Changes to border arrangements post-Brexit reducing throughput capacity for international services;
- Inflation reaching a 40-year high in 2023 with impacts on both costs and passenger travel, the latter also affected by the cost of living crisis;
- The impact of industrial action on operations, maintenance and renewals, station staff and train operators;
- With maturing assets, the approach to operational response and maintenance has had to change to meet new challenges including environmental conditions; and
- Uncertainty around the rail reform programme in Great Britain.

In CP3 we have continued to deliver strong operational and safety performance. For safety, we have fully embraced the ORR Risk Management Maturity Model (RM3) to benchmark and evaluate improvement activities; a recent independent audit showed we have achieved significant improvements in maturity over CP3. Operational challenges in CP3 have related mainly to points failures and trespass incidents; to address these areas NR(HS) has developed an asset resilience plan for S&CS and introduced a trespass mitigation strategy. We have also put in place a formal performance improvement plan with NR(HS). Evidence is growing that these interventions are having a positive impact on performance. The Thames tunnel flooding caused significant disruption in P10 2023/24; an investigation to determine the root cause and an independent review of the operational response to the incident are underway.

We have worked hard to keep outturn costs within the CP3 efficient budget despite the challenges in the period. Total O&M costs for the five years of CP3 are forecast to be only slightly (0.3%) higher than the budget. The HS1 costs over this period are forecast to be 5% higher than the budget, driven largely by the costs of recovering from Covid-19; these additional costs have been absorbed by HS1. We have undertaken a comprehensive review of our organisational

structure and other HS1 costs, which has reduced forecast costs for 2024/25 to below the efficient budget, enabling us to start CP4 in an efficient, steady state position. Pass through costs for CP3 are forecast to be 2% lower than budget, with all savings passed on to operators.

During CP3, we have made significant improvements in the way we plan and deliver renewals, improving our use of asset data in renewals decision making and continuing to mature renewals governance and assurance. Route renewals delivery in the first two years of CP3 was heavily impacted by the challenges noted above. In year 3, we undertook a review of the remaining projects in the CP3 route renewals workbank and developed a revised workbank for the remainder of the control period, based on asset condition and risk assessment. This led to a more economic use of renewals funding without compromising performance. We are currently on track in delivering against this revised plan.

The renewals element of OMRC is paid into the route escrow account. To assist with operator cashflow during the Covid-19 pandemic, we offered TOCs a deferral of this element of OMRC for 2020/21 and the first three periods of 2021/22 with deferred amounts repaid over the balance of CP3. This offer was taken up by EIL.

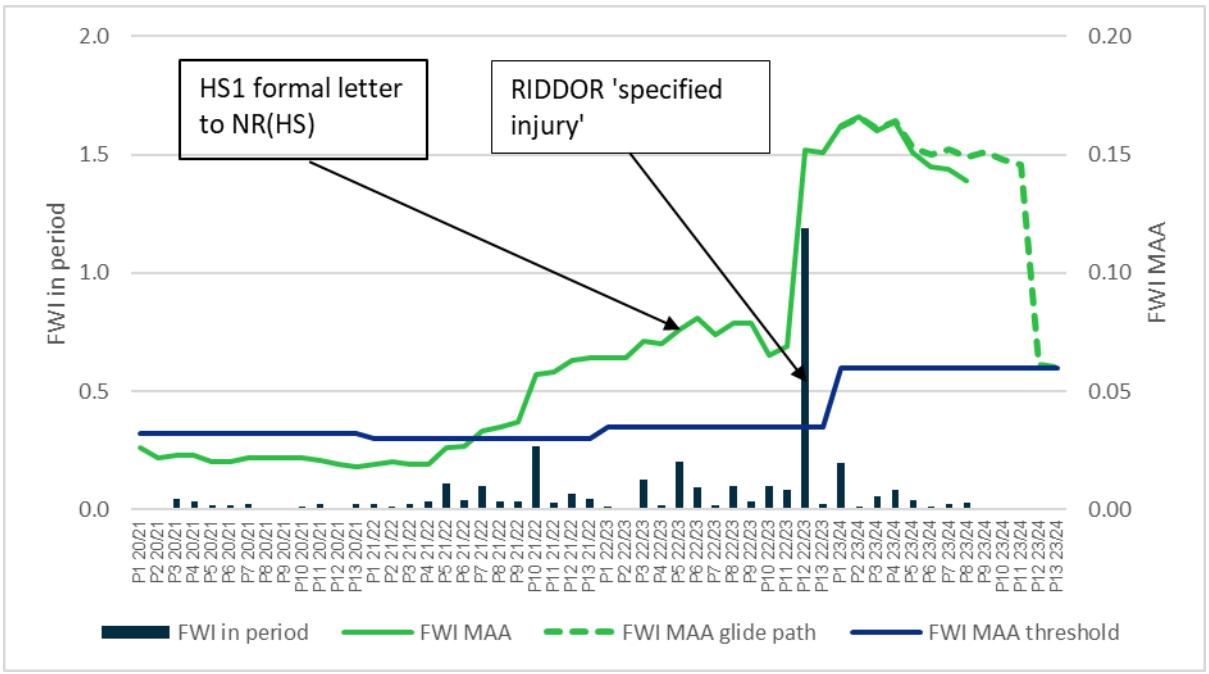
The PR19 Final Determination allocated R&D funding to HS1. Over the course of CP3, we implemented an R&D governance procedure to ensure responsible and targeted spending of funds, identified our highest priority areas (automated inspection, cross-domain integration and efficient possessions) to ensure targeted funding allocation and built a substantial pipeline of initiatives which we have converted into active R&D projects.

## 3.2 Safety performance

HS1 monitors a range of activity and outcome indicators to identify issues and challenge NR(HS) and other suppliers to make improvements. Outcome indicators include RIDDOR-reportable and lost time accidents for staff and contractors and public accidents. Activity indicators include RM3 improvement plan milestones and safety tours.

The top level safety indicator for workforce and contractors is the Fatalities and Weighted Injuries rate (FWI). To calculate workforce FWI, incidents are weighted by severity and normalised per million hours worked. Figure 8 shows the workforce FWI for the HS1 route and stations combined for CP3 up to P8 2023/24.

**Figure 8: Workforce FWI (HS1 route and stations combined)**




Following a positive start to CP3, with the FWI Moving Annual Average (MAA) better than the threshold for the first 19 periods, safety performance started to decline during 2021/22. HS1 raised concerns about trends in safety performance in the regular contract review meetings with NR(HS) and ultimately in a formal letter requesting NR(HS) to present its safety improvement plans to the HS1 Board Safety Subcommittee and the HS1/NR(HS) Joint Assurance Board. In response to HS1's concerns:

- NR(HS) changed how safety is managed as part of its Target Operating Model implementation. There are now safety specialists within the delivery functions as well as a central safety team.
- NR(HS) has developed locally owned safety improvement plans within the functions to address function-specific risk. The aim of the plans is to identify and predict the top causes of harm to workforce and members of the public enabling each function to address areas of concern. These plans are owned by the functions and analyse existing data to continually inform a risk-based approach to accident prevention. The phase 3 plan aims to develop an assurance regime and business-wide safety plan across NR(HS). Contractors account for around 70% of workforce accidents; Supplier Safety Days to share safety improvement initiatives and learning and develop joint safety improvement plans will continue as part of the phase 3 plan.

HS1 worked with NR(HS) to create an FWI MAA threshold of 0.060 for 2023/24 and a glide path for achieving it; this is a realistic but challenging threshold, based on analysis of recent safety performance. The relatively 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 P12 2022/23, when a member of security staff was physically assaulted by a member of the public, sustaining a 'specified injury'; this will drop out of the MAA calculation in P12 2023/24 and is reflected in the glide path. Workforce safety performance is currently trending below the glide path.

A key driver of worsening safety performance during CP3 is the increase in assaults on station staff (the rail industry as a whole has reported an upward trend in assaults across the network following Covid-19). NR(HS) is addressing this within the station team's locally owned safety plan, with initiatives such as the introduction of body worn cameras and conflict avoidance training. In addition, HS1 has challenged BTP to take a leading role in reducing workplace violence; a multi-stakeholder working group has been established to address this issue.

The 2022/23 ORR annual report on HS1 noted the failure to meet the FWI threshold but said *"We are satisfied that HS1 Ltd is challenging its main contractor appropriately to improve in this area"*. We will continue to closely monitor safety performance and the impact of initiatives introduced by NR(HS).

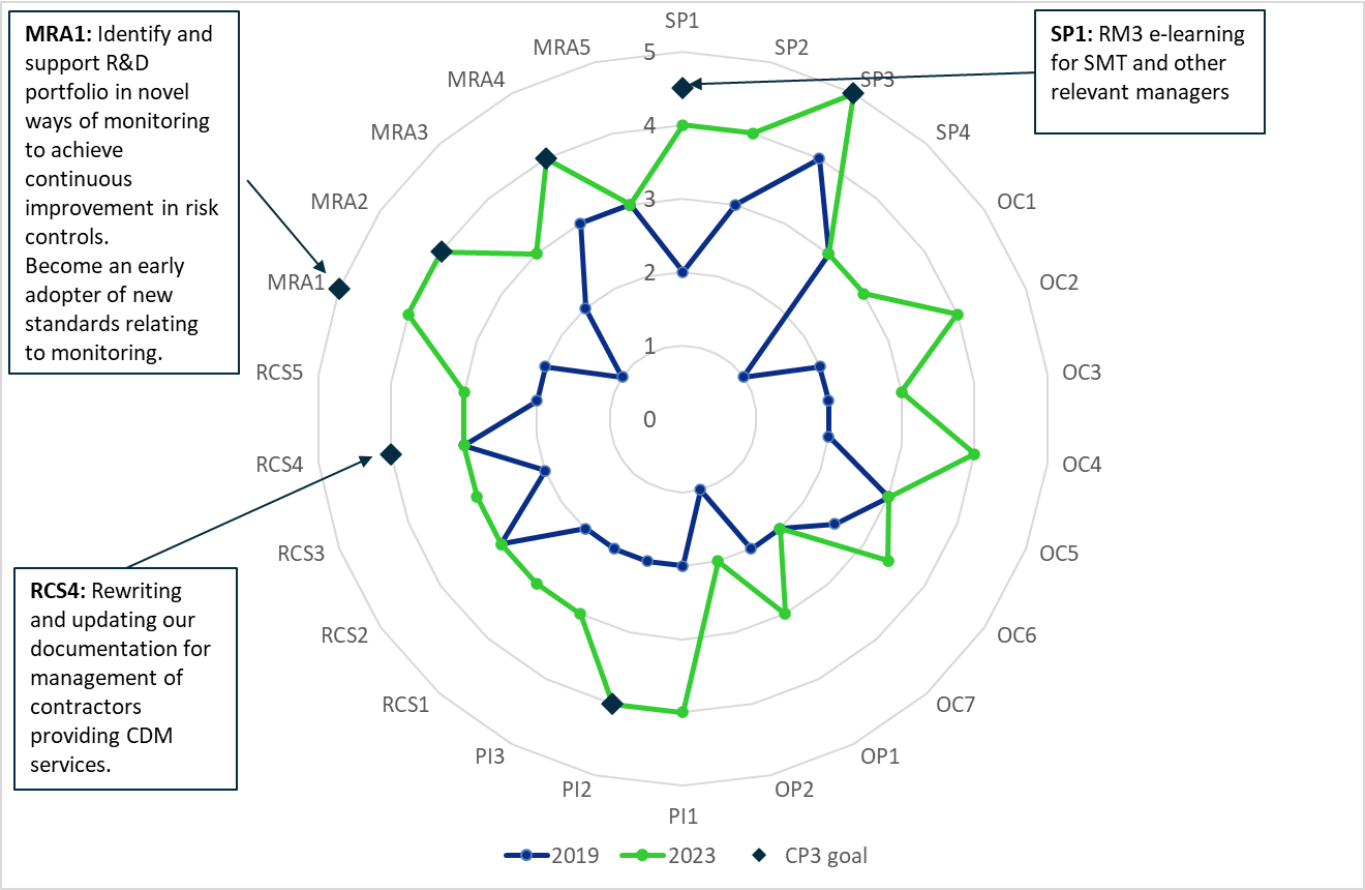
As part of PR19, ORR made seven recommendations related to safety. Actions to address these recommendations were completed in the first two years of CP3 and reported in the AMAS. A key recommendation was that HS1 should more fully embrace RM3.

RM3 is the core approach to driving maturity improvements within HS1 and the supply chain. We identified and agreed with ORR the seven spokes of RM3 to be addressed within CP3. Our aim was to reach Level 4 or 5 in each of these by the end of CP3. The seven spokes are:

- SP1: Leadership
- SP3: Board governance
- P12: Objective and target setting
- RCS4: Control of contractors and suppliers
- MRA1: Proactive monitoring arrangements
- MRA2: Audit
- MRA4: Management review

Figure 9 compares the 2019 baseline with the results of an independent audit undertaken in 2023 and our goal for CP3 exit, noting the actions we are taking to achieve our remaining goals. We have achieved significant maturity improvements since 2019 which will form the foundation for further improvement in CP4. Six of the seven selected spokes are now at maturity Level 4 or 5. The audit scored RCS4 (Control of contractors and suppliers) at Level 3 but noted *"however, the relationship with the HS1 partner organisations is considered to be more mature than this score indicates"*. The audit found no gaps against the CDM Regulations, but identified areas where clarity of the documents could be improved and recommended that these were reviewed and updated. Earlier in 2023 we had commissioned an audit of our management of contractors providing CDM services and we are in the process of rewriting and updating our documentation. Once complete, we expect that this will help move RCS4 maturity to Level 4.

**Figure 9: RM3 maturity improvements over CP3**




NR(HS) continues to integrate RM3 into its assurance processes. Improvement areas have been identified and will be addressed in the route-wide safety plan and the 2023/2024 safety strategy. HS1 conducts RM3 audits on NR(HS), the outputs of which will also feed into NR(HS)'s safety plan and strategy.

Section 8 sets out our health, assurance and safety strategy for the remainder of CP3 and CP4.

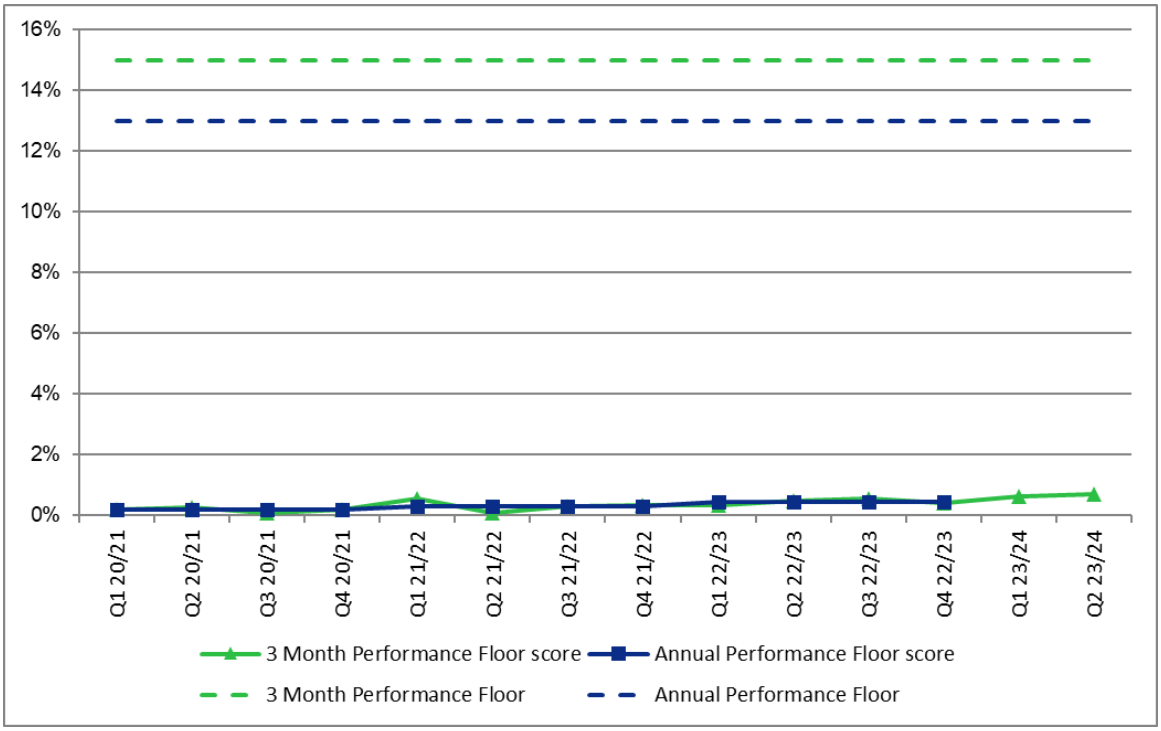
## 3.3 Operational performance

### 3.3.1. 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.

As shown in Figure 10, performance has been significantly better than the performance floors with fewer than 0.8% of trains delayed by five or more minutes or cancelled due mainly to incidents attributable to HS1 in every quarter of CP3 to date.

**Figure 10: Actual performance against performance floors**

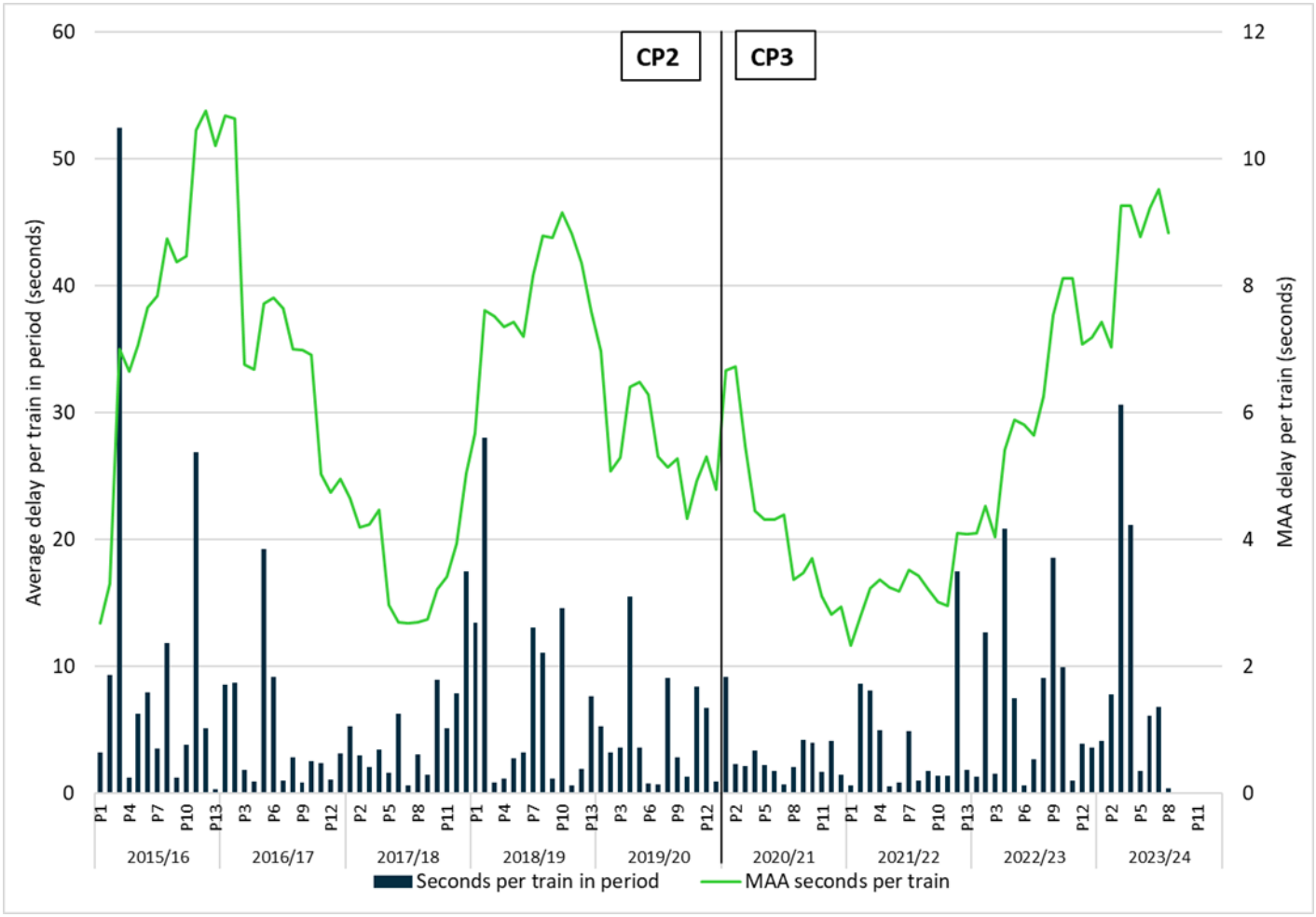



### 3.3.2. Delay minutes

The high level service measure for HS1 is average seconds delay per train for all incidents attributed to HS1. The measure is reported on both a period and an MAA basis. Figure 11 shows average seconds delay per train (by period and MAA) for CP2 and for CP3 to P8 2023/24.

Operational performance early in CP3 was very strong, although the large reduction in traffic as a response to Covid-19 meant that incidents naturally attracted fewer minutes. Performance later in the control period returned to similar levels to CP1 and CP2, demonstrating that our assets continue to perform well as they age, and our continuous efforts to manage operational performance.

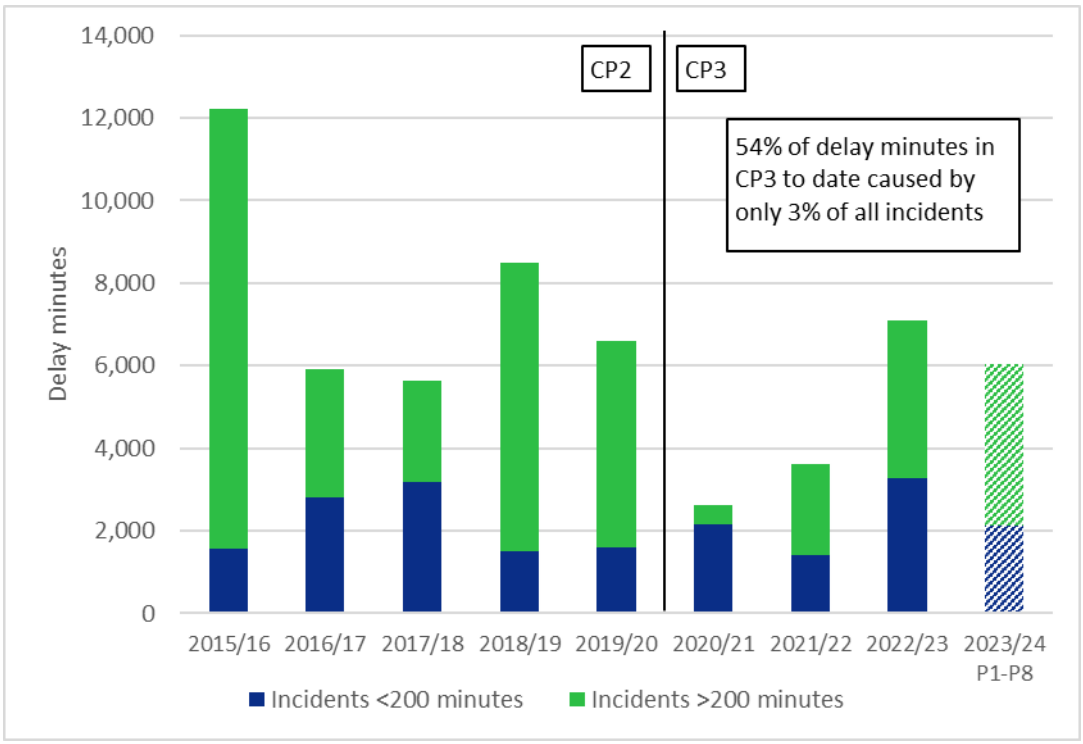
**Figure 11: Average seconds delay per train attributed to HS1**




We also report against a Significant Delays KPI, which includes all incidents with a performance impact of over 200 minutes. Figure 12 splits out delays caused by significant incidents from all other delays, showing that underlying performance is good but infrequent major incidents have a large impact on average performance. In CP3, to P8 2023/24, 54% of total delay minutes were caused by only 3% of all incidents.

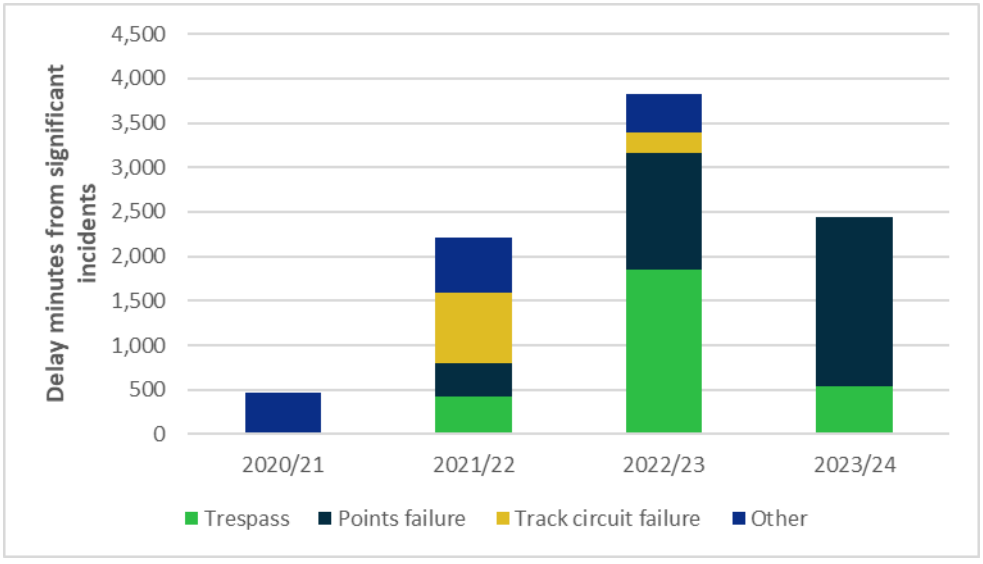
Each incident with a performance impact of over 200 minutes is reviewed with the HS1 system to learn and improve the operational response in order to minimise the impact of such events. These reviews are carried out for all incidents on HS1, not just those caused by HS1 assets.

**Figure 12: Total delays v significant delays**




The main causes of significant incidents in CP3 to date are shown in Figure 13 which shows an increasing trend in delays related to points failures and trespass incidents (there has been a national increase in trespass since the pandemic). Stakeholders will be aware of the significant disruption caused by flooding in the Thames tunnels in P10, which is not captured here. A technical investigation to determine the root cause of the flooding is underway and NR(HS) has also commissioned an independent review of the operational response to the incident. We will provide an update in the Final 5YAMS.

**Figure 13: Delay minutes by cause for significant incidents**



Trespass and points failures were responsible for more than half of all delay minutes in 2022/23 and we took the following steps to address these areas:

- We requested NR(HS) develop an asset resilience plan for S&CS to address performance impacting issues associated with points failures, including both tactical and strategic actions. NR(HS) undertook a full fault review, identifying trends and developing and implementing actions. This review informed the S&CS SAS developed for PR24. Mean-time between failure is used as a lead indicator to measure the success of the resilience plan.
- NR(HS) introduced an updated trespass mitigation strategy to reduce the number of trespass events and their operational impacts. The strategy built on the previous trespass strategy, with a new methodology for operating around trespass and formal agreement with BTP for use of a drone.

Following a further dip in performance in June 2023, we put in place a formal Performance Improvement Plan with NR(HS), addressing:

- Maintenance leadership, resource and capability plan;
- Operational resilience including an effective network control function;
- Interface management plans for both NRIL and Eurotunnel interfaces; and
- Acceleration of maintenance evolution and the modernisation of how NR(HS) undertakes maintenance, operations, planning and response activities.

Subsequent performance has shown improvement, with P5 to P8 all performing better than the seconds delay target. Although it is too early to say for certain, evidence is growing that NR(HS) interventions are having a positive impact on performance.

There has been significant industrial action during CP3 with staff in frontline maintenance and operations grades taking part, as part of a nationwide dispute. Proactive planning, with NR(HS) training management grade employees for operational competencies, minimised the service delivery impacts with 12 hours of route availability provided during each day of industrial action, with the exception of Boxing Day 2022.

## 3.4 CP3 outturn costs

This section covers costs for the whole of CP3. We present actual costs for 2020/21 to 2022/23 and forecast costs for the remainder of CP3. The forecasts are based on the business plan approved by the HS1 Board. All costs are presented in February 2023 prices.

### 3.4.1. CP3 efficient budget

The efficient budget for CP3 was determined by ORR in the PR19 Final Determination. The efficient budget was used in the calculation of access charges for CP3. Table 4 shows the CP3 efficient budget compared with CP3 actual costs to 2022/23 and cost forecasts for 2023/24 and 2024/25 (all in February 2023 prices).

We have worked hard to keep outturn costs within the CP3 efficient budget despite the challenges in the period. Total O&M costs for the five years of CP3 are forecast to be only slightly (0.3%) higher than the budget. The HS1 costs over this period are forecast to be 5% higher than the budget, driven largely by the costs of recovering from Covid-19; these additional costs have been absorbed by HS1. We have undertaken a comprehensive review of our organisational structure and other HS1 costs, which has reduced forecast costs for 2024/25 to below the efficient budget, enabling us to start CP4 in an efficient, steady state position. Pass through costs for CP3 are forecast to be 2% lower than budget, with all savings passed on to operators.

Details for individual line items are set out in the following sections.

**Table 4: CP3 efficient budget v CP3 outturn (£m, February 2023 prices)**

| | 20/21 | | 21/22 | | 22/23 | | 23/24 | | 24/25 | | Total | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Budget | Outturn actual | Budget | Outturn actual | Budget | Outturn actual | Budget | Outturn forecast | Budget | Outturn forecast | Budget | Outturn forecast | Variance | Variance % |
| NR(HS)[6] | 55.0 | 55.0 | 54.8 | 54.8 | 53.8 | 53.8 | 53.4 | 53.4 | 52.5 | 52.5 | 269.5 | 269.5 | - | - |
| HS1[7] | 15.8 | 16.7 | 15.9 | 16.8 | 16.5 | 18.2 | 16.9 | 18.6 | 16.1 | 15 | 81.1 | 85.3 | +4.1 | 5.1% |
| Pass through | 24.7 | 24.4 | 24.7 | 23.6 | 24.7 | 24.2 | 24.7 | 24.4 | 24.7 | 24.6 | 123.6 | 121.3 | -2.3 | -1.9% |
| Freight-specific | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.3 | 0.4 | 0.3 | 0.4 | 0.3 | 2.2 | 1.7 | -0.4 | -20.0% |
| **Total O&M** | **95.9** | **96.6** | **95.8** | **95.5** | **95.5** | **96.5** | **95.5** | **96.7** | **93.7** | **92.5** | **476.4** | **477.7** | **1.4** | **0.3%** |

[6] NR(HS) costs = the Annual Fixed Price under the Operator Agreement including escalation allowed under the Operator Agreement (1.1% above RPI) 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.

[7] HS1 costs include R&D costs

### 3.4.2. 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 CP3 was determined as part of PR19; NR(HS) bears the risk of variance from this price.

In PR19, NR(HS) committed to delivering a 7% net (10% gross) efficiency by the end of CP3, equivalent to an £11.0 million reduction in NR(HS) O&M costs. In the first three years of CP3, NR(HS) outperformed its committed net efficiency plans by £4.3 million, comprising:

- £1.5m in 2020/21;
- £1.4m in 2021/22; and
- £1.4m in 2022/23.

The main contributions to achieving this outperformance were from:

- Negotiating a reduction in the Provision of Services Agreement with NRIL for the whole of CP3; and
- Effectively managing the NR(HS) establishment, managing vacancy gaps and enhancing efficiency through the deployment of the Target Operating Model in 2022/23.

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. The methodology for calculating the Outperformance Share is set out in the Operator Agreement; on the basis of this calculation, the Outperformance Share was £1.6m for 2022/23 of which NR(HS) retained £0.8m, TOCs received £0.5m and HS1 received £0.3m.

### 3.4.3. 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.

CP3 outturn costs are expected to be 5.1% (£4.1m) higher than the CP3 efficient budget, driven largely by increased staff and consultancy costs incurred in managing our recovery from Covid-19. Tt was also due to spend on cyber resilience and sustainability initiatives, and costs related to the comprehensive organisational restructure to ensure we close the control period in a lean position. As HS1 Ltd is bound by the efficient cost determined in PR19 (which assumed a steady state basis) and there is no reopener for these increases, HS1 Ltd absorbed these costs.

HS1 costs are split into HS1 subcontract costs and HS1 internal costs. Table 5 shows a breakdown of the CP3 efficient budget compared with CP3 outturn costs. HS1 Ltd bears the risk of variance in these costs during CP3.

## Table 5: HS1 costs CP3 efficient budget v CP3 outturn (£m, February 2023 prices)

| | 20/21 | | 21/22 | | 22/23 | | 23/24 | | 24/25 | | Total | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Budget | Outturn actual | Budget | Outturn actual | Budget | Outturn actual | Budget | Outturn forecast | Budget | Outturn forecast | Budget | Outturn forecast | Variance | Variance % |
| **HS1 subcontractor costs** | | | | | | | | | | | | | | |
| NR costs | 2.0 | 2.2 | 2.0 | 2.0 | 2.0 | 1.9 | 2.0 | 2.0 | 2.0 | 2.0 | 10.2 | 10.1 | 0.0 | -0.3% |
| NR GSM-R | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 1.8 | 1.8 | 0.0 | 0.0% |
| NGC connection fees | 0.6 | 0.6 | 0.6 | 0.5 | 0.6 | 0.4 | 0.6 | 0.4 | 0.6 | 0.4 | 3.2 | 2.3 | -0.9 | -27.6% |
| BTPA | 1.3 | 1.2 | 1.3 | 1.1 | 1.3 | 1.1 | 1.3 | 1.0 | 1.3 | 1.0 | 6.7 | 5.4 | -1.4 | -20.2% |
| ORR regulatory and safety | 0.4 | 0.4 | 0.4 | 0.2 | 0.4 | 0.3 | 0.7 | 0.5 | 0.7 | 0.5 | 2.7 | 1.9 | -0.7 | -28.2% |
| Subtotal | 4.8 | 4.8 | 4.8 | 4.2 | 4.8 | 4.1 | 5.1 | 4.2 | 5.1 | 4.2 | 24.5 | 21.5 | -3.0 | -12.4% |
| **HS1 internal costs** | | | | | | | | | | | | | | |
| Staff | 5.8 | 6.0 | 5.8 | 5.9 | 5.8 | 7.1 | 5.8 | 6.9 | 5.8 | 5.9 | 28.8 | 31.9 | 3.0 | 10.5% |
| Technical support/ consultancy | 1.3 | 2.5 | 1.6 | 2.4 | 1.7 | 3.0 | 1.7 | 2.3 | 1.0 | 1.1 | 7.3 | 11.2 | 3.9 | 53.6% |
| Office running | 1.5 | 1.5 | 1.4 | 1.6 | 1.6 | 1.7 | 1.7 | 1.7 | 1.7 | 1.3 | 7.9 | 7.8 | -0.1 | -0.9% |
| Other: Concession | 1.3 | 1.1 | 1.2 | 1.6 | 1.5 | 1.6 | 1.4 | 1.5 | 1.2 | 1.6 | 6.5 | 7.4 | 0.9 | 13.4% |
| Other: Railway | 0.7 | 0.9 | 0.7 | 0.5 | 0.7 | 0.6 | 0.7 | 0.5 | 0.7 | 0.5 | 3.5 | 2.9 | -0.6 | -16.7% |
| Subtotal | 10.5 | 12 | 10.6 | 12 | 11.2 | 13.9 | 11.2 | 13 | 10.4 | 10.3 | 54 | 61.2 | 7.2 | 13.2% |
| R&D | 0.5 | 0.0 | 0.5 | 0.6 | 0.5 | 0.2 | 0.5 | 1.4 | 0.5 | 0.5 | 2.6 | 2.6 | 0.0 | 0.0% |
| **Total** | **15.8** | **16.7** | **15.9** | **16.8** | **16.5** | **18.2** | **16.9** | **18.6** | **16.1** | **15** | **81.1** | **85.3** | **4.1** | **5.1%** |

Details of variance by line item for HS1 subcontract costs and HS1 internal costs are shown in Table 6 and Table 7 respectively.

**Table 6: Changes in HS1 subcontract costs in CP3**

| Cost category | Comments |
|---|---|
| NR costs | The CP3 efficient budget included:<br>• OMA: £1.76m p.a. with RPI indexation for costs incurred in relation to the interface assets between the NRIL network and HS1; these assets are covered by the OMA.<br>• Ripple Lane: £0.22m 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 cost of doing this (mothballing costs) is included in long term common costs. Additional costs incurred because of the operation of freight trains are included in freight long term avoidable costs.<br>• Safety audit: High level safety audit costs of £0.13m in total for CP3.<br><br>CP3 outturn cost is forecast to the same as the CP3 efficient budget. |
| 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.<br><br>CP3 outturn cost is forecast to be the same as the CP3 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.<br><br>CP3 outturn costs are forecast to be £0.9m (28%) lower than the CP3 efficient budget as a result of lower power usage from operating fewer trains on HS1 due to the impact of Covid-19. |
| BTPA | Fixed price contract with reopeners for vehicles and overtime. Our CP3 efficient budget assumed that costs would continue at the 2019/20 level with indexation with RPI.<br><br>We continue to challenge the cost of our Police Service Agreements with BTP, with the aim of delivering the right level of security and policing at an efficient cost by deploying the right blend of BTP and security resources.<br><br>This has led to a forecast reduction of £1.4m (20%) compared with the CP3 efficient budget. |

| Cost category | Comments |
|---|---|
| ORR regulatory and safety | The CP3 efficient budget included:<br>• ORR regulatory fees: £310k p.a.<br>• ORR safety levy: £160k p.a.<br>• Access Disputes Committee: £50k p.a.<br><br>Outturn costs are forecast to be 28% (£0.7m) lower than the CP3 efficient budget as a result of lower regulatory fees and safety levy billed by ORR partially offset by additional ORR fees for annuity relief exploration and stations transfers. |

**Table 7: Changes in HS1 internal costs in CP3**

| Cost category | Comments |
|---|---|
| Staff | CP3 outturn is forecast to be 11% (£3.0m) higher than the CP3 efficient budget.<br><br>The CP3 efficient budget assumed staff costs would remain constant in real terms. However, the Covid-19 pandemic significantly increased the complexity of the HS1 business and there was a need to increase headcount to manage the additional work caused by:<br>• Volume reopeners and ongoing underpin as a result of lower train volumes;<br>• Increased use of spot bidding and resulting invoicing including strike billing and TOCs querying invoices;<br>• Active cash and supplier management to maintain liquidity;<br>• Stakeholder relationships requiring more regular dialogue;<br>• Customer challenges around the regulatory framework;<br>• Regular forecasting in the volatile market to ensure debt obligations were met;<br>• Escrow management; and<br>• Added audit complexities.<br><br>In addition to increased headcount, staff costs have increased due to:<br>• Retention incentives required for some non-SMT staff or high performing staff members to provide certainty through the volatile period, including benchmarking salaries; |

| Cost category | Comments |
|---|---|
| | • Fixed term contractor support to cover maternity leave (2 roles) and long-term leave;<br>• Increase in market rates for salaries in excess of the levels assumed in the CP3 budget. To remain competitive in the current market, where there has been staff turnover, new joiners have started on higher rates. To support retention in key functions we conducted salary reviews to match market rates;<br>• SMT changes in response to Covid-19, with an additional SMT, Finance Director, until July 2022.<br><br>The CP3 efficient budget included a stretch target of £2m of efficiency savings in staff costs over CP3. As a result of additional complexities incurred from Covid-19 this stretch target has not been achieved up to 2022/23.<br><br>We have executed an efficiency review of our structure to ensure it is appropriate for CP3 and beyond, focusing on the resources required to deliver our core commitments and steady state. This has resulted in a £1.2m reduction in staff costs by 2024/25 from their 2022/23 peak and reducing headcount by five. HS1 absorbed the £0.8m cost of this restructure, ensuring our 2024/25 staff costs are equivalent to the CP3 efficient budget. |
| Technical support/ consultancy | CP3 outturn is forecast to be £3.9m (54%) higher than the CP3 efficient budget.<br><br>The increase was driven by the need for resilience with additional business complexity arising from the response to Covid-19. The immediate need was interim support for HS1 staff during the pandemic, and more recently consultants have helped drive efficiency to reduce costs in CP4. Significant drivers of the increase were:<br>• Interim consultants in the Finance team. This cost is expected to return to baseline in 2024/25;<br>• Consultant CIO to support the IT efficiency review and cyber risk management requirements. This was a temporary resource;<br>• Additional support for the COO on renewal projects and Procurement Portal License;<br>• Specialist legal support. This is not an ongoing spend;<br>• CBRE rates advice. The rateable value has doubled and HS1 has spent a significant amount of money in an attempt to reduce the costs borne by the TOCs; |

| Cost category | Comments |
|---|---|
| | • Interim regulation modeller to deliver the planned charging model refresh. We had planned to do this in house but could not find the right skillset for such a specialist task. This is not an ongoing spend;<br>• Unbudgeted recruitment spend as a result of staff churn.<br><br>Technical support and consultancy costs are forecast to fall £1.9m by 2024/25 from their 2022/23 peak, reducing the gap to the CP3 efficient budget to less than £0.1m.<br><br>The CP3 efficient budget included a stretch target of £2.1m of efficiency savings over CP3; these would be sought in all cost categories, however, the total saving was shown in the technical support/ consultancy cost line for simplicity. As a result of additional costs incurred from Covid-19 this stretch target has not been achieved up to 2022/23 and is not expected to be achieved by CP3 outturn. |
| Office running | The CP3 efficient budget included:<br>• Rent and service charge (55% of total)<br>• IT/telecoms (30% of total)<br>• Other running costs (15% of total).<br><br>CP3 outturn is forecast to be £0.1m (1%) lower than the CP3 efficient budget due to the reduced costs incurred with staff working from home partially offset by an increase in IT systems costs in relation to better virtual communication tools. The HS1 office lease has been renegotiated and fixed for a further 5 years, saving £0.9m compared with the CP3 efficient budget. This cost saving, c.30% compared to comparable office spaces, will continue into CP4. This saving was mostly offset by cyber resilience technology, which HS1 invested in outside of the CP3 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.<br><br>CP3 outturn costs are forecast to be £0.9m (13%) higher than the CP3 efficient budget, driven by additional spend incurred on sustainability initiatives. |
| Other: running the railway | The main costs included in the CP3 efficient budget were:<br>• £1.2m for the rescue locomotive;<br>• £0.8m for Ashford Integrated Electronic Control Centre (IECC); and |

| Cost category | Comments |
|---|---|
| | • £1.2m for route-specific PR and marketing.<br><br>CP3 outturn costs are forecast to be £0.6m (17%) lower than the CP3 efficient budget. The Ashford IECC agreement with NRIL was reviewed during the control period, as services are now established with NR(HS) this was no longer needed, resulting in £0.8m of savings. This was partially offset by £0.3m of costs in relation to stock movements not included in the CP3 efficient budget. |
| R&D costs | The CP3 efficient budget included £2.6m for R&D activities (£2.0m in 2018 prices). CP3 outturn costs are forecast to be the same as the CP3 efficient budget. |

### 3.4.4. Pass through costs

Pass through costs in CP3 are expected to be 1.9% (£2.3m) lower than the CP3 efficient budget, driven largely by a decrease in rates and insurance costs.

Table 8 shows a breakdown of the CP3 efficient budget compared with CP3 outturn costs. Variances are discussed in Table 9. Variance in these costs is passed through to train operators.

**Table 8: Pass through costs CP3 efficient budget v CP3 outturn (£m, February 2023 prices)**

| | 20/21 | | 21/22 | | 22/23 | | 23/24 | | 24/25 | | Total | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Budget | Outturn actual | Budget | Outturn actual | Budget | Outturn actual | Budget | Outturn forecast | Budget | Outturn forecast | Budget | Outturn forecast | Variance | Variance % |
| NR(HS)[1] | 2.4 | 2.4 | 2.4 | 1.6 | 2.3 | 2.9 | 2.3 | 2.3 | 2.3 | 2.7 | 11.7 | 11.9 | 0.2 | 1.3% |
| HS1[2] | 3.9 | 3.7 | 3.9 | 4 | 3.9 | 4 | 3.9 | 3.6 | 3.9 | 3.7 | 19.6 | 19.1 | -0.5 | -2.4% |
| Pass through | 7.4 | 7.4 | 7.4 | 7.3 | 7.4 | 7.3 | 7.4 | 7.3 | 7.4 | 7.3 | 36.9 | 36.6 | -0.3 | -0.8% |
| Freight-specific | 11.1 | 10.9 | 11.1 | 10.8 | 11.1 | 9.9 | 11.1 | 11.1 | 11.1 | 10.9 | 55.3 | 53.6 | -1.8 | -3.2% |
| **Total** | **24.7** | **24.4** | **24.7** | **23.6** | **24.7** | **24.2** | **24.7** | **24.4** | **24.7** | **24.6** | **123.6** | **121.3** | **-2.3** | **-1.9%** |

**Table 9: Changes in pass through costs in CP3**

| 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.<br><br>CP3 outturn is forecast to be 1% higher than the CP3 efficient budget; this is despite large increases in wholesale electricity prices which were mitigated to some extent by our Corporate Power Purchase Agreements and our hedging strategy. |
| Insurance | The majority of insurance requirements are set out in the Concession Agreement. The insurance price for CP3 was locked in until November 2021. The CP3 efficient budget assumed that we would be able to continue to procure insurance at the same rate for the remainder of CP3, increasing with RPI, with a small increment in November 2020 to allow for a potential cost increase as a result of the revaluation programme.<br><br>The CP3 cost outturn is forecast to be £0.5m (2%) lower than the CP3 efficient budget as a result of risk analysis work performed by HS1 to reduce the principal amount required to be insured. |
| 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.<br><br>CP3 outturn costs are forecast to be slightly lower (£0.3m, 1%) than the forecast in the CP3 efficient budget. |
| Rates | The CP3 outturn cost is forecast to be £1.8m (3%) lower than budget.<br><br>The CP3 efficient budget assumed that there would be two rates revaluations in CP3 and that rates would continue at the CP2 exit level, increasing with RPI. The first rates revaluation was delayed and the rates multiplier was frozen for two years meaning there was no increase compared with the RPI increase assumption in the CP3 efficient budget. Business rates have now been reassessed; the original increase in rateable value was c.100% but HS1 worked with rating consultants, the Valuation Office Agency and TOCs to minimise the increase to c.35%. |

### 3.4.5. Freight-specific 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.
- Long term 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.
- Long term 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 10 shows a breakdown of the freight-specific costs in the CP3 efficient budget. CP3 outturn costs are forecast to be £0.4m lower than the CP3 efficient budget over the five years of the control period as a result of Ripple Lane charges being lower than forecast. Table 11 explains how each of these costs was built up.

**Table 10: Freight-specific costs CP3 efficient budget (£m, February 2023 prices)**

| | 20/21 | 21/22 | 22/23 | 23/24 | 24/25 | Total |
|---|---|---|---|---|---|---|
| NR(HS) | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.70 |
| NRIL Ripple Lane | 0.24 | 0.18 | 0.24 | 0.24 | 0.24 | 1.14 |
| HS1 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.33 |
| **Total** | **0.44** | **0.38** | **0.45** | **0.45** | **0.45** | **2.17** |

**Table 11: Freight-specific costs in CP3**

| 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, calculated as a proportion of total NR(HS) O&M costs based on the number of trains, train weights and equivalent track-km.<br><br>For CP3 this is a total cost of £139k p.a. comprised of £79k p.a. variable O&M cost plus £60k p.a. long term avoidable O&M cost (exclusive of mothballing costs). |

| | |
|---|---|
| NRIL costs (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.<br><br>The CP3 efficient budget included the following costs:<br>• £358k p.a. for operations, inspections, regular proactive and reactive maintenance and vegetation clearance; and<br>• A smoothed allowance of £92k p.a. for heavy maintenance works.<br><br>Ripple Lane costs have been gradually decreasing over CP3; the annual average for both elements combined is forecast to be £362k p.a., meaning total Ripple Lane costs in CP3 would be £0.4m less than the efficient budget.<br><br>Mothballing costs of £220k p.a. are subtracted from total Ripple Lane costs, with the remaining cost charged to freight operators.<br><br>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. |
| HS1 | This is an allocation from total HS1 costs of those costs which are specific to freight operations.<br><br>For CP3 this was £66k p.a. |

### 3.4.6. 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 PR19, we provided an indicative forecast of traction electricity costs for CP3; this was based on electricity price forecasts provided by our supplier, npower (assuming no change in purchasing strategy) and our forecast increase in train paths. Table 12 shows this indicative forecast and CP3 outturn costs.

**Table 12: CP3 traction electricity costs outturn v indicative (£m, February 2023 prices)**

| | 20/21 | 21/22 | 22/23 | 23/24 | 24/25 | Total |
|---|---|---|---|---|---|---|
| PR19 estimate | 27.2 | 26.5 | 26.3 | 26.4 | 26.2 | 132.5 |
| Outturn/forecast | 19.6 | 12.9 | 48.8 | 52.3 | 44.2 | 177.8 |
| Variance | -7.6 | -13.6 | +22.5 | +25.9 | +18.0 | +45.2 |

For CP3 as a whole, outturn costs are expected to be 38% higher than forecast as a result of significant increases in electricity prices (with reductions in the first two years driven by lower train volumes). Our hedging strategy provided some mitigation against short term electricity price volatility.

Section 12.5.2 (Energy purchasing strategy) discusses how we have procured electricity from npower during CP3 and the purchasing strategy we have agreed with the train operators.

Section 9.2.1 discusses how we have achieved a 5.4% reduction in traction energy consumption in CP3, through the introduction of regenerative braking on the SETL high speed train fleet and the N-1 Energy Saving Scheme.

## 3.5 CP3 renewals

In CP3, we have made significant improvements in the way we plan and deliver renewals, improving our use of asset data in renewals decision making. We have continued to improve renewals governance and assurance, introducing leading indicators to proactively manage risks to the workbank.

### 3.5.1. Governance and assurance improvements

At the start of CP3, we introduced an improved governance process in line with the recommendations from the Arup governance study reported in the PR19 5YAMS. We have continued to mature our renewals governance and assurance throughout CP3, making improvements to the HS1/NR(HS) Renewals Board and introducing leading indicators for renewals performance.

We have changed the structure of the periodic HS1/NR(HS) Renewals Board to better suit the maturing HS1 and NR(HS) project delivery organisations, with greater focus on forward looking plans, issues and blockers to renewals delivery. We have also worked with NR(HS) on reporting inputs, review processes and outputs to ensure there is a line of sight from NR(HS) data inputs to HS1's assurance processes and reporting obligations.

As part of HS1's maturity as a project delivery function, and in response to ORR challenge on proactive renewals assurance, we have introduced a leading indicator dashboard. The aim of this dashboard is to assure renewals delivery performance and identify where support and intervention may be needed by answering the key assurance questions of how confident is HS1 that the plan will be delivered, both in the current year and for CP3 as a whole, and whether resource and effort are being focused on the right areas.

The dashboard is based on interrogation of NR(HS) reporting and Renewals Board inputs, analysed using Power BI. It was developed in discussion with the ORR and was designed to use existing data sources where possible, be proportionate to the workbank and focus on HS1's assurance of the renewals portfolio. We plan to review and mature the leading indicators as NR(HS)'s reporting inputs mature and based on the priorities and challenges of the workbank.

The dashboard is shared with stakeholders at Quarterly Asset Renewal Review meetings.

### 3.5.2. Capability improvements

HS1 and NR(HS) are continuing to build joint capability, focusing on:

- **Integration:** as part of the NR(HS) Target Operating Model (TOM) review, NR(HS) restructured its infrastructure team leading to better alignment between asset management, renewal and planning functions. This has improved renewals management, as evidenced by the CP3 workbank review (see Section 3.5.3).
- **Resource:** as part of the TOM, NR(HS) put in place a new Head of Renewals with previous experience of high output ballast refurbishment, a key project in CP3 and CP4. NR(HS) has improved the project controls resource which has allowed for the acceleration of the governance and assurance improvements noted above and the process maturity driven by HS1. Work is ongoing to identify the renewals organisation and capability required to successfully deliver future control period renewals volumes and complexity; HS1 is assessing the team, skills, experience and competence required and NR(HS) plans to implement this.
- **Process:** continuing to strengthen NR(HS)'s PMO processes and capability, to ensure they meet both NR(HS) internal needs and HS1 requirements through clarification of reporting and requirements. HS1 and NR(HS) will work to make project reporting more effective and efficient by implementing new systems and technologies to aid collaboration.

In its PR19 5YAMS, NR(HS) identified a number of works packages that would offer value for money by incentivising the supply chain with larger packages of work and streamlining the project authority and governance process. NR(HS) varied from these packages over the first two years of CP3, carrying out a high volume of single sourcing for projects, due to the priority of works and the delays experienced. NR(HS) completed a reconciliation exercise for the remainder of CP3 which provided an opportunity to determine which packages remain 'intact' and can be progressed in future years to drive improved delivery. In addition, NR(HS) is seeking endorsement for the use of existing frameworks within NRIL where these would add value.

### 3.5.3. CP3 renewals budget and outturn costs

Renewals delivery in the first three years of CP3 was heavily impacted by significant geopolitical and macroeconomic pressures including the Covid-19 pandemic, inflation at its highest rate in 40 years, significant increases in energy costs, post-Brexit border arrangements and significant industrial action on the railways.

As a result of these factors, renewals in the first three years of CP3 were less than the PR19 plan, although the volume of renewals increased significantly in year 3, to 73% of planned volumes. HS1 managed the portfolio dynamically, regularly reviewing the workbank and managing change through the project governance and deferred renewals processes.

During year 3, HS1 instructed NR(HS) to review the remaining projects in the CP3 route renewals workbank and provide:

- An asset management justification for each project; and
- A justified and credible plan for delivering the remainder of the CP3 workbank.

The review took into account improved knowledge of asset condition and deterioration rates, including early analysis carried out as part of the PR24 planning process. Each renewal was subject to a deliverability review to evaluate development status and supply chain readiness. HS1 worked closely with NR(HS) to review progress and provide challenge, assure the deferrals and mitigations and assure the deliverability of the revised portfolio and the appropriate governance of change. HS1 engaged with ORR during the process and presented the results to stakeholders.

As a result of the workbank review, a number of renewals projects have been moved from CP3 to CP4. The most significant, in terms of cost, was the deferral of the ballast renewal to CP4; this decision was supported by asset condition data from recent surveys and will enable a more effective delivery strategy, combining the CP3 and CP4 ballast renewal requirements into one delivery package in CP4. The changes can be grouped into three categories:

- Asset management led;
- Deliverability/emerging PR24 strategy led; and
- Impacted by macro factors.

All deferred renewals have been risk assessed and recorded on the deferred renewals log. With the exception of three higher risk projects (UPS renewals, fibre optic signalling renewal and reduced volume of crossing replacements), the deferrals present minimal risk and can be managed effectively through existing maintenance plans or with minor mitigations. For the three projects which present a higher performance risk, NR(HS) will work to improve the delivery plan for these projects to bring the programme back in line with the asset requirement.

Within the three categories, we identified governance groupings to assist in managing the portfolio change and the treatment of individual projects; these are outlined in Table 13.

**Table 13: Governance groupings**

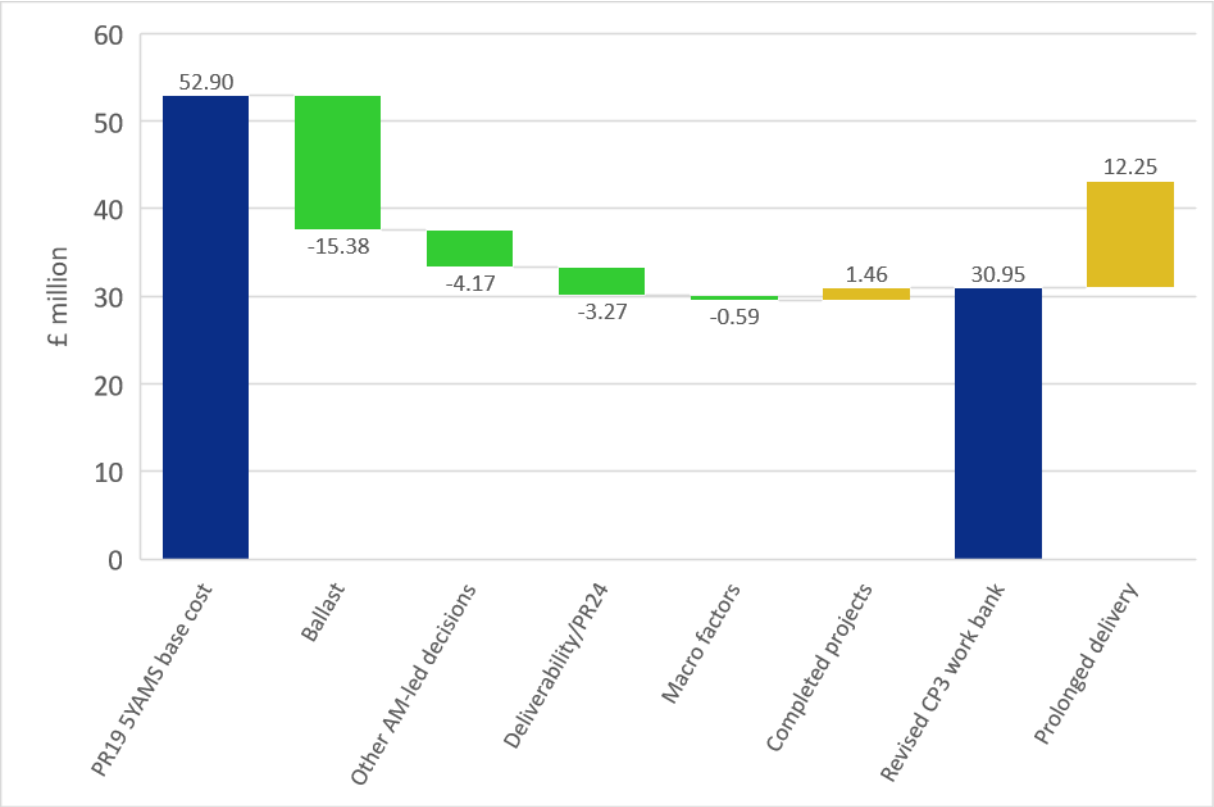
| Driver | Governance grouping | |
|---|---|---|
| Asset management | Deliver reduced volume | Reduced volumes to be delivered in CP3, project to be closed, any future funding to be sought through PR24. |
| | To be closed | No volumes to be delivered in CP3, project to be closed, any future funding to be sought through PR24. |
| Deliverability optioneering and emerging PR24 strategies | Strategy change/'efficient closure' | Project to continue either to a suitable and efficient hold point then closed or to deliver outputs which support a change in strategy. |
| | Replace on failure | Replace on failure (maintenance) - items which fail safe - potentially to be moved to maintenance in CP4. |
| Impacted by external macro factors | Continue against existing approval/plan | Proceed as planned/current governance – no change planned. |
| | Prolonged delivery | Volumes still need to be continuously delivered but over a longer period outside CP3. Funding retained within CP3 budget. |

The main risks to achieving the revised delivery workbank for the remainder of CP3 are:

- Unplanned activity, such as industrial action and Covid;
- Raw materials supply shortages;
- Access availability (possessions); and
- Key delivery resource (in-house and contractor).

In the PR19 Final Determination, the CP3 route renewals budget was £52.9m (base cost) (in February 2018 prices). The workbank review process reduced this to £30.9m as shown in Figure 14. Of this £22m reduction, £15.4m was from the deferral of the ballast refurbishment project to CP4.

**Figure 14: CP3 workbank review – movements from PR19 5YAMS (Feb 2018 prices)**




The full portfolio of renewals in CP3 includes estimated outturn costs for additional elements related to:

- Known opportunities: potential acceleration of CP3 prolonged delivery works and CP4 development work;
- Risks: replace on failure schemes being realised; and
- Additional Data Transmission Network (DTN) costs (the DTN change request has been supported by ORR and approved by DfT).

The revised CP3 base cost funding envelope, including costs for all of these elements, is £48.7m. The total cost, including overlays, is shown in Table 14.

Renewals volume delivery in P1-P8 of 2023/24 was 138% of plan. This is a significant improvement which has been achieved by greater integration of renewals, asset management and planning within the NR(HS) Infrastructure directorate as a result of the implementation of the Target Operating Model (TOM), and the continued maturity improvements in PMO, change, reporting and assurance, driven by HS1.

**Table 14: CP3 renewals revised total cost (£ million, Feb 2018 prices)**

| Item | PR19 Final Determination | Forecast outturn |
|---|---|---|
| Revised CP3 workbank cost | | 30.9 |
| CP3 prolonged delivery (spend in CP4) | | 12.2 |
| Known opportunities | | 1.6 |
| Replace on failure works | | 0.8 |
| Additional funding for DTN project | | 3.1 |
| **Base cost** | **52.9** | **48.7** |
| NR(HS) markup (10%) | 5.3 | 4.9 |
| **Subtotal** | **58.2** | **53.6** |
| Risk (12.6%) | 7.3 | 6.8 |
| **Subtotal** | **65.5** | **60.4** |
| PMO[8] | 5.5 | 7.1 |
| **Subtotal** | **71.0** | **67.5** |
| Efficiency (1.8%) | (1.3) | (1.2) |
| **Total** | **69.7** | **66.3** |

## 3.6 Renewals escrow account

Part of the OMRC paid by train operators is designed to fund future renewal of the HS1 railway. The funds collected from the renewals element of OMRC are paid into a route escrow account. 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.

[8] The forecast outturn PMO is 15% of the base cost compared with the 8-12% range in the PR19 Final Determination and the 10% target. This is due to PMO costs incurred in years 1 and 2 for the development of a larger workbank. The disruption early in CP3 prolonged the delivery of CP3 renewals and increased PMO costs due to replanning and repeat procurement works. Much of this work will be used in CP4. The target for years 4 and 5 is 10% of the base cost.

### 3.6.1. CP3 investment strategy

During PR19, we agreed with the ORR and DfT that the aim of the escrow investment strategy for CP3 was to maximise the interest we could earn on the escrow balances. However, at the start of CP3, market interest rates fell, partially driven by the Covid-19 pandemic, together with a lower and flatter longer term interest rate curve than initially forecast. Due to this, and the EIL escrow holiday that was offered to support operator cashflow through the initial months of the pandemic[9], it was agreed to keep the investments to a shorter tenor of six months to maintain liquidity during an uncertain time (as the associated volatile train paths meant new cash receipts into the escrow were also uncertain). This allowed HS1 to quickly move investments to a longer tenor when the interest rate curve improved.

Since December 2021, we have returned to maximising interest earned over the remainder of the control period while ensuring liquidity. This has happened as (i) market interest rates have risen to tackle inflation; and (ii) train paths have stabilised. Our dedicated and experienced Treasury function therefore agreed with the ORR, DfT and the TOCs to extend the tenors of the investments from a minimum of six months up to the maximum, being the end of CP3.

While outturn interest rates are above the forecast rates set out at the start of CP3, this will not close the gap between interest rates and inflation. In addition, we informed the DfT that investment capacity was reached in June 2023 which will have a negative impact on TOCs due to the lack of avenues to earn interest income. HS1 is inputting into DfT's work to amend the escrow investment requirements set out in the Concession Agreement to further optimise the interest rates earned in the future (see Section 20).

### 3.6.2. Escrow account movements in CP3

**Table 15: Escrow account in CP3 (£m, nominal)**

| | 20/21 actual | 21/22 actual | 22/23 actual | 23/24 forecast | 24/25 forecast |
|---|---|---|---|---|---|
| Opening balance | 91.3 | 90.5 | 101.8 | 127.1 | 155.7 |
| Transfers in | 13.6 | 20.6 | 34.3 | 42.0 | 41.2 |
| Withdrawals | (14.5) | (9.4) | (9.4) | (14.4) | (17.0) |
| Interest | 0.2 | 0.1 | 0.4 | 1.1 | 8.8 |
| Closing balance | 90.5 | 101.8 | 127.1 | 155.7 | 188.7 |

[9] We offered an escrow holiday for 2020/21 and the first three periods of 2021/22 to both EIL and SETL; this offer was taken up by EIL.

Table 15 shows escrow account movements in CP3 in nominal terms. This table includes both current account and deposit account balances. Table 16 compares the PR19 forecast for CP3 with the current outturn forecast.

**Table 16: PR19 estimate and current outturn forecast for the end of CP3 (£m, nominal)**

| | PR19 CP3 estimate | CP3 outturn | Difference |
|---|---|---|---|
| Opening balance | 75.4 | 91.3 | +15.8 |
| Transfers in | 144.7 | 151.7 | +7.0 |
| Withdrawals | (87.0) | (64.8) | +22.2 |
| Interest | 5.9 | 10.6 | +4.6 |
| Closing balance | 139.1 | 188.7 | +49.7 |

Variances between the PR19 estimate and our current forecast of CP3 outturn are a result of the following:

- In PR19, we under-forecast the CP3 opening balance; we started CP3 with £15.8 million more in the escrow account than our forecast;
- Transfers in are higher than forecast as a result of significantly higher RPI than the 2.75% forecast, despite both international and domestic train paths being lower than forecast;
- Withdrawals are lower than forecast as a result of changes in the renewals spend profile (as discussed in Section 3.5.3);
- Market conditions have resulted in interest received being higher than forecast. At the time of PR19 we assumed that 80% of funds would be placed in Authorised Investments with an average interest rate of 1.22%. Actual interest rates have been significantly higher than forecast, as shown in Table 17. Although we are now able to place 90% of funds in Authorised Investments, as of 2023/24 we have reached capacity for these investments.

As required by the Concession Agreement, Table 17 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. As noted above, at the start of CP3, during the pandemic, it was agreed to keep investments to a shorter tenor.

**Table 17: Authorised Investments in CP3**

| Investment date | Investment horizon | Aggregate investment amount placed | Weighted average interest rate | Interest to maturity (£000) |
|---|---|---|---|---|
| Apr-20 | 3 months | £67.2m | 0.34% | 55 |
| Jul/Aug-20 | 4-5 months | £72.8m | 0.25% | 70 |
| Dec-20 | 6 months | £78.9m | 0.15% | 61 |
| Jun-21 | 6 months | £69.7m | 0.16% | 55 |
| Dec-21 | 6-12 months | £84.9m | 0.61% | 371 |
| Jun-22 | 6-12 months | £47.0m | 2.24% | 975 |
| Dec-22 | 12-27 months | £60.0m | 4.64% | 4,427 |
| Jun-23 | 21 months | £46.0m | 6.16% | 4,950 |

## 3.7 Upgrades

In CP3, we led the 4G installation project to improve mobile network coverage in HS1 tunnels and stations. In the remainder of CP3 we plan to carry out ERTMS early works and install a radio network to support the new Home Office Emergency Services Network.

### 3.7.1. Specified Upgrade

The European Rail Traffic Management System (ERTMS) is a large signalling project that we currently anticipate implementing in CP5. We need to undertake early design and planning works to appropriately and efficiently plan for the full ERTMS project. These ERTMS early works will be undertaken over 2024.

The TOCs have agreed in principle to fund the ERTMS early works upfront through a cost recovery arrangement. HS1 is in the process of finalising this agreement with stakeholders in order to begin these works. If the agreement is not finalised, HS1 will follow the Specific Upgrade provisions under the Concession Agreement to obtain funding via an Additional IRC.

### 3.7.2. Other upgrades

**4G network**

To improve customer experience, we have worked with EE to install a 4G system in the HS1 tunnels and at St Pancras International and Stratford International stations. The objective was 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 is designed to be direct to handset but with secondary connectivity to onboard train wi-fi systems.

The project was completed in CP3, the tunnel systems were switched on in early 2021 and the station systems in early 2023; both projects were delayed by works being temporarily suspended through much of 2020 due to Covid-19. The project has installed in-tunnel and in-building distributed radio antenna systems to provide users with better mobile connectivity. The work in the tunnels was particularly complex due to the large size of the radiating cable that was installed and the difficulty of working in the tunnel environment. The project was completed without any injuries to the project installation teams. The project was funded by EE.

**Emergency Services Network (ESN)**

The Home Office is leading a cross-government programme to deliver the new Emergency Services Network (ESN) critical communications system to replace the current Airwave service used by the emergency services.

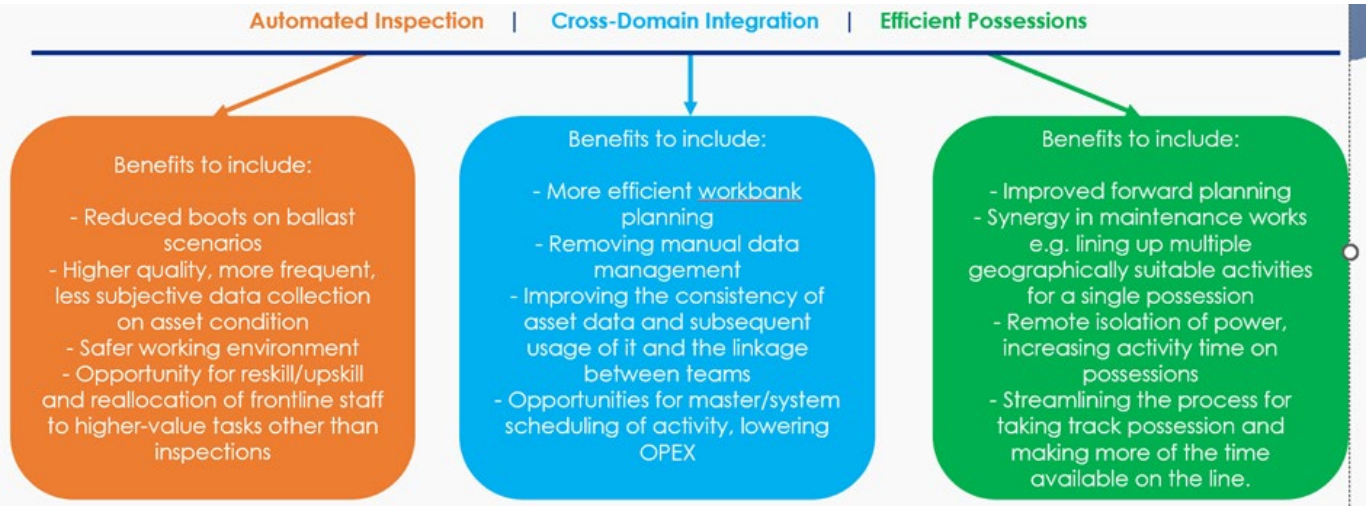
In August 2023, we began a project with EE to install the new radio network on HS1 as part of this programme. The project is being funded by the Home Office. The HS1 ESN deployment project is planned to run for 18 months, using the same teams as and the learning from the 4G installation project to improve the speed of project delivery and reduce the costs of deployment for the Home Office.

## 3.8 Innovation

As part of the PR19 Final Determination, the ORR agreed to the provision of research and development funding for CP3 with the aim of reducing the costs of asset maintenance and renewals in the future. At the start of CP3, HS1 created a Research and Development Panel to govern and assure the investment of funds; the panel includes representatives from HS1, NR(HS), UKPNS and train operators.

We collaborated with Connected Places Catapult to identify our highest priority areas and develop three challenge statements which articulated our focus areas of automated inspection, cross-domain integration and efficient possessions to prospective suppliers. We published the challenge statements in 2021/22. Subsequently we built a pipeline of initiatives which we have converted into active R&D projects following the challenge statement themes. The initiatives are a mix of projects that deliver benefit in the short, medium and long term with a variety of technology readiness levels.

**Figure 15: CP3 R&D priority areas**




18 R&D initiatives have been approved in CP3 to date with projects ranging from short term tactical initiatives to long term university research; with additional initiatives planned for the remainder of CP3. Progress on the R&D programme is reported each year in the AMAS and a summary of all of the CP3 R&D projects is included in the Joint R&D Strategy (Appendix 14 of the NR(HS) Route 5YAMS). Of the 18 initiatives to date, seven are complete and 11 are ongoing. Of the completed projects, four are either being implemented or being developed to be implemented in CP3. These are:

- **Challenge statement identification** (as noted above).
- **In-service monitoring on Eurostar trains:** Phase 2 had a single system installed on a Eurostar train which allowed us to identify areas of deterioration and plan remediation. Phase 3 will optimise the technology and develop it into a commercial proposition, while also deploying a second system.
- **ArcGIS geospatial information model prototype:** the proof-of-concept trial to provide a geospatial representation of assets which can integrate with other systems and software is complete. The aim is to build capabilities in the areas of asset mapping, crime tracking, renewals planning and possession management. The system demonstrated the ability to capture, process and visualise the data from remote condition monitoring devices allowing close to real-time asset monitoring and supporting our transition to risk-based asset management. Following conclusion of the trials, NR(HS) is developing an ArcGIS Implementation Plan in collaboration with HS1 which will align the implementation of ArcGIS with EAMS2.0 and ProjectWise.
- **Support for AI-based overhead line monitoring:** NR(HS) is working with Hitachi and SETL to trial Hitachi's on-board system on HS1. If successful, the system will facilitate the prediction and identification of overhead line defects to allow intervention before a potentially disruptive incident is caused. Initial R&D funding was used to exercise options in contracts with Hitachi to enable this initiative. For the next stage, we have scoped a year-long trial of the full technology for overhead line monitoring.

Three initiatives have been completed and are either not being taken forward or paused:

- **Tunnel vision:** the objective of this project is to demonstrate both a safety case and a business case for the replacement of physical inspections of tunnel assets with a technological alternative. The project is currently paused due to issues around data quality and data ownership. We plan to restart the project in CP4 when we address these issues.
- **Digital bridge inspections:** the outputs of the trial were positive but further work is needed on the approach to data capture to reduce the requirement for staff on and around the asset. This initiative is currently paused but could be paired with automated capture technology in the future.
- **Overhead line equipment in real time (OLErt):** this has been replaced by the AI-based overhead line monitoring initiative discussed above, which was deemed to have a higher likelihood of success for a lower R&D investment.

In addition to further work on ArcGIS and AI-based overhead line monitoring discussed above, key R&D projects for the remainder of CP3 are:

- **Fibre optic acoustic sensing (FOAS):** a partnership with NRIL with trials on the NRIL network and HS1. The purpose of the trial is to demonstrate how FOAS can be used to monitor the condition of high-speed switches and crossings, supporting the move to a condition-based approach to maintenance and renewal activities for these assets.
- **Management of track in hot weather:** an ongoing academic research project to understand the behaviour of the track system across a range of temperatures. This will allow a matrix of controls to be developed to assure safe operating conditions as temperatures rise.

HS1 and NR(HS) are planning to hold an R&D showcase in March 2024 to demonstrate to stakeholders the benefits, outputs, and value for money of the projects delivered in CP3. The Final 5YAMS in May 2024 will include information on CP3 R&D benefits.

# 4 CP3 outturn: Stations

This section sets out the CP3 outcomes across HS1 stations. While the broader environment has become more challenging, HS1 and NR(HS) have continued to deliver on the key areas to ensure station assets are maintained in good condition while managing costs. During 2022/23 there were issues with availability of lifts, escalators and travelators (LETs) and cleaning which we have proactively addressed to return performance in these areas back above target.

There have been significant changes related to **Ashford International**. The impact of Covid-19 and EIL's decision not to use the Kent stations as intermediate stops has had a material impact on Ashford International. The station has not been used by Eurostar since March 2020 but has remained open to provide domestic passenger thoroughfare. HS1 is maintaining the assets in a cost-efficient manner, appropriate to the significantly lower traffic, while ensuring station asset condition and performance is maintained at sufficient levels to ensure a smooth recommencement of services when needed. In 2023, ABM took over the management of Ashford International station from Mitie.

In this section we provide a summary of CP3 outcomes for HS1 stations for key areas including:

- Safety (Section 4.1);
- Operational performance, with a focus on LETs and cleaning (Section 4.2);
- Renewals delivery in CP3 (Section 4.3);
- Renewals escrow account movements (Section 4.4);
- Stations operations and maintenance costs which, although not within scope of PR24, are an important element of stations asset management and costs (Section 4.5); and
- Other improvements we have made, including the implementation of the Station Enhancements Policy, innovation and sustainability initiatives (Section 4.6).

The specific requirements of the Station Leases for the periodic review are covered in the stations Life Cycle Reports (LCRs) provided as supporting documents to this Draft 5YAMS.

## 4.1 Safety performance

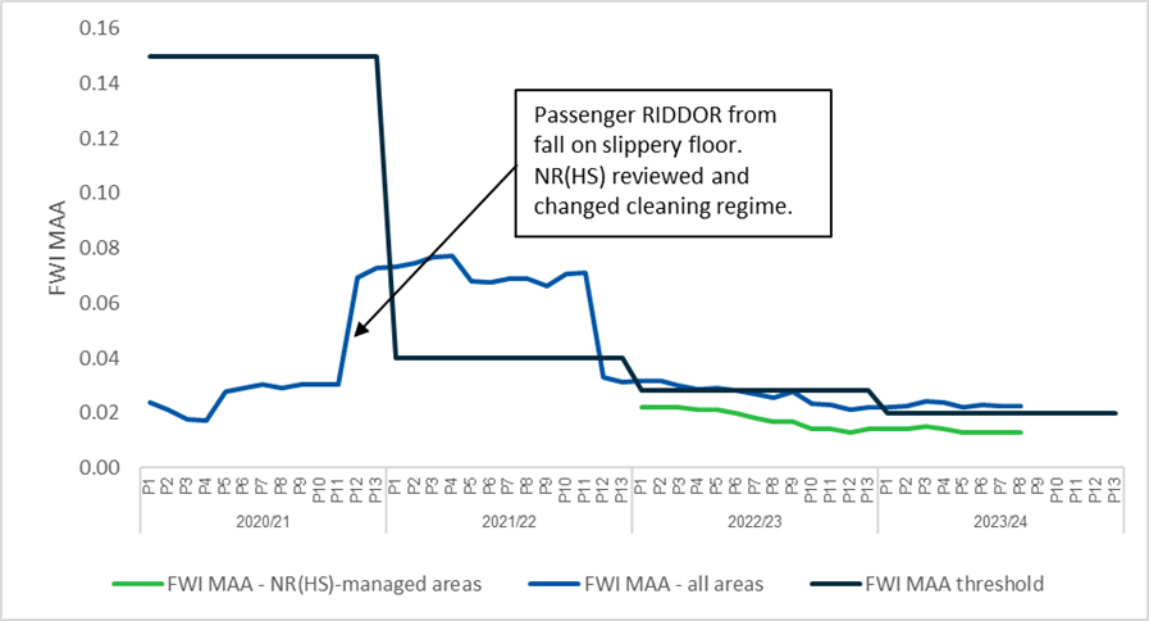
Our top level safety metrics are:

- Workforce safety: Fatalities and Weighted Injuries (FWI) per million hours worked; and
- Public safety: FWI per 10 million footfall at stations.

Workforce safety for route and stations combined is discussed in Section 3.2. This section covers public safety at the stations.

Figure 16 summarises public safety performance at St Pancras, Stratford and Ebbsfleet in CP3. FWI MAA is shown both for the NR(HS)-managed areas of the stations and for all areas of the stations.

**Figure 16: Public FWI (St Pancras, Stratford, Ebbsfleet)**




Passenger safety over CP3 has been generally good. The number of accidents at the NR(HS)-managed stations was low during the height of Covid-19 and increased as footfall returned to the stations. FWI increased above the threshold at the end of year 1 due to a passenger RIDDOR at St Pancras. The stations locally owned safety improvement plan (introduced as part of a wider safety improvement initiative, discussed in Section 3.2) includes targeting key public safety risks such as escalators and slips, trips and falls accidents.

In 2022/23, the NR(HS) stations team commenced a project trialling the use of artificial intelligence (AI) screens which recognise unsafe behaviours as people approach the escalators, such as carrying luggage. The screens warn them to stop and guide them to use the lift. NR(HS) is currently assessing the data from the trial to understand the benefits of a wider roll out.

These safety improvement plans have been effective in reducing the number of accidents and bringing the FWI within the lowered threshold. The public FWI at Stratford remains above threshold due to an increase in accidents over 2022/23, with 30% of these accidents occurring on the Stratford Boardwalk outside the station where NR(HS) has limited ability to control. The number of accidents at Stratford has reduced in 2023/24 and these are not due to the infrastructure.

At **Ashford International** station there were no accidents recorded for members of the public in CP3 to date, reflecting the low passenger traffic at the station.

Section 8 sets out our health, assurance and safety strategy for the remainder of CP3 and CP4.

## 4.2 Operational performance

Station performance is measured against a number of KPIs. In this section, we summarise the two key measures of station performance:

- Availability of LETs in stations; for all other assets identified for performance monitoring[10], there has been excellent availability; and
- Station cleaning audit scores.

Further detail on critical asset performance is in Section 3.1 of the station LCRs.

In addition to these metrics, HS1 focuses on understanding our station customers. We continually monitor customer feedback through our customer satisfaction programme, Station Matters, to ensure we are getting the basics right and are responding to changing customer needs, behaviours and profiles. Based on customer feedback we have invested in several station improvement initiatives including:

- Customer service training at Stratford International and Ebbsfleet International which resulted in improved customer satisfaction ratings across several service delivery measures; and
- Launch of a digital map at St. Pancras International, planned for spring 2024, as a wayfinding solution to help customers navigate their way around the station; this was identified as important to passengers in our survey feedback.

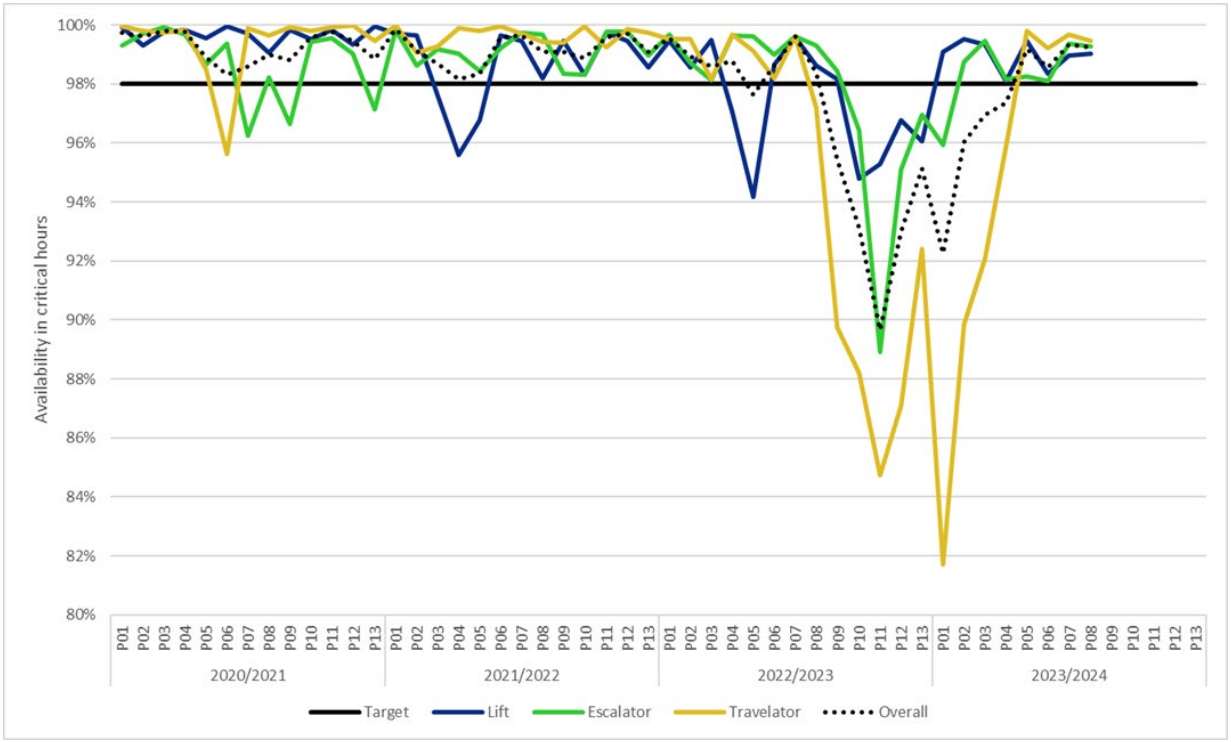
### 4.2.1. Lifts, escalators and travelators

During PR19, HS1 system stakeholders agreed to a budget for renewals plans for CP3 that sought to balance the appropriate asset intervention timeframes (based on the asset information available at the time) with the affordability concerns of the operators. We were aware that the LET assets would be reaching, or operating beyond, their design life in CP3. We took advice from external experts and had additional condition surveys taken at the time to plan the renewal timings of the LET assets to meet performance targets. The PR19 plans were approved by DfT via the PR19 Final Decision as meeting the Life Cycle Purpose.

During the first two years of CP3, overall LET availability averaged 99.2%, with above target performance in every period, as shown in Figure 17. All asset groups performed well, with lifts averaging 99.1%, escalators 98.9%, and travelators 99.5% against a target of 98%.

[10] As set out in Annex 13 of the Stations Access Conditions for St Pancras, Stratford and Ebbsfleet stations and the Ashford Station Management Agreement. See the LCRs for more information.

**Figure 17: LET availability in critical hours at St Pancras, Stratford and Ebbsfleet stations**




As reported in our AMASs and quarterly reporting to the ORR, performance deteriorated from mid 2022/23 through to 2023/24. This was due to a small number of sudden significant failures in certain assets. The impact on asset availability, with all measures falling below target, was caused by issues with the quality and availability of manufactured spares and equipment which affected recovery times from failures. These issues also lengthened the recovery from planned outages. Other similar LET assets were subject to additional examinations and as a result their parts were proactively replaced through maintenance activities.

Appropriate action was taken by HS1 and NR(HS) at the time to address these issues. HS1 challenged NR(HS) to work closely with its specialist LET contractor to ensure stock of critical spares to enable timely repair. The contractor also now has additional dual-skilled engineers on our contract to reduce time to fix. The contractor is targeting maintenance on the assets with the most frequent failures to help drive improvements. At the start of 2023/24, NR(HS) put in place a tightly managed improvement plan with the contractor. This resulted in an increased planned inspection regime and maintenance activities. Availability has since improved and has been above target since P5 2023/24.

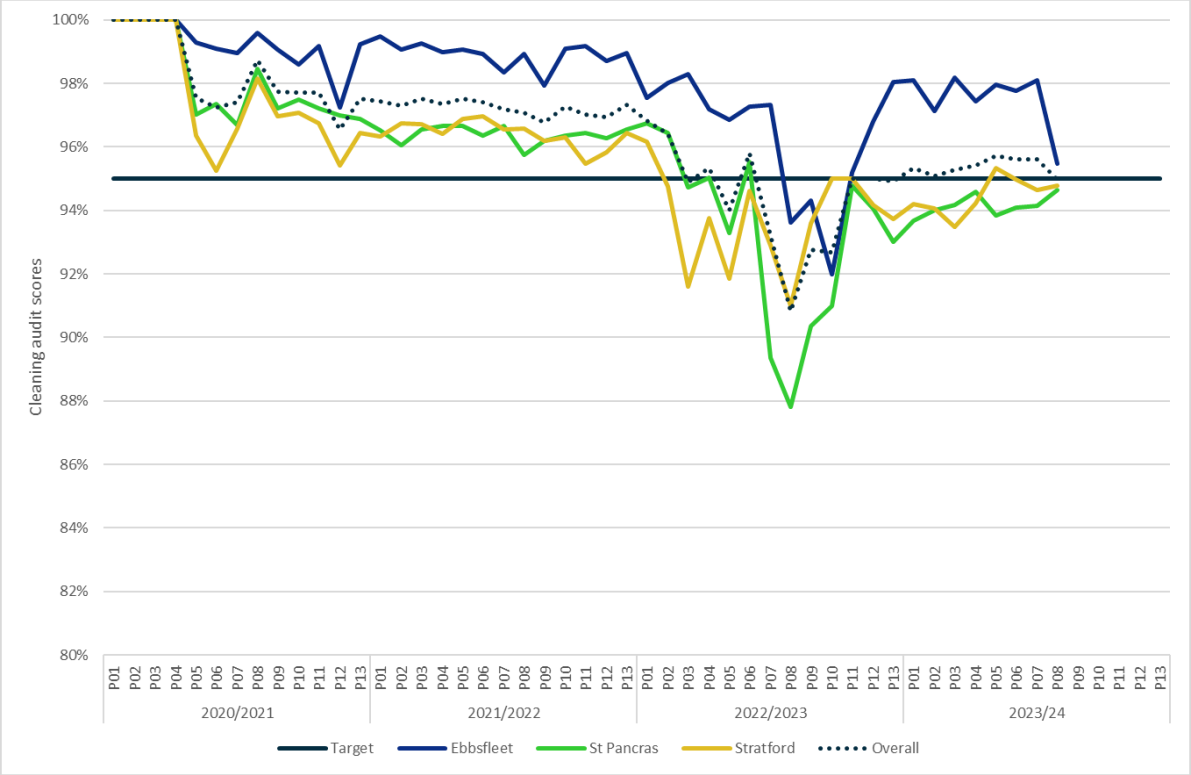
NR(HS) has also improved its asset condition data and understanding of necessary interventions, utilising technology such as remote condition monitoring. The timing of planned LET renewals in CP3 remained appropriate. We did not need to accelerate any renewals beyond the decision to bring forward a CP4 travelator renewal into CP3 for delivery efficiencies. As noted Section 4.3, LET renewals in CP3 have generally been delivered to budget. Based on the asset information and totex modelling, NR(HS)'s PR24 proposals include an acceleration of LET renewals from CP5 into CP4 at some stations, and a change in the renewals strategy to more smaller scale operational renewals from less frequent full scale asset renewals.

At **Ashford International**, availability was below target because of extended maintenance of the unused platform lift in mid-2022/23 (due to a flooded lift shaft and damaged components) and in mid-2023/24 (replacement of the invertor). This had no performance impact as these assets are not currently in use by passengers. A review of the frequency which the lift and escalator assets are 'ghost run' (occasional running to ensure performance) and water management is being undertaken to reduce the environmental impact of the assets. See the Ashford LCR for more detail.

### 4.2.2. Cleaning scores

Figure 18 shows the station cleaning audit scores for St Pancras International, Stratford International and Ebbsfleet International stations to P8 2023/24 compared with the target of 95%.

**Figure 18: Cleaning audit scores at St Pancras, Stratford and Ebbsfleet stations**




NR(HS) evolved its approach to station cleaning operations over CP3 with Covid-19 developments, introducing enhanced cleaning regimes and new technology such as autonomous cleaning devices. Cleaning audits were suspended for the first four periods of CP3 during the enhanced cleaning in response to Covid-19. Once reinstated, audit scores were above target for the first two years of CP3.

At the start of 2022/23 a new combined soft services contract with a new audit regime was introduced. The new contract aimed to consolidate services to maximise outputs, efficiency, and sustainability and resulted in a significant saving in cleaning and waste costs across the stations. The new NR(HS) cleaning contractor did not deliver a consistent product, leading to contractual

targets being missed. The contractor has been delivering major changes to its internal staffing resource, notably its management team, to improve consistency of delivery. A performance plan was agreed with NR(HS) at the start of 2023/24 in which a review of auditing was undertaken to ensure that the audit process and scoring were clearly understood by all parties. This has led the operations teams to deliver consistency of audits across the estate and therefore start delivering to target. Ebbsfleet station saw a more significant improvement; a review of the process being followed at Ebbsfleet is underway to consider implementation at St Pancras and Stratford.

Cleaning audit scores for **Ashford International** have been 100% over CP3 to date.

## 4.3 CP3 renewals

Stations renewals delivery has been good over CP3. There was little impact from the transfer of regulatory oversight of stations renewals from DfT to the ORR in 2022 as the stations and route processes were already broadly aligned. The steps HS1 has taken over CP3 to improve the maturity of renewals governance and assurance are discussed in Section 3.5.1.

Forecast CP3 outturn for renewals is broadly in line with plan, as shown in Table 18. The exception is Ashford International station, where the majority of renewals (c£2m) were deferred. This was driven by the station being used only for domestic passenger thoroughfare following EIL's decision to stop using the station in early 2020. Expenditure across all the stations is slightly above the PR19 budgets due to the addition of the operators' Customer Information Screens (CIS) assets to the workbank during the control period. Excluding this, renewals outturn for CP3 is forecast to be in line with the PR19 budget.

**Table 18: Forecast CP3 renewals outturn vs PR19 budget (£m, nominal)**

| | PR19 budget (February 2018 prices) | Forecast CP3 outturn (money of the day) | Variance |
|---|---|---|---|
| St Pancras | £10.46 | £11.86 | £1.40 |
| Stratford | £3.17 | £3.20 | £0.03 |
| Ebbsfleet | £2.54 | £2.94 | £0.40 |
| Ashford | £2.71 | £0.72 | (£2.0) |
| **Total** | **£18.88** | **£18.72** | **(£0.16)** |

LETs represented c40% of the total station renewals portfolio by value and are forecast to deliver within CP3 and within budget; the LET performance issues noted in Section 4.2.1 did not have an impact on CP3 renewals delivery. HS1 delivered a 5% efficiency on LETs by accelerating a travelator asset renewal from CP4 to CP3 to combine delivery and remove the additional downtime of the asset in CP4. HS1 also identified an opportunity for efficiencies from a

subsidised lift enhancement at St Pancras which would deliver a permanent lift in place of the temporary lift needed to maintain step free access during a renewal. This would have provided additional operational capacity and resilience and negated the need for temporary lift costs in future control periods. This opportunity was not taken forward by DfT.

Efficiency was also delivered through acceleration of the CIS scope from CP4 to combine it with CP3 scope reducing asset disruption, improving supplier long lead times for CIS equipment and market appetite, and fixing material costs which mitigated inflationary risks of c£300k compared with delivery in CP4.

HS1 led the successful delivery of the Station Communication System Renewal (SCSR), which used a phased development and delivery approach to mitigate the impact to station operations and delivered cost savings of c£250k against the project budgets. The renewal of the Building Management System at Stratford and Ebbsfleet was delivered through the SCSR project. This delivered a combined cost saving of £138k compared with the budget.

The design phase of the space heating renewal project identified complexities and constraints with the delivery. The project will continue into CP4 to mitigate the delivery risks.

## 4.4 Renewals escrow accounts

The LTC paid by train operators is designed to fund future renewal of the HS1 stations. The funds collected from the LTC are paid into a separate escrow account for each station; funds may only be used to fund renewals and are not transferrable between accounts. The escrow accounts are held in joint names and withdrawals require two DfT approved signatures. There are due diligence checks to support the processes and an annual DfT audit requirement. The provisions of the Station Leases allow for cash to be moved into Authorised Investments to earn a greater return.

The total station renewals annuity for CP3 was £11.6m (in February 2023 prices), split between the stations as shown in Figure 19.

Table 19 shows escrow account movements in CP3 for all four stations combined, comparing the forecast outturn with the PR19 forecast. Further detail by station can be found in Section 3.3.4 of the LCRs.

**Figure 19: CP3 renewals annuity by station (£m, February 2023 prices)**

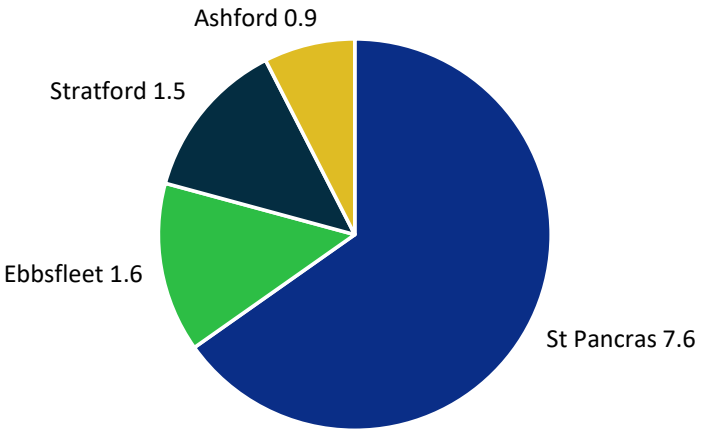



**Table 19: Escrow account movements in CP3 - all four stations combined (£m nominal)**

| | PR19 CP3 estimate | CP3 outturn forecast | Variance | % variance |
|---|---|---|---|---|
| Opening balance | 48.2 | 52.7 | 4.5 | 9% |
| Receipts | 49.3 | 53.7 | 4.5 | 9% |
| Withdrawals | (22.9) | (29.1) | (6.2) | 27% |
| Interest | 3.3 | 6.7 | 3.4 | 101% |
| Closing balance | 77.9 | 84.0 | 6.2 | 8% |

Variances between the PR19 estimate and our current forecast of CP3 outturn are a result of the following:

- The CP3 opening balance for all four stations was higher than forecast;
- Receipts are expected to be 9% higher than the CP3 forecast for all four stations with higher than forecast inflation;
- Withdrawals are expected to be 27% higher than the CP3 forecast overall, driven mainly by renewals at St Pancras. Withdrawals were much lower than forecast at Ashford International due to the deferral of renewals.
- Market conditions have resulted in interest received being higher than forecast. At the time of PR19 we assumed an average interest rate of 1.2%. Actual interest rates have been significantly higher. As a result, interest is expected to be 101% higher than the CP3 forecast overall.

- The net effect is that the closing balance for all four stations combined is expected to be 8% higher than was forecast in PR19.

Table 20 shows the expected CP3 escrow account closing balance by station; the large variance at Ashford is due to the deferral of renewals.

**Table 20: Escrow account CP3 closing balances (£m nominal)**

| | PR19 CP3 estimate | CP3 outturn forecast | Variance | % variance |
|---|---|---|---|---|
| St Pancras | 51.7 | 52.9 | 1.3 | 2% |
| Stratford | 8.9 | 9.6 | 0.7 | 8% |
| Ebbsfleet | 11.5 | 12.1 | 0.6 | 5% |
| Ashford | 5.9 | 9.5 | 3.6 | 60% |

## 4.5 Operations and maintenance (Qx) costs

The operations and maintenance costs at HS1 stations are known as Qualifying Expenditure (Qx). While this element of costs is outside the scope of the periodic review, we recognise its importance in stations asset management planning for the delivery of efficient works that maintain the performance and reliability of the assets. Section 10 outlines our asset management approach to stations maintenance and renewals.

We also recognise that stations Qx is a significant cost for operators (a larger cost than the LTC) and therefore an important consideration in the overall affordability of HS1 access charges. The current Qx costs for each station and operator are shown in Table 21.

**Table 21: 2024/25 Stations Qx Best Estimates* (£m, February 2023 prices)**

| Qx by station | | Qx by operator (all stations) | |
|---|---|---|---|
| St Pancras | 28.38 | EIL | 14.66 |
| Stratford | 4.47 | EMR | 8.43 |
| Ebbsfleet | 4.90 | SETL | 16.93 |
| Ashford | 2.28 | | |
| **Total** | **40.03** | **Total** | **40.03** |

* These are the latest Qx estimates available deflated to February 2023 prices to be consistent with the LTC. The allocation of St Pancras Qx among operators may be amended.

Qx costs have been impacted by the challenging macroeconomic developments during CP3 including electricity price volatility, high inflation and industrial action. HS1 has worked hard with NR(HS) to drive efficiencies in Qx costs.

Over CP3 we have delivered Qx efficiencies totalling £6.0m (in money of the day) across the four stations relative to the best estimates set at the start of each year. This was despite the increases in electricity prices and business rates during mid CP3. We achieved large savings through retendering supplier contracts for LET and MEP assets and cleaning. HS1 also delivered cost savings early in CP3 through its electricity hedging strategy, and on BTP costs for stations.

## 4.6 Other improvements

### 4.6.1. Station Enhancements Policy

Unlike for the route assets, there are no provisions in HS1's legal and regulatory framework that explicitly provide for station enhancements. During PR19 and early CP3, HS1 ran an extensive consultation with the operators and DfT (which had regulatory oversight of stations at the time) to develop a framework approach to station enhancements based on the 'beneficiary pays' principle.

HS1 published the Station Enhancements Policy in early 2022.[11] This outlines the key principles and considerations for the way we expect to address enhancements funding and financing to be applied on a case-by-case basis. There have not yet been any enhancements agreed to apply the policy to in CP3. Station enhancements expected in CP4 are outlined in Section 16.4.1.

The introduction of the Entry/Exit System (EES) in autumn 2024 will see self-service kiosks installed at St Pancras station for some international passengers to scan their travel documents and record other information required by the EU. This is not considered an enhancement as the related infrastructure is not incorporated into the station renewals workbank and LTC (the regulated asset base). The EES infrastructure will be leased from the French Ministry of the Interior (MOI) as a standalone system that will operate under a service agreement with the MOI to maintain and renew the kiosks. The area where the kiosks are placed may be re-zoned but this is expected to have little impact on the allocation of LTC across operators based on floor space.

### 4.6.2. Innovation

Alongside the route innovation work, several innovation initiatives have been implemented in the stations. We noted the introduction of autonomous cleaning devices, trialling of artificial intelligence for escalator safety and the implementation of remote conditioning monitoring in the sections above. Other initiatives include:

[11] station-enhancements-policy-april-2022.pdf (highspeed1.co.uk)

- The 5G ARDT project delivered a next-generation trial using augmented reality technology to deliver data about assets to our people. The digital twin allowed us to monitor our assets, ensuring high customer service and proactive asset management. The digital twin brought live asset data to operations via virtual reality headsets, allowing us to react and plan accordingly. This project has been key in informing our systemwide asset information vision and subsequent strategies.
- NR(HS) working with leading third parties to trial a range of drone-based technologies for station roof inspections. Drones have already been used successfully to access and inspect sections of the roof at St Pancras International. Unmanned aerial vehicles will be trialled, combined with high-powered camera sensor(s) to capture an aerial photogrammetry dataset.
- HS1 led development of the OpenSpace operational digital twin. The system is currently assisting financial planners in HS1 Ltd, who are using the data output to inform assumptions about passenger footfall in the stations. The consolidation of innovative activity in the stations has resulted in a plan to integrate several data streams into OpenSpace to allow centralisation of information and provide a reliable and informative stations usage and operations dashboard.

### 4.6.3. Sustainability

HS1 and NR(HS) are working together in our joint ambition to reduce our impact on the environment, reducing energy consumption and cost to the benefit of our customers. Details are set out in Section 9.

# Part 3:

# CP4 PROPOSALS

# 5 Overview of CP4 proposals

Our asset management objective is to manage the HS1 infrastructure in an efficient and sustainable way to ensure we achieve the asset stewardship requirements in the Concession Agreement and the Station Leases. We aim to maintain high asset performance and availability while remaining affordable for train operators. The Covid-19 pandemic during CP3 had a significant financial impact on the HS1 system, from which the system is recovering. We recognise the increased importance of affordability for train operators recovering from this impact. This has shaped our approach to think differently about PR24.

Events over CP3 have introduced more uncertainty and complexity into the HS1 system; and the potential entry of a new international operator adds to this. This has presented additional challenges in preparing our proposals compared to previous periodic reviews. We have based our proposals on a number of assumptions that aim to balance the range of risks and opportunities the system faces, based on evidence and good judgement. Most notably, we assume that a second operator does not start operation until CP5. We consider a change to this assumption would be a material and significant change to the circumstances on the basis of which the CP4 OMRC was determined in accordance with Schedule 10 of the Concession Agreement. This would need to be addressed by means of reopening the PR24 determination through an Interim Review. Our proposals also do not include any asset management impact from the flooding event in HS1's Thames tunnels. Investigations are ongoing and if any amendments to our 5YAMS are necessary on the basis of the findings, we will aim to incorporate these in time for the ORR's Final Determination.

Good asset management is the foundation of our proposals. During CP3 we have continued to improve our asset management capability through the delivery of our PR19 asset management commitments, working collaboratively with NR(HS) and taking a consistent approach across route and stations to share good practice. Continued improvements in asset information have strengthened our asset management decision making.

One of the key challenges for PR24 was to improve our understanding of track assets and the timing of their renewal. To do this we developed an industry-leading deterioration model that uses actual wear data which has resulted in significant reductions in the 40-year track renewals. For other route and station assets we have developed risk-based models that build a totex (total expenditure) output. R&D initiatives in CP3 have improved data collection and quality across asset types and contributed to deterioration modelling. To navigate the uncertainty around the rate of recovery from the pandemic we set out four different scenarios against which NR(HS) evaluated different life cycle costs by varying the time to renewals interventions and maintenance requirements. This provided clarity on the drivers of asset renewals to support our asset management decisions for our CP4 and 40-year renewals workbanks for route and stations.

NR(HS) developed the Operations Strategy and Engineering Access Strategy for CP4 in close consultation with HS1 and with a wide range of stakeholders. The Operations Strategy integrates

route and station operations and aligns with infrastructure and asset management to ensure cross-functional working and promote synergies and efficiencies. For the Engineering Access Strategy, NR(HS) has taken a more sophisticated, data-led approach, using a modelling tool to understand access intervention impacts and provide options for engineering access to enable informed and balanced decisions to be made for CP4. HS1 supports the step change in maturity that is being delivered through these strategies.

We launched our Sustainability Strategy in early CP3. The strategy sets out our plans for assessing and improving our performance in six priority areas, with targets and roadmaps for delivery to the end of CP4. The HS1 Energy Strategy focuses on reducing energy use, the use of alternatives to gas and greener procurement of electricity. We have achieved a 5.4% reduction in traction energy use by the introduction of regenerative braking on the SETL high speed fleet and implementation of the N-1 Energy Saving Scheme in CP3, with cost savings passed through to operators. We are on track to achieve our non-traction energy targets through a number of station, depot and lineside building projects in the remainder of CP3 and CP4, notably the replacement of station gas boilers with heat pumps. HS1 has procured a 10-year Power Purchase Agreement (PPA) with a renewable generator, providing c. 40% of baseload electricity; subject to TOC agreement, we intend to secure a PPA for a further 40% from April 2025 to support our operators through CP4.

In developing the route O&M costs for CP4, 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. Both NR(HS) and HS1 costs have been subject to a robust process of assurance and internal review and challenge. Where appropriate, costs have been benchmarked. Elements of NR(HS) O&M costs have been assured by HS1. **We forecast an overall reduction of 4% in O&M costs for CP4 compared with the CP3 efficient budget**. For HS1 costs, we are delivering an 8% reduction as a result of our comprehensive review of our organisational structure and other HS1 costs enabling us to start CP4 in an efficient, steady state position while managing the increased complexity in the system. NR(HS) is delivering a net efficiency on its Annual Fixed Price (AFP)[12] of 7% between CP4 exit (2029/30) and CP3 exit (2024/25); this is equivalent to a 4% reduction when comparing the costs for the five years of CP4 with CP3.

For route renewals, NR(HS) has developed, and HS1 has assured, the 40-year renewals workbank and CP4 renewals costs. As a result of the assurance, both renewals volumes and CP4 costs were reduced from initial estimates. Ballast cleaning is the largest work package in CP4 and work is ongoing to validate the current cost estimate and delivery strategy. In CP3, we have continued with the renewals capability development programme started in PR19, which has fed into a number of areas of our PR24 work including track deterioration modelling and the NR(HS) Renewals Strategy. For PR24, HS1 has funded and developed the Cost Policy which provides a structured and transparent approach to pricing long term renewals, recognising the inherent uncertainty of forecasting so far into the future. HS1 has used the Cost Policy framework to estimate renewals costs for CP5 to CP11. We use a renewals annuity arrangement to smooth the

[12] The AFP may need to be adjusted for the impact on risk cost resulting from a performance regime recalibration or the introduction of provisions to compensate for reactionary delay.

funding of renewals spend over time. **The proposed route renewals annuity for CP4 is £31.5m per annum, a reduction from £34.0m per annum in PR19.**

As a result of the reductions in both O&M costs and the renewals annuity, the overall route cost to be recovered in CP4 has reduced compared to CP3. This results in OMRC per train charges for passenger operators that are around 13% to 18% lower than current charges, as shown in Table 22. The CP4 charges differ by less than 1% from the charges determined in PR19, with charges for international services slightly lower and charges for domestic services slightly higher. This is a good outcome given the lower traffic volumes forecast in the system compared with PR19.

**Table 22: CP3 and CP4 route OMRC (£ per train, February 2023 prices)**

| | PR19 OMRC | Current OMRC* | PR24 proposed OMRC |
|---|---|---|---|
| **International passenger services** | 2,605 | 3,168 | 2,594 |
| **Domestic passenger services** | | | |
| St Pancras – Ashford | 1,935 | 2,234 | 1,948 |
| St Pancras – Springhead Jn | 1,011 | 1,170 | 1,015 |
| St Pancras – Ebbsfleet Up | 870 | 1,005 | 876 |
| St Pancras – Ebbsfleet Down | 926 | 1,071 | 931 |

Although freight costs have been significantly reduced from PR19, the number of forecast train paths on HS1 is only 44% of the PR19 forecast. The freight route OMRC charge has therefore increased to £1,313 per train from the current charge of £981 per train.

For freight operators accessing Ripple Lane only from the NRIL network, the proposed Ripple Lane (Domestic Sidings) charge is £88.52 per train compared with the current charge of £71.42 per train.

This is the first periodic review of HS1 stations renewals and LTC under the ORR's regulatory oversight. Over CP3, the ownership of stations Specific Asset Strategies has moved to NR(HS). This includes the move to totex modelling giving better line of sight of station assets since PR19. The proposed 40-year plans result in an increase in the renewals costs across all stations. This is due mainly to higher costs and some additional interventions for civils and mechanical, electrical and plumbing assets relative to PR19 estimates for the comparable periods. **Based on these plans, the Long Term Charge for CP4 for all stations combined is £15.56 m per annum, an increase of 34% from PR19**. This increase is across all the stations, as shown in Table 23. HS1 and NR(HS) will undertake further work to fully understand the factors driving the large variance. HS1 is also exploring if the Cost Policy approach used for route can be applied to stations long term renewals pricing. We will incorporate any findings our Final 5YAMS submission.

**Table 23: CP3 and CP4 stations LTC (£ million, February 2023 prices)**

| | PR19 LTC | PR24 proposed LTC |
|---|---|---|
| St Pancras International | 7.55 | 10.36 |
| Ebbsfleet International | 1.62 | 2.23 |
| Stratford International | 1.54 | 1.93 |
| Ashford International | 0.87 | 1.04 |
| **Combined total** | **11.58** | **15.56** |

Taking the latest estimates of the stations O&M costs (Qx) this gives a total combined charge for the HS1 stations of £55.59 million per annum (February 2023 prices).

The remainder of this Part 3 is structured as follows.

**Section 6** sets out the key **outcomes** we plan to deliver in CP4 for both route and stations.

**Section 7** discusses the **key assumptions** we have made including traffic forecasts, financial assumptions (including our approach to the indexation of renewals costs) and other assumptions underpinning our asset management plans.

**Section 8** sets out our **safety and security** strategies and our approach to **cybersecurity**.

**Section 9** sets out our **sustainability** strategy for CP4 with particular focus on our energy strategy.

**Section 10** describes our **asset management approach** for both route and stations and how this has informed our plans for CP4 and beyond. It describes how we have delivered on our commitments to improve our asset management maturity and asset data and discusses how innovation, research and development are built into our plans.

**Section 11** outlines our approach to **route operations and maintenance** in CP4. It summarises the NR(HS) Operations Strategy and Engineering Access Strategy and the maintenance approach set out for each asset discipline in the route SASs.

**Section 12** outlines our approach to identifying efficient **route O&M costs** and the benchmarking work undertaken as part of PR24. It sets out our forecast of O&M expenditure for CP4, separately identifying the NR(HS) Annual Fixed Price and other O&M costs.

**Section 13** sets out our approach to **route renewals**. We discuss renewals volumes; CP4 renewals costs, delivery plans and proposed changes to governance; our approach to estimating renewals costs for the remainder of the 40-year period 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 CP4.

**Section 14** discusses **route access charges** for CP4. It describes how our route charging model allocates costs between operators to calculate charges for passenger and freight operators and sets out our proposed charges for CP4.

**Section 15** discusses **route upgrades** planned during CP4 and beyond.

**Section 16** summarises our plans for **stations** covering 40-year renewals activities and costs, expected station enhancements and our proposed LTC for CP4 for each station and operator. We also set out the expected total station charges, with stations O&M costs, for context.

# 6 Our outcomes for CP4

At the launch of PR24, we engaged with key stakeholders to understand their priorities for the HS1 system in CP4, for both route and stations. These priorities can be summarised as follows:

- Cost reductions to support operator affordability;
- Maintaining or improving performance against the HS1 Asset Management Objectives;
- Maintaining a seven-day railway and maintaining asset performance and reliability;
- Delivering a renewals portfolio that minimises operational disruption and costs and secures long term value for the HS1 system.

HS1 and, via the Operator Agreement, NR(HS) have asset stewardship obligations and performance standards to meet for route and stations assets. However, unlike other regulated industries we do not have binding regulatory output targets with penalties for failure. For CP4, we have developed a set of outcomes which we aim to deliver to ensure we meet our vision of "getting people to fall in love with high speed rail travel" and meet or exceed the needs of our customers and rail passengers.

The stakeholder priorities above and our asset stewardship and other obligations have set the framework for our CP4 outcomes which build on NR(HS)'s CP4 outcomes set out in the NR(HS) Route 5YAMS Section 4.2.

HS1's CP4 outcomes are:

- Maintain a reliable, safe and sustainable railway and stations that deliver a great experience for our customers and their passengers.
- Provide an excellent operational railway by continuing to deliver low per second train delay, striving to outperform our internal stretch target for delay seconds and meeting or exceeding our stations asset performance metrics.
- Keep enhancing asset management best practices – building on the capability maturity developed over CP3 and making the most of innovative solutions – to continue to deliver the most cost-efficient outcomes and value for money for operators and their passengers.
- Ensure that our infrastructure meets the current and future needs of our customers and will be ready to accept growth in train services from existing and potential new operators.
- Deliver on our 2030 sustainability targets on the way to achieving net zero and maintaining climate resilience.

As noted in our stakeholder engagement throughout PR24, a certain level of cost must be incurred to deliver on our asset stewardship and performance obligations as set by the Concession Agreement and Station Leases. HS1 has put forward plans that will deliver these in the most efficient, economic and timely manner. This has resulted in:

- A reduction in route costs for the HS1 system relative to PR19, with a corresponding decrease in passenger operator per train OMRC compared to current charges. This is a good outcome given we are moving into a phase with a maturing asset and increased renewals profile. There is an increase in freight charges reflecting the significant reduction in forecast volumes relative to PR19.
- An increase in Stations LTC across all stations and operators. This largely reflects the increased costs and some more frequent interventions in the civils and mechanical, electrical and plumbing assets. We are continuing work to fully understand these cost variance drivers and to explore what steps we can take in our plans to address these cost increases while still meeting our asset stewardship obligations.

We recognise there are other costs associated with operating on the HS1 system (e.g. traction electricity and stations Qx charges). These are important for the overall context when considering train operators' affordability and HS1 has taken steps to drive efficiencies in these areas. We are pleased that our Draft 5YAMS results in a net overall reduction in those HS1 system costs that are the focus of PR24, with the combined costs of route OMRC and stations LTC recovered over CP4 at 1.5% lower than CP3.

# 7 Key assumptions

## 7.1 Traffic forecasts

This section discusses recent changes in train paths and our forecasts of future traffic growth. We use our traffic forecasts:

- As a driver of asset interventions over the long term;
- For the calculation of the renewals annuity; and
- To apportion operating, maintenance and renewal costs between train operators for CP4.

Developing long-term traffic forecasts is particularly difficult in the current climate with uncertainty around the long-term impacts of Covid-19 on passenger travel, the rail reform programme in Britain, the impacts on international travel of the EU Entry/Exit System (EES), the Eurostar-Thalys merger and potential new international operators on HS1. Early in the PR24 process we developed four train path demand scenarios for use by NR(HS) in its asset management planning (see Section 10.5). Over the course of PR24, we have engaged with stakeholders to refine these forecasts.

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 and collaborating with other infrastructure managers to align the offer to train operators (as described in Section 1.2.5).

We are in discussion with several potential international operators and supporting their efforts in our role of infrastructure manager. These conversations are at an early stage and the timing of any new entry is uncertain. Our forecasts assume a new international operator commences services on HS1 in CP5. If a new operator were to commence services in CP4, we consider this would be a material and significant change under the Concession Agreement that would need to be addressed by means of reopening the PR24 determination through an Interim Review. This would reflect the updated system costs and propose a reset of charges across all operators.

### 7.1.1. Domestic passenger services on HS1

The Covid-19 pandemic has had a lasting impact on working patterns and travel behaviour. While leisure travel has recovered to pre-Covid levels, commuting and business travel have remained significantly below pre-pandemic levels. The immediate impact of the pandemic and associated lockdown was a 15% drop in domestic train paths on HS1 in 2020/21, the first year of CP3, and this was followed by further declines in the following two years.

From December 2023, some domestic high-speed services between Faversham and St Pancras were reinstated, increasing train volumes to just below 49,000 trains per annum. We have assumed domestic train paths will remain constant at this level throughout CP4, after which our long-term forecast assumes slow growth back to the underpin level. There is significant uncertainty around domestic traffic growth which depends on factors outside HS1's control, in particular, wider rail industry changes. HS1 will support stakeholders on train path planning.

Domestic train paths are underpinned by Government at a level set before the sale of HS1 at around 52,800 (with slight variations by year) with a defined split between the different domestic routes. For asset management purposes we use forecasts of train paths operated. If actual train paths are below the underpin, HS1 bills domestic services on the basis of the underpinned level of train paths and the charging calculations therefore use the greater of the actual train paths operated and the underpin level.

### 7.1.2. International passenger services on HS1

Eurostar currently operates direct services between St Pancras International and Paris, Brussels, Amsterdam, Rotterdam and Lille and a seasonal service to the Alps. Pre-Covid, Eurostar also served Ebbsfleet International and Ashford International and operated a daily service to Disneyland Paris and a seasonal service to Lyon/Provence; these are currently suspended and no timeline for reopening is known.

In response to the collapse in international travel during the Covid-19 pandemic, Eurostar reduced traffic to a skeleton service, operating only around 16% of its 2019/20 service level in 2020/21. By 2023, Eurostar passenger numbers had recovered to almost pre-Covid levels, and December 2023 timetable services were approaching pre-pandemic levels. Our forecasts assume Eurostar train paths reach pre-pandemic levels in CP4 with moderate growth for the remainder of the 40 year forecast. We use the split between Eurostar's two train types based on expected future service patterns.

Our international forecast also includes a new international operator commencing services on HS1 in CP5, building up to 6,000 train paths during CP5 with moderate growth for the remainder of the 40 year forecast. Alternatively, the new paths could come from the incumbent operator; the merger with Thalys has not yet driven new services but could increase the range of destinations.

### 7.1.3. Conventional freight services

Only a small fraction of freight between the UK and the Continent is transported by rail. In 2022/23, 1,457 freight trains operated through the Channel Tunnel; 393 of these (27%) operated on HS1.

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

Through most of CP3, freight paths on HS1 were relatively stable at around 400 per year. With the closure of the Barking depot in December 2023 we expect this number to fall to 200 freight services per year across CP4. We do not expect the depot closure to have any impact on the operation of freight accessing Ripple Lane from the NRIL network. We currently expect all freight services on HS1 to run on the Dollands Moor to Ripple Lane route, and none on the shorter Ashford to Ripple Lane route.

### 7.1.4. Train path forecasts

Our CP4 train path forecasts are set out in Table 24. For domestic services there are two sets of train path forecasts:

- The underpin level of train paths – as this is greater than the forecast of actual trains for CP4, the underpin level is used in the charging calculations; and
- The actual number of domestic trains forecast to be operated in CP4.

**Table 24: CP4 train path forecast, Financial Year**

| Trains per annum | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 |
|---|---|---|---|---|---|
| **Domestic passenger (underpin level)** | | | | | |
| Ashford | 24,604 | 24,570 | 24,688 | 24,590 | 24,604 |
| Springhead Junction | 26,220 | 26,180 | 26,320 | 26,196 | 26,220 |
| Ebbsfleet up | 1,000 | 992 | 1,012 | 992 | 1,000 |
| Ebbsfleet down | 1,000 | 992 | 1,012 | 992 | 1,000 |
| **Total domestic passenger** | 52,824 | 52,734 | 53,032 | 52,770 | 52,824 |
| *Total domestic paths operated* | *48,756* | *48,756* | *48,756* | *48,756* | *48,756* |
| **Total international passenger** | **17,797** | **17,846** | **17,895** | **17,944** | **17,993** |
| **Total freight** | **200** | **200** | **200** | **200** | **200** |

Any significant change from these forecasts would trigger the volume reopener provisions in the HS1 Passenger Access Terms and/or HS1 Freight Access Terms to adjust the apportionment of operating, maintenance and renewal costs between train operators (see Section 18.3). The introduction of a new operator may also trigger these provisions.

In most cases, the threshold for triggering a volume reopener is in relation to the train paths in a Timetable Year; this period is from December to December so does not align with the Financial Year. For clarity, Table 25 sets out the forecast train paths for CP4 in the Timetable Years that correspond to the Financial Year forecasts in Table 24 above.

**Table 25: CP4 train path forecast, Timetable Year**

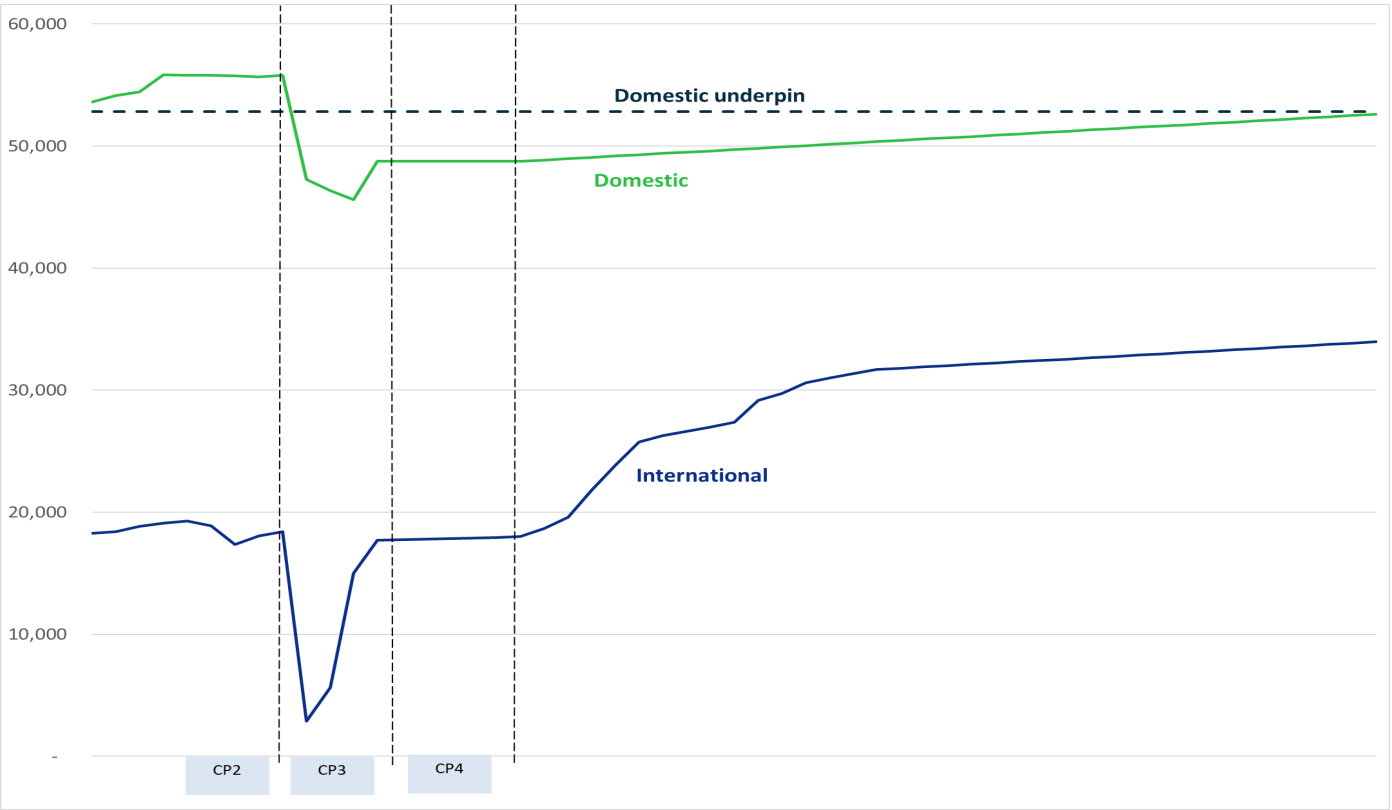
| Trains per annum | 1 April 2025 to 13 Dec 2025 | 14 Dec 2025 to 12 Dec 2026 | 13 Dec 2026 to 11 Dec 2027 | 12 Dec 2027 to 9 Dec 2028 | 10 Dec 2028 to 8 Dec 2029 | 9 Dec 2029 to 31 March 2030 |
|---|---|---|---|---|---|---|
| Total domestic passenger* | 37,436 | 52,670 | 52,652 | 52,652 | 52,670 | 16,104 |
| Total international passenger | 12,531 | 17,783 | 17,797 | 17,865 | 17,929 | 5,571 |
| Total freight** | 141 | 199 | 199 | 199 | 199 | 62 |

* The split between domestic services aligns with the Domestic Underpin Agreement.
** All freight services forecast to run the Dollands Moor to Ripple Lane route.

Our 40-year traffic forecasts for passenger train services are set out in Figure 20 below.

We are confident that our asset management approach is robust to the upside risk on international growth from the entry of potential new operators. Current demand forecasts indicate that existing capacity on the HS1 route will be sufficient although long term forecasting is particularly challenging in a post-pandemic environment. In practice, the limiting factors for the number of train paths are operation of mixed traffic, the pattern of services being operated and the turnaround times required at St Pancras International. Growth in international train volumes may have implications for the capacity at our stations which will need to be addressed ahead of the commencement of services by new international operators or significant growth in EIL services; we are considering this as a station enhancement in CP4 (see Section 16.4).

**Figure 20: 40-year train path forecasts**




## 7.2 Financial assumptions

### 7.2.1. Indexation indices

Under HS1's contractual framework, charges are indexed in the following way:

- For route, OMRCA1, OMRCA2 and OMRCB are indexed by RPI in accordance with the Concession Agreement. OMRCC (pass though costs) is passed through to train operators at cost so is not indexed. IRC, which is unregulated, is indexed by RPI under the Concession Agreement.
- For stations, the LTCs are indexed by RPI in accordance with the Station Access Conditions, while Qx is calculated on an annual basis so is not indexed.

HS1's expenditure (except for renewals) is also tied to RPI with many supplier contracts indexed by RPI. This includes, in particular, NR(HS)'s Annual Fixed Price under the Operator Agreement that accounts for a significant majority (over 50%) of the O&M costs excluding pass through costs.

There was a review of inflation indices prior to PR19. The ONS in 2016 recommended a move away from the retail price index (RPI) to the consumer price index (CPI). As part of its PR18 Determination for NRIL, the ORR incorporated CPI as the inflation index for all NRIL income and

expenditure from 2019/20 onwards. However, in the PR19 Final Determination for the HS1 system, the ORR approved the continued use of RPI as the general inflation index, recognising that RPI is the index incorporated into many of HS1's contracts for expenditure and income.

It is important to note that CPIH – which is CPI including owner occupiers' household costs – is the UK headline inflation measure preferred by the ONS. The methodology for calculating RPI will be revised from 2030 so it aligns with CPIH, thereby ensuring consistency of HS1 contracts with the preferred general measure of inflation.

For PR24, the ORR recognised in its Approach and Process[13] document that HS1's major supplier contracts for operations and maintenance are indexed by RPI. Therefore, the ORR's approach to PR24 will only consider the appropriate index for renewals cost inflation.

We welcome the ORR's position on the indexation of operations and maintenance expenditure. In developing our plans for CP4, RPI is used as the inflation index where this is applicable, e.g. to compare NR(HS)'s Annual Fixed Price to PR19 in real terms. Any forecast of RPI reflects the change in methodology to align with CPIH from 2030 (see Section 7.2.2).

We have reviewed our approach to the indexation of renewals price inflation. There are two elements related to renewals cost.

The first is the pricing of renewals costs in real terms over the 40-year outlook. The approach used for pricing renewals for CP4 follows the RMM1 methodology drawing largely on current market prices and benchmarking, with specific project risk allowances. These are used as the base costs for the longer term pricing of renewals. For route renewals, HS1 also applies additional steps and our Cost Policy. The Cost Policy takes account of the uncertainty in renewals pricing in the longer term in the form of risks and opportunities. HS1 is exploring the application of the Cost Policy approach to long term pricing of stations renewals.

The second is the index used to inflate renewals expenditure in the calculation of the renewals annuity for route (that forms part of the OMRC) and stations LTC. For this, we use CPI at this time.

The inflation assumption in the annuity calculation means that we set the annuity to fund the projected 40-year renewal activity in real terms. It does not include any specific additional risk premium for shock effects, such as a higher input or construction price inflation, beyond the project risk allowances. If such a risk premium was included in the calculation – for example in the form of inflating the renewals costs by CPI+X% for a set period – this would potentially reduce the risk of needing to adjust the annuity payments in future periodic reviews. This would however come at the expense of deliberately carrying an additional balance in the escrow account. We do not currently believe any forecasts or other evidence suggests prices for HS1 renewals works will remain above general inflation over the 40-year period. Furthermore, as the real investment returns on the escrow are very low, or even negative in real terms, and with the current projected headroom in the escrow account, adding a risk premium in this way becomes a comparatively expensive way of managing such risk.

[13] Paragraph 2.31, Periodic Review of HS1 Ltd 2024 (PR24) - Approach and process

We therefore propose that a more economic and efficient way to manage the risk of future construction price shock is through adjustments to annuity payments in future periodic reviews if such shocks materialise. We believe this strikes an appropriate balance between meeting our asset stewardship purpose in a sustainable economic way, while also supporting affordability for the operators. For these reasons, we consider CPI to be the appropriate inflation index at this time. If DfT work during CP4 to amend the Concession Agreement to support higher escrow investment returns is successful (see Section 20.1), then it may be sensible to revisit this approach in PR29.

When considering the indexation of HS1 charges, HS1 does not think there would be any material benefit to changing the Concession Agreement and Station Access Conditions to link charges to CPI in CP4. This is because RPI will align with CPIH (the preferred headline inflation measure) by the end of CP4. HS1 has also entered into long term inflation swaps which are linked to RPI, therefore moving away from RPI would create a mismatch in our hedging arrangements since both a portion of our debt and our revenues are RPI linked. Therefore, changing the basis of the indexation part way through the concession would be unreasonable. If any potential change to a different inflation index needs to be made it should be done at the end of the concession.

### 7.2.2. Inflation rate assumptions

All costs provided in this document and in our charging models are in real terms. The exception is the general inflation incorporated into the route and stations annuity models. In PR24 we use:

- RPI to inflate the renewals annuity income. This income is contractually linked to RPI so we use this to accurately reflect the expected income.
- CPI as the inflation index for renewals expenditure.
    - We use CPI as the general index for PR24 as there is currently no long term forecasts for CPIH (which RPI methodology will align to from 2030). We will revisit the appropriate renewals expenditure inflation index in PR29.

The forecast inflation rates we have assumed for these indices are set out in Table 26.

**Table 26: Inflation rates**

| Period | RPI | CPI | Basis of forecasts |
|---|---|---|---|
| 2025/26 | 3.01% | 1.90% | Forecasts used internally by HS1 compiled from forecasts of UK banks, HM Treasury and Bank of England (BoE) as at January 2024. |
| 2026/27 | 2.79% | 1.83% | |
| 2027/28 | 3.26% | 2.09% | |
| 2028/29 and 2029/30 | 2.75% | 2.00% | BoE's forecast of 2.00% CPI. For RPI we account for the wedge of 75 to 100 basis points between CPI and RPI, assuming the bottom of this range. Consistent with HS1's internal forecasting principles. |
| Long term | 2.00% | 2.00% | Assumes CPI at BoE target. RPI moves to CPIH methodology in 2030; with limited long term forecasts on CPIH we assume for now it is similar to CPI. To be revisited in PR29 when more forecasts for CPIH are available. |

### 7.2.3. Discount rate assumptions

For calculation of OMRC, we have used HS1's nominal WACC of 7.45% alongside our inflation forecast assumptions above, to incorporate a real WACC in our calculations.

WACC is also relevant for Specified Upgrades. For small scale Specified Upgrades during CP4, we would expect to use the WACC value of 7.45%. We believe this is appropriate because in practice we would fund small scale investments through operating revenue – and in this situation this is money forgone by shareholders who would otherwise receive a return.

This is a WACC rate specific to HS1 and its funding structure, which is relatively unique. As a result HS1 updates its WACC annually to reflect the cost of capital at the time. We are proposing that the ORR reviews and endorses in its PR24 Determination that this WACC is used for small scale projects in CP4.

We would expect larger projects to need project specific WACC rates. For ERTMS implementation we propose to develop a project-specific WACC taking into account the detailed arrangements for financing the project.

### 7.2.4. Escrow account assumptions

For the purpose of calculating charges for CP4, we have assumed that 80% of funds are placed in Authorised Investments and 20% remain in the escrow account. Escrow account interest rate assumptions are shown in Table 27.

**Table 27: Escrow account interest rate assumptions**

| | CP4 | CP5 onwards |
|---|---|---|
| For Authorised Investments | 3.20% | 3.30% |
| For funds remaining in the escrow account | 2.00% | 2.00% |

We have assumed an escrow account opening balance at the start of CP4 of £188.7 million (as in Section 3.6.2).

## 7.3 Asset management assumptions

- Traffic Volumes: the Annual Fixed Price and renewals volumes for CP4 are based on the traffic demand forecast of the HS1 SAMP 'Re-build' scenario, provided by HS1 Ltd in July 2022 and further updated in April 2023. The track deterioration model specifically applies the revised demand forecast supplied by HS1 Ltd in April 2023, termed the 'Asset Management' traffic forecast. Train paths have increased in the 'September 2023' forecast. NR(HS) and HS1 have undertaken a high-level evaluation of the train path change. Considering the extent of workbank smoothing undertaken, track renewals such as re-railing volumes have been moved into CP4 and renewed ahead of the 'need' to balance cost and access requirements. Based on the information HS1 and NR(HS) are content that CP4 track renewal volumes do not need to be reassessed at this time. The CP5-CP11 track renewals volumes can be reassessed at PR29 when the track model has been refined with more asset deterioration data.
- Re-build: NR(HS) refers to the outcome scenario being 'Re-build' which means that its proposals meet the AMOs at the most efficient cost while supporting the HS1 system to rebuild to pre-pandemic demand and performance levels (this is explained in the Note on NRHS Asset Management approach PR24, provided as a supporting document). For stations this has been modelled through the totex models that underpin the plans set out in the SASs for each discipline. For route, NR(HS) has achieved this by developing an optimised approach given:
    - Expected traffic demand for track assets (the main asset class sensitive to train path volumes); and
    - For the other assets using risk-based modelling on an asset by asset basis such that this achieves our asset stewardship duty and demonstrates best practice.
- The track deterioration model specifically applies the revised demand forecast supplied by HS1 Ltd in April 2023, termed the 'Asset Management' traffic forecast.
- ERTMS Signalling Upgrade occurs in CP5, between 2030-2032.
- The NR(HS) Renewal & Replacement Proposal assumes that volumes for future ballast campaigns can be awarded to the supply chain over multiple control periods to achieve the most efficient ballast unit rate on HS1.

- Stations totex models are in February 2023 prices. Totex modelling prices developed from more recent contractor cost estimates where available, or PR19 rates (which were benchmarked and audited) inflated to February 2023 prices.
- The NR(HS) Renewal & Replacement Proposal assumes that the governance and ways of working for renewals delivery are updated to be in accordance with those agreed through the Capability Development Partner workstream.
- NR(HS) will seek to apply long term contracting strategies over multiple control periods for other renewals volumes to maximise efficiency and output, where deemed appropriate. NR(HS) expects that any such agreement let in good faith to maximise efficiency will not be affected by future regulatory outcomes.
- Operational or rolling stock variations: the Annual Fixed Price takes no account of variations, beyond those described in traffic volumes, 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.
- New operators and franchise changes: NR(HS)'s Annual Fixed Price takes no account of any new train operating companies which may begin services during CP4 and assumes that any refranchising terms and conditions will not change objective outcomes and/or performance levels. Should a new train operator be introduced during CP4, or refranchising terms and conditions change with an impact on performance levels, NR(HS) will seek to recover any additional and allowable costs arising. HS1 would consider this a material and significant change under the Concession Agreement that would need to be addressed by means of reopening the PR24 determination through an Interim Review. An application for an Interim Review by HS1 would consider the updated system costs and outline what charges would be required from all operators to allow HS1 to continue to comply with its General Duty.
- The proposals do not include any asset management impact from the flooding event in HS1's Thames tunnels in December 2023. Investigations are ongoing; if any amendments to our asset management plans are necessary on the basis of the findings, we will aim to incorporate these in time for the ORR's Final Determination.
- No allowance has been made for compensation to TOCs/FOCs for planned possessions in addition to the standard annual access windows, based on the assumption that Engineering Access is provided in accordance with the Engineering Access Strategy.
- No allowance has been made in this Draft 5YAMS submission for the impact of introducing the Entry Exit Scheme (EES) as it is not expected to affect stations renewals.

# 8 Safety and security

## 8.1 Health, Assurance and Safety Strategy

Our safety objective is to *"act as the systems focal point for safety leadership, enhancing safety management so that any person interacting with our infrastructure can do so without risk of harm"*.

The HS1 CP4 Health, Assurance and Safety Strategy provides strategic direction to the HS1 system, setting out our ambition for continuous improvement and enhanced safety maturity.

In CP3, HS1 and our supply chain have enhanced safety through embedding RM3 into the system taking a capability improvement approach and ensuring that systems, people and processes are set up to deliver excellence. Maturity, assessed using RM3, has significantly improved during CP3 (see Section 3.2). In CP4, we will consolidate this maturity and drive for excellence in targeted areas. In addition, we will further enhance our understanding of risk through a barrier-based approach to supply chain assurance.

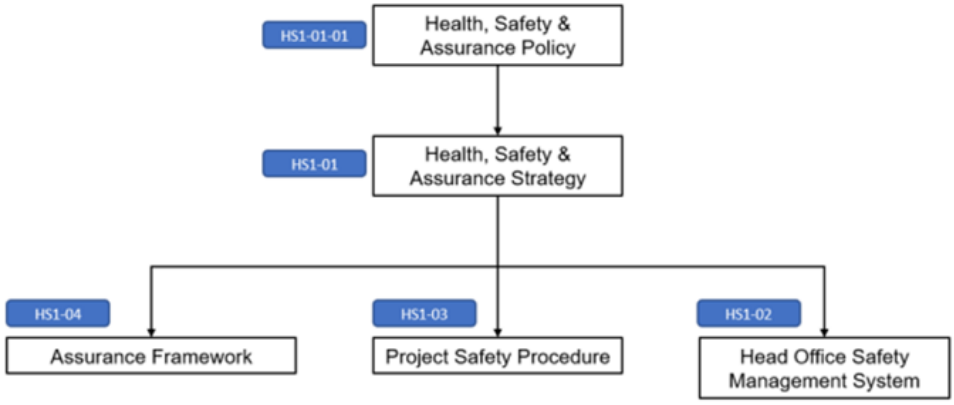
We operate an outsourced model with long term competent contractors delivering much of the railway. Our two infrastructure managers (NR(HS) and ABM) hold safety authorisation from the ORR under the Railways and Other Guided Transport Systems (Safety) Regulations 2006 (ROGS). This does not absolve us of our duties and we will continue to demonstrate that we are acting as an informed and intelligent client through enhancing the structured approach embedded in CP3. As the client organisation, we remain focused on longer-term safety threats and opportunities through capability, maturity and innovation whilst the supply chain manages the shorter-term risk.

The NR(HS) Safety Strategy for CP4, developed in close consultation with HS1, is in Appendix 10 of the NR(HS) Route 5YAMS.

### 8.1.1. HS1 Safety Management System

The HS1 Safety Management System addresses the risk profiles of the business (corporate office, operational railway and project safety). The system is well established and rooted in best practice; requirements from ISO45001 (Occupational health and safety management systems) have been built into the system with RM3 as the key improvement and development tool. The HS1 Safety Management System has been continually improved throughout CP3.

**Figure 21: HS1 Safety Management System**



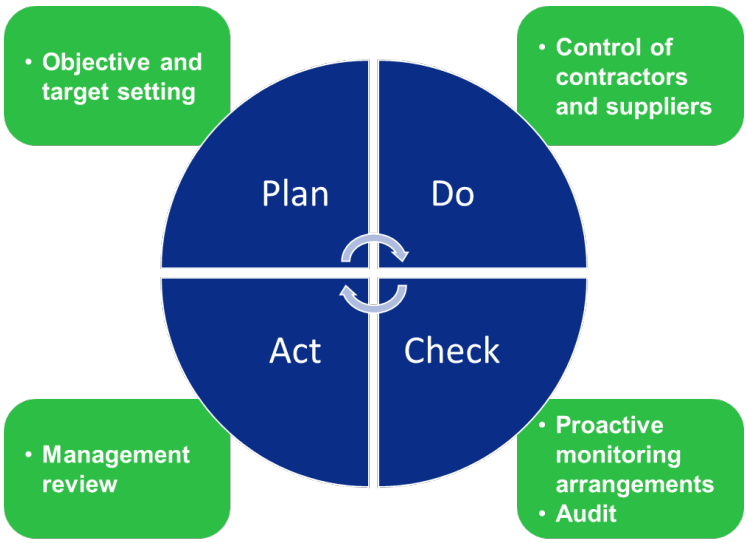

The systems and process that have been developed will be maintained and enhanced based on best practice, lessons from HS1 and other organisations, and audits. System documentation will be maintained, reviewed and updated and will be allocated to owners across the business. The external focus of the management system will be on how we control contractors and suppliers doing work on our behalf. We will build on the progress made in CP3 to enhance our processes around contractor management for both Category 1 suppliers and suppliers providing CDM-related services.

### 8.1.2. RM3

We have fully embraced RM3, building the approach into our audit and improvement plans and encouraging the supply chain to engage with the model. RM3 remains the core approach to driving maturity improvements within HS1 and the supply chain. We demonstrate our commitment to RM3 by setting the completion of the annual RM3 improvement plan as a business performance metric.

During CP3, we targeted maturity improvements across seven RM3 spokes. We conducted annual self-assessments against RM3 to evaluate the effectiveness of our Health, Safety and Assurance Strategy. In 2023, we commissioned an external assessment against the RM3 model which demonstrated that we have achieved significant maturity improvements over CP3 (see Section 3.2). This will be used as the baseline for CP4 and the development of the detailed improvement plan.

The CP3 spokes, along with the full model, were reviewed and five key spokes were identified for focus in CP4. The selection of the CP4 spokes reflected our understanding of the HS1 business and ensured that the range of focus areas covers the Plan-Do-Check-Act and HSG65 models.



We will develop a detailed plan which will define the actions required during each year of CP4 to increase maturity towards Level 5 in these spokes. These will form part of the annual safety improvement plan and will be tracked and monitored through the periodic and quarterly safety report.

We will continue to carry out annual self-assessments of our maturity to ensure that planned improvements are being achieved. These assessments will consider the whole RM3 model to ensure that no RM3 spoke falls below a Level 2 (Managed) maturity level.

The adoption of RM3 allows HS1 and our suppliers to define what excellence looks like in safety and risk management. The five spokes selected for CP4 will continue to improve how safety and assurance is managed in HS1 and formalise how HS1 approaches the supply chain. During CP4, HS1 will evaluate and drive improvement across the supply chain in these five spokes. As the risk profile of the supply chain is different to that of HS1, the supply chain may target other spokes to drive maturity in their own businesses and their own supply chain.

### 8.1.3. Bowties

Throughout CP3 the HS1 bowties have been significantly improved and enhanced from inception to models that support assurance. The approach follows established best practice in barrier-based safety. In CP4, these bowties will be central to the safety and assurance programme and will contain all relevant information to identify and demonstrate that risks are being proportionately managed. The bowties:

- Provide risk visualisation and prioritisation;
- Define the HS1 monitoring strategy including supporting the identification of potential KPIs;
- Support targeted conversations with the supply chain on risk and tolerance;
- Support the development of the formal assurance plans; and
- Provide mapping and modelling of risk.

The current HS1 bowties will be reviewed to ensure that the right topics are included to focus effort on areas with the greatest regulatory risk. This ensures that our efforts are proportionate.

**Current HS1 bowties**

- Safety – route and stations
- Security – route
- Security – stations
- Environment – route and stations
- Fire – route and stations
- Health – route and stations

We will continue to review the bowties throughout CP4 to ensure that they address the correct risks and remain appropriate. Where gaps are identified, we will build further bowties where they will add value, integrated with our overall corporate risk processes to ensure alignment and understanding across the business.

To ensure that the HS1 approach to bowties remains consistent, we will develop an HS1-specific bowtie guidance document which will include a standard bowtie template and a guide to updating and creating bowties, linked to HS1 procedures and terminology.

The bowties have been designed to manage corporate memory for HS1 and support the management of change through the identification of barrier 'owners' and links to HS1 procedures which define specific assurance requirements. They allow HS1 to easily see where to focus its efforts in controlling risk and enhancing barriers. In maintaining the bowties to ensure they are up to date following assurance activities such as safety tours and incident reviews, specific improvement projects and audits can be focused to deliver safety improvements.

The bowties will be reviewed quarterly to ensure that they are being maintained and that progress is being made against the identified improvement plans.

### 8.1.4. Assurance

The HS1 Assurance Framework drives our approach to assurance for HS1 and the supply chain. The Assurance Cycle is applied to the HS1 management system, RM3 improvement programme and the bowtie enhancement programme.

HS1 has embraced the bowtie process; the bowties will be the assurance plans and will contain pertinent information such as owner, actions and effectiveness.

The joint assurance plan with NR(HS) is an annual and control period based plan that picks up the assurance activities already planned and delivered by NR(HS) and HS1 and shares these across organisational boundaries. The benefit is joint awareness which will aid in the development of each organisation's own plans.

Wider assurance activities within HS1 include:

- HS1 annual audit plan;
- RM3 self-assessment against HS1-specific spokes;
- HS1 leadership safety tours;
- Targeted conversations and activity based on risk;
- Joint NR(HS)/HS1 assurance plan; and
- Assurance Board report to HS1 Board.

## 8.2 Security and cyber security strategies

The HS1 Trespass and Security Strategy sets out our high-level strategy for delivering our security responsibilities. It covers:

- **Policing** – HS1 works with BTP, NR(HS) and ABM on the policing policies for HS1 route and stations.
- **Counter terrorism security** is regulated by DfT; HS1, NR(HS) and ABM are regulated entities. HS1 looks strategically across the system and can bring organisations together to prevent and respond to threats.

- **General security provision** is provided by our supply chain and their sub-contractors and assured by HS1.

The HS1 Trespass and Security Strategy will be reviewed bi-annually to ensure that it remains effective and keeps pace with advancing technology and knowledge. Compliance with the strategy is monitored through:

- HS1 assurance activities to monitor progress against plan;
- NR(HS) operational reporting to monitor trends;
- BTP liaison meetings;
- Audits; and
- Testing and exercises.

HS1 and NR(HS) both have responsibilities for system and information security in line with our status as Critical National Infrastructure (CNI). As both organisations are Operators of Essential Services, both are required to observe the Network and Information Systems Directive (NIS) as separate organisations. HS1 and NR(HS) are separately regulated by the DfT Cyber Compliance team and have standalone relationships with the DfT. Both organisations are responsible for maintaining cyber compliance with regard to operational systems, NR(HS) for operational railway systems and HS1 for the SCADA system.

During CP3, HS1 has taken steps to improve its information and cyber security. Improvements have been made across people, process and technology.

HS1 has a Cyber Security Strategy in place and a Cyber Security roadmap for initiatives. A continuous improvement process for cyber security is now in place to ensure risk is minimised and that our protection against cyber-attack continually evolves to keep up with cyber-attackers.

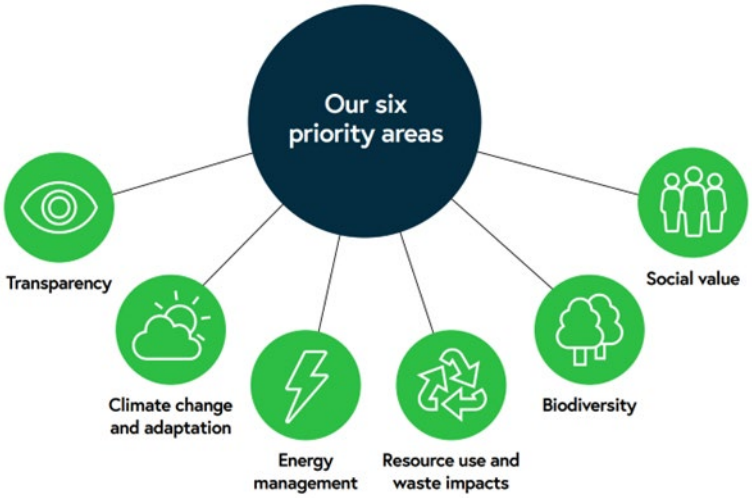
We provide more detailed information on the HS1 Trespass and Security Strategy, the Cyber Security Strategy and the work we have been doing in these areas as a confidential supporting document.

# 9 Sustainability

## 9.1 Sustainability Strategy

We launched our first Sustainability Strategy in October 2020, which set out our ambition to baseline our current performance, improve our sustainability credentials, and support customers in achieving their own sustainability aspirations. The strategy set out our plans for assessing and improving our performance in six priority areas.

**Figure 22: Our sustainability priority areas**

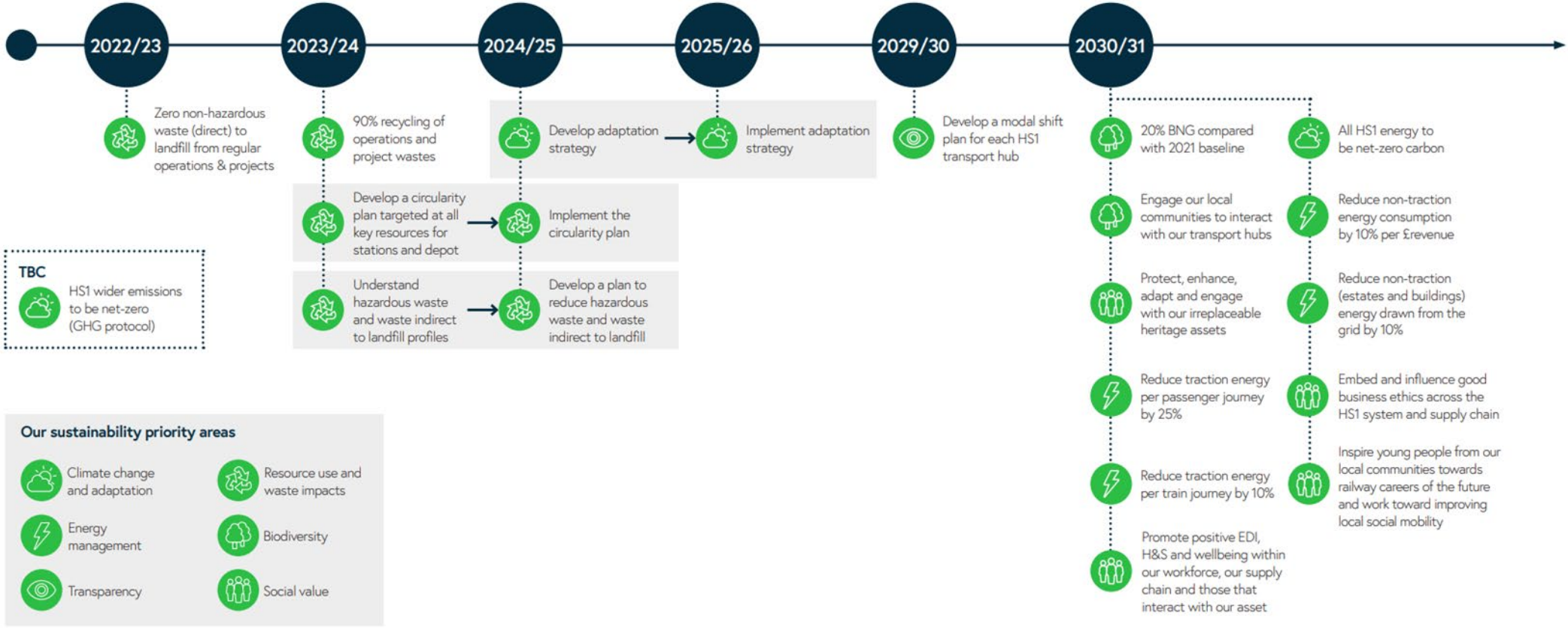



For each priority area, we set targets to 2030 and developed roadmaps showing our plans to deliver on these targets. We have made progress across the whole of the strategy, completing significant roadmap actions in challenging market conditions. We publish annual ESG reports which highlight progress against this strategy, in line with our transparency focus area.

As planned, we reviewed the strategy in 2022/23 to ensure that the targets were still both relevant and ambitious. We benchmarked our sustainability performance and ambition against a range of comparators, reviewed and updated our targets and realigned the roadmaps. The six priority areas within our strategy remain unchanged and continue to represent the aspects of sustainability where HS1 can have the biggest impact. Targets to 2030 for each of these priority areas are set out in Figure 23. The HS1 Sustainability Strategy is provided as a supporting document.[14]

[14] This is also publicly available: https://highspeed1.co.uk/media/ctabtyho/hs1-sustainability-strategy-2023.pdf

## Figure 23: Sustainability targets to 2030



Our commitment to improving sustainability on the HS1 network has been backed by our partners. Our partners have their own sustainability strategies which focus on their specific impacts but where there is alignment we work together for greater gains. Collaboration is overseen by the annual HS1/NR(HS) Environment Forum with senior representatives from our partner organisations. The HS1 System Sustainability Working Group meets quarterly and includes sustainability managers from HS1, NR(HS), EIL, SETL and EMR. We collect quarterly data from our supply chain to monitor progress.

In PR24, significant work has been undertaken on developing the NR(HS) sustainability strategy for CP4, aligning HS1 and NR(HS) goals.

The remainder of this section focuses on delivery of our energy and climate targets through our Energy Strategy.

## 9.2 Energy Strategy

The HS1 Energy Strategy, published in March 2023 and updated in January 2024, outlines the strategy that HS1 will follow to meet the energy and carbon reduction targets in the Sustainability Strategy.[15] The strategy is based on three principles, each of which is discussed below:

- Reducing energy use;
- Use of alternatives to gas; and
- Greener procurement of electricity.

### 9.2.1. Traction energy reduction

Our traction energy targets are:

- To reduce traction energy per train journey by 10% by 2030; and
- To reduce traction energy per passenger journey by 25% by 2030.

The introduction of regenerative braking on the SETL high speed fleet and implementation of the N-1 Energy Saving Scheme in CP3 gave a 5.4% reduction in overall traction energy use.

We are over halfway to meeting our target but further gains will be more difficult to achieve. HS1 has invested in the fitting of power quality monitoring devices (expected to be online in April 2024) to enable HS1 to gain a better understanding of power consumption across the traction power system which may identify areas for potential optimisation. The introduction of regenerative braking on the Eurostar fleet would provide a further reduction but a shortfall

[15] 2019/20 figures are used as the baseline for the HS1 Energy Strategy to align with the targets.

would remain. The achievement of further traction energy savings is not in HS1's direct control; we would need to work with train operators to achieve further savings.

**Regenerative braking**

Implementation of regenerative braking on the Class 395 fleet required the following activities:

- Electrical system monitoring, protection, harmonic and electromagnetic compatibility studies, to support acceptance testing and authorisations;
- Modifying the Class 395 trains, including upgrading software and installing on-train metering; and
- Testing the upgraded trains and authorising their entry into service.

HS1 entered into a contract with UKPNS to deliver assurance activities and oversee project management activities. The test plan was developed in conjunction with SETL and NR(HS) and the test trains operated successfully in spring 2022. Following NR(HS) Safety Review Panel (SRP) approval, all 29 units were regen-enabled.

Supporting activities included:

- Installation of on-train meters (OTM) to allow HS1 to charge SETL for traction electricity based on metered consumption rates. SETL completed OTM installation in March 2022; and
- Updating the HS1 Passenger Access Terms (PAT) to make provision for OTM and regenerative braking. Changes were agreed by all parties and approved by ORR.

Entry into service of the full regen-enabled fleet was completed in October 2022. This initiative is currently producing energy savings which surpass those predicted by pre-implementation modelling. Based on emerging data, the benefits of regenerative braking include a 10% energy reduction for the Class 395 fleet, equating to a c. £2.6 million annual saving in energy costs for SETL (based on winter 2022 electricity prices). The project cost was paid by SETL.

Previous feasibility studies suggested that enabling regenerative braking on the Eurostar e320 fleet would require modifications to the Sellindge feeder station to handle the maximum power fed into the grid. A refreshed feasibility study would be required for the project to progress, taking into account current timetables and stopping patterns and recent changes to the National Grid. The cost is currently estimated to be around £700k with an annual saving of 2-3,000 MWh. This scheme would need to be agreed with and funded by EIL.

**N-1 Energy Saving Scheme**

HS1 has worked with UKPNS to implement the N-1 Energy Saving Scheme to reduce energy consumption and provide cost savings for train operators on HS1. Following a consultation with train operators, DfT and ORR we updated the HS1 PAT to include the scheme. The N-1 Energy Saving Scheme came into operation in January 2024.

There are four electricity feeder stations for the HS1 route. Only two are required at any one time to operate the railway. For distribution system resilience, the remaining two feeder stations had operated in hot standby mode, which uses electricity. The N-1 Energy Saving Scheme involves switching one of these to cold standby mode, which does not use electricity. While this reduces the resilience of HS1, there would need to be concurrent faults at two feeder stations before this would cause an operational impact.

In a typical year, energy consumption savings are expected to be 3,300 MWh (carbon saving of 920 tonnes CO2e per annum). At winter 2023 energy prices this would result in a saving of c.£1.1m per year, which will be shared between the TOCs proportional to their usage.

As traction electricity costs are passed through to train operators directly, HS1 does not receive any financial benefit from this scheme.

Annual costs of approximately £45k are incurred to implement the scheme which will be recovered from the TOCs, as will one-off implementation costs for HS1 of approximately £22k in the first year. For CP3, we have agreed that these costs will be recovered via an annual TOC Contribution shared between the TOCs proportional to their traction electricity usage. From CP4, we propose that these costs will be treated as pass through costs (see Section 18.6).

### 9.2.2. Non-traction energy reduction

We are on track to achieve our non-traction energy targets:

- To reduce non-traction energy drawn from the grid by 10% by 2030; and
- To reduce non-traction energy consumption per £ revenue by 10%.

In 2020, we commissioned Ascentia Carbon Management to survey the HS1 estate to identify energy saving opportunities. Energy saving measures to be taken forward are based on the Ascentia recommendations; projects that are likely to be simple to implement, have a good payback and are not reliant on changes in staff behaviour or working practices have been considered.

We set up the HS1 Route Energy Action & Carbon Reduction Team (REACT) and Stations Energy Action Group (EAG) to consider smaller scale energy reduction initiatives to complement larger schemes. The groups have a small annual project budget of £50k each.

- REACT is a collaboration between our key supply chain partners, drawing on specialist knowledge from across our assets. The group is focused on delivering lineside energy reduction and has conducted surveys at several lineside assets which have been used to plan carbon reduction schemes, some of which have already been implemented.
- The Stations EAG is a collaboration between our key supply chain partners and TOCs, focused on identifying and implementing small scale energy saving initiatives in our stations. Initiatives have included optimising station Building Management Systems.

For REACT, the current process is that HS1 requests approval from the TOCs to spend the £50k budget each year; this is funded by HS1 and recovered from the TOCs as a pass through cost. A project proposal for each year is shared with the TOCs. For CP4, we propose a change in the process, with upfront approval for the full CP4 budget (£250k across the five years). This change will allow us to implement a rolling programme of small-scale energy schemes rather than being constrained to £50k per year. The results of HS1's phase three Energy Savings Opportunities Scheme (ESOS) will provide insight for energy saving opportunities across our estate and some schemes will cost over £50k. At the end of each financial year, the TOCs will receive a summary of projects implemented, budget spent, estimated payback period and carbon savings. As now, the actual spend in each year would be recovered from the TOCs as a pass through cost.

Projects underway in CP3 and planned for CP4 are listed below:

- Station gas boilers at St Pancras, Stratford and Ebbsfleet International are being replaced with air source heat pumps under the CP3 station renewals programme. The replacement of the boilers (in St Pancras in particular) is a key element of delivering the non-traction energy savings. Delivery of these three projects is expected to result in a 12% net saving in non-traction energy, exceeding the 10% target reduction.
- We plan to replace the Ashford International station and Singlewell infrastructure maintenance depot gas boilers with heat pumps in CP4. The Ashford station project is included in the CP4 station renewals portfolio; the Singlewell project is included in the NR(HS) Annual Fixed Price for CP4.
- Two additional projects at St Pancras station – air handling unit and control modifications and lighting control upgrades; these projects are not included in the CP4 station renewals portfolio. The capital cost for the two projects is estimated at £700k, with a payback period of less than two years. Estimated annual savings are 430 MWh for the air handling unit and control modifications and 1,300 MWh for the lighting control upgrade.
- The NR(HS) remote maintenance teams will move from Camley Street to a new, more efficient, facility in Stratford.
- Lineside buildings and infrastructure use a significant amount of power. The Energy Strategy recommended that more detailed energy surveys are undertaken, and REACT should progress this. The strategy estimates a total saving of 600 MWh by 2030.
- Smaller projects at stations and Singlewell – REACT and the Stations EAG are currently working on initiatives identified by Ascentia. Examples include modification of air handling units, upgrading lighting and lighting control, parallel operation of heating and cooling pumps, improved control of heating. The Stations EAG will focus on projects identified for Stratford and Ebbsfleet. REACT will consider lineside infrastructure and Singlewell maintenance depot.
- A number of solar schemes have been identified on the roofs of Ebbsfleet station, Singlewell maintenance depot, London tunnel portal, and lineside communication buildings. HS1 intends to fund these schemes providing the TOCs are prepared to sign a letter of intent to purchase the power. Once the letter is signed, HS1 will proceed with surveys and design works before going out to tender.

Table 28 summarises the estimated energy savings from these projects and expected timing.

**Table 28: Summary of non-traction energy savings**

| Project | Annual energy saving (MWh) | When |
|---|---|---|
| St Pancras station gas boiler replacement | 4,960 (10.7%) | CP3 |
| Stratford station gas boiler replacement | 240 (0.5%) | CP3 |
| Ebbsfleet station gas boiler replacement | 422 (0.9%) | CP3 |
| St Pancras station air handling unit upgrade | 430 (0.9%) | CP4 |
| St Pancras station lighting control upgrade | 1,300 (2.8%) | CP4 |
| Ashford station gas boiler replacement | 908 (2.0%) | CP4 |
| Singlewell gas boiler replacement | 396 (0.9%) | CP4 |
| Camley Street relocation | 30 (0.1%) | CP4 |
| Smaller schemes (at stations and Singlewell) | 750 (1.6%) | CP4 |
| Lineside buildings and infrastructure | 600 (1.3%) | CP4 |
| Solar schemes | 3,200 (6.9%) | CP4 |
| **Total** | **13,236 (29%)** | |

The table above does not include increases in electricity due to an increase in the use of electric vehicles. In CP4, NR(HS) will begin to transition its vehicle fleet to electric or hybrid vehicles; the NR(HS) Annual Fixed Price includes funding for the creation of electric vehicle charging points.

### 9.2.3. Alternatives to gas

The conversion of gas boilers to heat pumps at all of the HS1 stations and Singlewell maintenance depot is discussed above. Once this is complete, HS1 will have no further dependency on gas.

### 9.2.4. Greener procurement of electricity

The HS1 Sustainability Strategy has a target of all HS1 energy being net zero carbon by 2030. This is an ambitious target and is ahead of the National Grid decarbonisation target of 2035.

The HS1 Energy Purchasing Strategy has been developed in support of the HS1 Sustainability Strategy. It is designed to deliver both cost and carbon benefits through:

- Purchasing 100% renewable electricity by April 2030, through the progressive introduction of PPA volume; and
- Minimising unit costs by ongoing efficiency in purchasing.

HS1 has procured its first PPA with a renewable generator; this provides c. 40% of total volume of renewable baseload electricity for 10 years. Subject to TOC agreement, we intend to secure a further 40% for 10 years from April 2025. HS1 will find an appropriate solution for the remaining 20% by 2030 later in CP4; depending on the best economic option at that time and actual demand. See Section 12.5.2 for further details of the Energy Purchasing Strategy.

# 10 Asset management approach

## 10.1 Overview

Our asset management objective is to manage the HS1 infrastructure in an efficient and sustainable way to ensure we achieve the asset stewardship requirements in the Concession Agreement and the Station Leases. We aim to maintain high asset performance and availability while remaining affordable for train operators. The Covid-19 pandemic during CP3 had a significant financial impact on the HS1 system; we recognise the increased importance of affordability for train operators recovering from this impact.

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.

Under the Station Leases, our overarching asset stewardship obligation is to ensure that each station remains in good and substantial repair and condition during the whole of the Life Cycle Period.

As we began the process of updating our Asset Management System documents in preparation for PR24, the HS1 system was still feeling the impact of the pandemic and train paths remained

significantly below pre-pandemic levels. The fundamental uncertainty about the rate of recovery made it very challenging to have confidence in train path forecasts over the short term, let alone for CP3 and beyond. To help navigate this level of uncertainty and allow us to explore options and make dynamic decisions as the HS1 system recovered, the HS1 SAMP set out four different recovery scenarios. The HS1 SAMP was published on our website and shared with stakeholders.[16]

The HS1 SAMP and the four scenarios within it supported NR(HS) in evaluating the recovery options. Through this process NR(HS) evaluated different life cycle costs by varying the time to renewal intervention and maintenance requirements. As a result of evaluating the four scenarios we are now much clearer on the asset renewals that are driven by obsolescence, those that deteriorate in relation to train paths and those that deteriorate as a function of age or environment. This supports us in making much more intelligent asset management decisions. This information is captured in the SASs and, as a result of our assurance activities, we are confident in the need for and drivers of the renewals volumes proposed.

During CP3 we have continued to improve our asset management capability through the delivery of our PR19 asset management commitments. We have worked collaboratively with NR(HS) to prioritise and develop our asset management capability to enable us to make more informed decisions about asset interventions. We have improved our Asset Management System, aligning it with ISO55001 and taking a consistent approach across both route and stations to share good practice. We have continued to improve our asset information to strengthen our asset management decision making and move away from using manufacturers' recommendations.

One of the key challenges for PR24 was to improve our understanding of the track assets and the timing of their renewal. To do this we have developed an industry-leading track deterioration model, using actual wear data, which has resulted in significant reductions in 40-year track renewal volumes. For other assets we have developed risk-based models that build a totex (total expenditure) output that considers both maintenance and renewals cost implications of asset management options.

Research and development projects in CP3 to support our asset management include:

- A trial of ArcGIS demonstrating a number of uses and benefits (see Section 3.8);
- A trial use of Pandoscope which provided ballast condition information allowing us to defer ballast cleaning;
- Following a successful R&D proof of concept, we have now introduced train mounted equipment to deliver automated surveys of overhead line equipment improving our asset data; and
- In stations we have invested in the OpenSpace operational digital twin to improve information on customer numbers and manage throughput. It also supports us in bringing together various station data sources together on one platform.

[16] https://highspeed1.co.uk/media/dg0j0agy/hs1-ams-201-samp-june-2022-final-v1-1.pdf

HS1, while a maturing asset, is still relatively new. Although an increasing number of renewals have been delivered during CP3, CP4 marks the period where assets are moving closer to the end of their economic life and the volume of renewals will increase further.

## 10.2 Improving our asset management capability

### 10.2.1. Overview

We have made significant asset management improvements during CP3, these have focused on four core areas – Asset Management System, NR(HS) organisational structure, asset data and renewals delivery.

**Asset Management System:** All documents in our Asset Management System have been updated and re-issued as detailed below in Section 10.4.

HS1's new policy and HS1 SAMP were introduced across all assets, both route and stations, bringing consistency in approach and methodology to all the asset strategy documents and setting clear timelines for asset management improvements to be introduced.

New SASs have been written by NR(HS) which include details of forecast asset condition in 40 years' time, the introduction of risk-based maintenance as appropriate and optimised asset life modelling.

**NR(HS) organisational structure:** Following a review of the organisation, NR(HS) introduced a new Target Operating Model (TOM) in 2022. The TOM is an important enabler for the delivery of long-term operations, maintenance, and renewals efficiencies. The TOM included the appointment of Heads of Asset across route and station assets to focus on delivering the AMOs. The TOM was planned to be introduced in CP4; however, HS1 pushed for this to be accelerated to deliver benefits sooner, supporting the operators in a time of unprecedented cost pressures from macroeconomic factors.

**Asset data:** HS1's Asset Information Strategy and associated roadmap were introduced in November 2020 and have supported the consistent delivery of significant asset information improvements by HS1 and our partners over CP3. Our data improvements have included trials of remote condition monitoring and from these trials long-term solutions have been introduced.

**Renewals delivery:** As renewals volumes have increased over CP3, HS1 has continued to review and improve its process for managing the delivery of renewals. A new renewals performance lead indicators dashboard was introduced to provide better renewals assurance. To support successful delivery, renewals meetings have also been reviewed and improved to give greater focus on forward looking plans, issues, and blockers (see Section 3.5.1).

Through our assurance and continuous improvement processes, we have identified a number of further improvements we wish to make in CP4; these are recorded as CP4 commitments in Appendix A5. The CP4 commitments cover a number of areas including improvements in asset information, condition scoring, the approach to obsolescence and totex forecasting capability;

ISO55001 certification; delivery of maintenance efficiencies and a trial of streamlined governance for minor renewals (which is discussed in Section 13.3.1).

### 10.2.2. Delivery of our CP3 commitments

ORR made 28 route asset management recommendations for CP3 in its PR19 Final Determination and DfT made 11 station asset management recommendations in the DfT Final Decision. We monitor progress against these recommendations and report quarterly to the ORR. An annual summary is included in the AMAS.

We have completed all of the station recommendations. Three of the route recommendations remain open; all are on target for completion by the end of CP3. More detail is available in the 2023/24 AMAS.

### 10.2.3. Asset Management Maturity: ISO55001

NR(HS) route and UKPNS have achieved ISO55001 certification. HS1 and NR(HS) stations are seeking ISO55001 certification by the end of CP3. Both NR(HS) and UKPNS are regularly audited against ISO55001 and maturity improvements are embedded into strategy documents.

In 2023 we commissioned BSI to undertake a gap assessment of HS1 competency in asset management against the ISO55001 standard. This identified a number of specific areas for improvement which we are addressing, with the intention of achieving certification against the ISO55001 standard in 2024.

In CP4, HS1 will continue to identify and introduce asset management good practice, looking across the rail and wider industries for emerging concepts and developments.

## 10.3 Innovation, research and development

HS1 and NR(HS) have developed a Joint R&D Strategy for CP4 (which is provided as Appendix 14 of the NR(HS) Route 5YAMS). For CP4 we have an ambitious improvement plan across our system that will drive efficiency for our customers. Having learned from CP2 and CP3, we believe we have made the right changes and plans supported by the right structure, people, and processes to ensure that we can deliver tangible, efficiency-driving and safe changes to our network by starting CP4 with a robust innovation budget.

### 10.3.1. CP4 R&D initiatives and funding

Findings and lessons learned from CP3 R&D initiatives have informed the development of the SASs and other strategies for CP4, which include proposals for route R&D initiatives in CP4. There are several successful projects from CP3 which we wish to continue to develop in CP4, innovating to realise further benefit and drive more efficiency. Our strategy splits the proposed CP4 R&D initiatives into the following maturity categories:

- **In Flight:** these are the most progressed initiatives in the portfolio. They include:
  - Initiatives commenced in CP3 that will continue into CP4;
  - Additional phases of initiatives commenced in CP3;
  - Initiatives specified in the SASs with a high likelihood of success, due to previous R&D or high rail industry readiness level, or technology readiness level; and
  - Initiatives where benefits can be further leveraged across the control period boundary.
- **Scoped/Sighted:** these are well progressed initiatives that have been identified and worked up in significant detail as well as less well understood initiatives and challenges that need idea creation or further refinement and development to better articulate and understand scope, cost, timescales and intended benefits. These include:
  - Initiatives from the CP3 pipeline that need further detail to progress to approval;
  - Initiatives that consider known solutions to challenges that have not yet been explored in the HS1 context;
  - Challenge statements from other HS1 system strategies where R&D is an enabler for resolution, for example, the Safety, Operations or Sustainability strategies within NR(HS), or the Digital, Sustainability or Asset Management Strategies within HS1 Ltd; and
  - Initiatives that support improved delivery of renewals in CP4.
- **Horizon Innovation:** we are proposing a 'horizon innovation' budget (equivalent to 15% of the In Flight and Scoped/Sighted budget) to be used for opportunities that are not currently identified. This would allow flexibility in CP4 to consider innovative technologies, processes and approaches and leverage new innovation. It would also allow us to address gaps in the achievement of objectives which the in flight and scoped/sighted categories have not already covered. This will prevent us locking in and limiting our thinking to only the innovations we know about today – taking advantage of HS1's strong position as a closed system testbed.

Initiatives in the In-Flight category are designed to drive efficiency, safety improvement and transformation of approach in key areas such as:

- Remote isolation of OCS built into planned renewals projects;
- Improving datasets that feed the track deterioration model and models for other asset groups;
- Further development of automated inspection techniques for Civils assets;
- Maturing of renewals delivery by coupling R&D funded initiatives to renewals projects; and
- Continuation of long-term academic research to improve understanding of asset degradation and performance in relation to the climate, as well as exploring new areas of research based on expected future challenges.

Each R&D initiative will have a sponsor who will be responsible for applying for funding, presenting the business case, estimating the return on investment, expected benefits, and seeing the project into full implementation, post-trials.

Our proposal for CP4 R&D funding is £3.995m split as shown in Table 29.

**Table 29: CP4 R&D funding by asset type**

| Asset type | Funding (£ million) |
|---|---|
| Electrification and Plant | 1.250 |
| Signalling and Communications | 0.600 |
| Track | 0.820 |
| Civils | 0.500 |
| Horizon Innovation | 0.475 |
| R&D personnel | 0.350 |
| **Total** | **3.995** |

An additional £1.06m of R&D initiatives linked to O&M efficiencies is embedded in the NR(HS) Annual Fixed Price to cover R&D related to Infrastructure Evolution, Operations Strategy, Safety Strategy and People Strategy.

It should be noted that all of the proposed CP4 R&D funding is for the HS1 route. NR(HS) and HS1 originally proposed expanding the R&D remit to include stations; however, the TOCs did not agree for station R&D funding to come from route OMRC or from station Qx.

### 10.3.2. Management and governance of R&D in CP4

In CP3, R&D funding has been owned and managed by HS1. R&D project governance has been through the R&D Panel, chaired by HS1, with representatives from NR(HS) and train operators.

HS1 and NR(HS) have considered alternative proposals for funding and governance of R&D schemes in CP4 with the objectives of continuing the success experienced in R&D delivery in CP3, simplifying processes, expediting delivery and achieving greater value for money outputs. For CP4 we propose the following:

- NR(HS) holds the funding for R&D. These funds would be treated as O&M costs but ring fenced by NR(HS) – similar to what HS1 has done in CP3. (This funding is separate to the NR(HS)'s Annual Fixed Price.) Funds are expected to be fully allocated to projects in CP4. However, if there is any underspend this will be carried forward to the CP5 budget.
- Continuation of the multi-stakeholder R&D governance panel to continue to achieve cross-system input, validation of schemes and success of benefits or lessons learned.

- NR(HS) will be required to follow the existing project governance and progress R&D projects through each gate stage to authorise funding, managing the cost envelope transparently via the R&D governance panel.

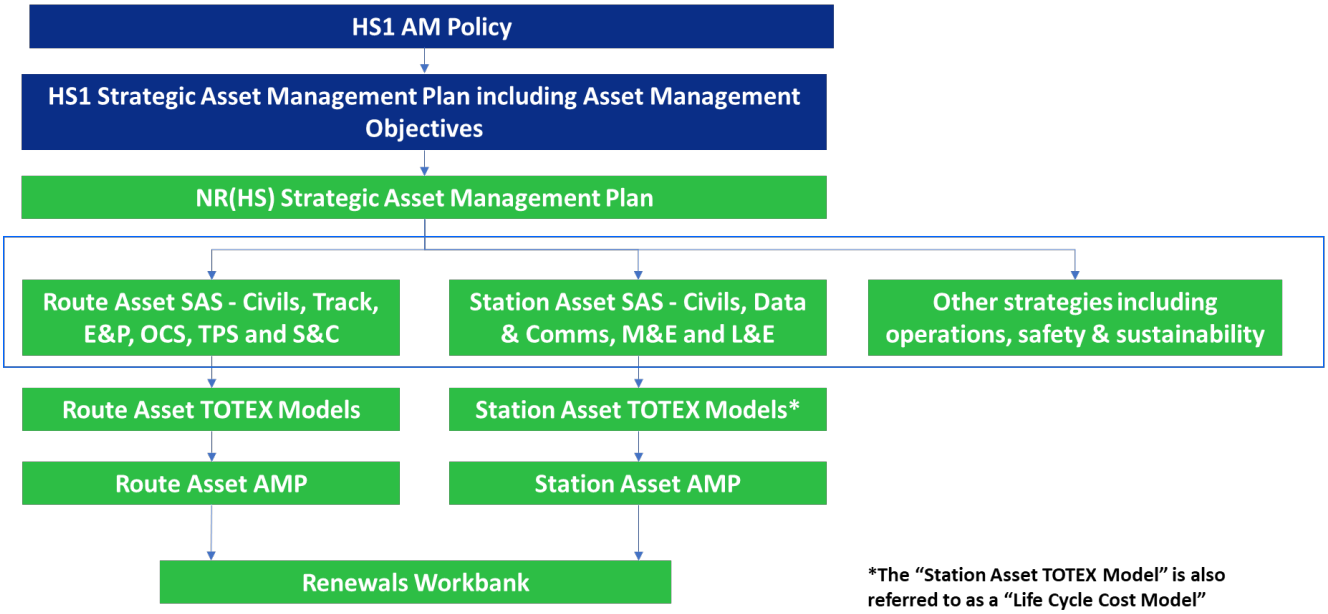
NR(HS) is making the following organisational changes ahead of CP4 with new roles and responsibilities designed to manage R&D and embed an innovative culture across the system:

- Appointment of a Head of High Speed Engineering (R&D), to oversee the implementation of the R&D strategy. They will be responsible for creating and embedding an innovative culture across NR(HS), sourcing suitable initiatives that respond to planned innovation and convening the R&D panel and will take a lead role in controlling R&D spend and reporting.
- NR(HS) has already appointed a Change Project Manager (R&D) within its Business Change team. Their role is to:
  - Engage with key R&D participants and projects ensuring good knowledge of transformational activity is understood;
  - Be influential in the successful transition of R&D projects from the R&D portfolio into business-as-usual (BAU) activities for the HS1 system; and
  - Focus on the recording of key success metrics that will determine if R&D projects are adopted on a long-term basis.

## 10.4 Asset Management System

During CP3, we have worked with NR(HS) to improve the HS1 Asset Management System, aligning it with ISO55001 for both route and stations. The components of the asset management system are summarised in Figure 24 and discussed in the remainder of this section.

**Figure 24: Asset Management System**



The **HS1 Asset Management Policy** reflects our commitment to delivering sustainable operational performance and asset availability through world leading asset management.

HS1 introduced an **HS1 SAMP** during CP3 to drive consistency in approach and methodology across all assets and set out clear outcomes across the HS1 system. The HS1 SAMP includes details of the Asset Management Objectives (AMOs).

The Covid-19 pandemic had a severe impact on the HS1 system during CP3 and train paths were significantly reduced to reflect international travel restrictions and reduced passenger demand. Passenger numbers and train paths were still significantly below forecast levels when asset management preparations for CP4 began. To address the uncertainty around future demand, the HS1 SAMP included four future growth scenarios; these are discussed in Section 10.5.

The **HS1 Asset Management Objectives**, shown in Figure 25 (below), help shape our decisions about how to operate, maintain and renew our assets, placing customer requirements at the centre of our asset management. AMO weightings were developed for each of the four scenarios, reflecting the different trade-offs between performance, cost and growth. The AMOs have been tested through the PR24 stakeholder engagement sessions and have received positive feedback.

The HS1 Asset Management Policy, SAMP and AMOs provide the framework within which NR(HS) has developed the **NR(HS) SAMP** in line with ISO55001 best practice. The NR(HS) SAMP sets out the framework and processes necessary to develop, document, implement and continually improve the approach to asset management. It provides strategic guidance for development of the SASS in terms of context, planning, enablers and delivery of asset management practices. The NR(HS) SAMP includes details of current asset management status and targets/milestones for improvement.

The **SASs** are discipline-specific strategy documents which cascade the NR(HS) SAMP across asset disciplines. 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 were already at a good standard in the PR19 submission, but have further improved in quality, driven through better thinking in NR(HS) and also in response to detailed constructive challenge from HS1. Further detail on the SASs is provided in Section 10.7.

A number of **other strategies** have been developed by NR(HS) to support the operation, management and renewal of the HS1 system, these include a Safety Strategy, Sustainability Strategy, Operations Strategy, Engineering Access Strategy, Rail Plant Strategy and R&D Strategy.

One **totex model** has been built for each station asset group and the route assets, excluding track. The totex models use asset condition and criticality to generate risk-based 40-year renewals workbanks. For track assets, a detailed data-driven model has been developed.

The **route renewals 40-year workbank costings** is a single spreadsheet bringing together for route assets the outputs of each discipline-specific models, providing planned renewals volumes

and cost information for the 40-year period. This builds on the NR(HS) renewals workbank. For stations, the outputs of the totex models are summarised in the Long Term Charge model.

**Figure 25: Asset Management Objectives**

| Business attribute | Asset management objective | Weighting for each future state | | | |
|---|---|---|---|---|---|
| | | Growth | Re-build | Re-structure | Re-think |
| **Safety** | We will manage our assets so that the risk of a safety incident is as low as reasonably practicable. | 40% | 40% | 40% | 40% |
| **Performance** | **Punctuality** - We will manage our assets so that passengers arrive on time.<br>**Availability** - We will manage our assets such that the availability of route assets will meet the needs of our passengers and the train operating companies.<br>**Satisfaction (stations)** - We will manage our assets to maintain the asset related elements of the NRPS score at or above the current levels of scoring. Recognising the importance of station architecture, internal design, cultural significance and general ambience in influencing passengers' experience. | 30% | 30% | 25% | 20% |
| **Cost effectiveness** | We will ensure that the total cost (operational and capital) of managing our assets (over the concession time period) is demonstrably cost effective and provides good value whilst balancing external cost pressures (such as the impact of the COVID 19 pandemic) with the need to minimise risk and maximise performance.<br>Costs will be different for the different future states – for example, in a 're-think' future state, short term cost reductions may be more important than whole life cost. Likewise, in a 're-build' future state, whole life cost becomes more important. | 10% | 15% | 25% | 35% |
| **Environment and social** | We will manage our assets to enable our sustainability strategy, including: protect and reduce our impacts on the natural environment and on our local communities; and achieve our carbon net-zero ambitions. | 5% | 5% | 5% | 0% |
| **Growth** | We will manage our assets to support long-term growth in capacity and revenue, taking future demand into account. | 15% | 10% | 5% | 5% |
| **Legal compliance** | We will comply with all legislation, HS1 consents, Historic England conditions, concession agreement, (station) leases and environmental policy commitments. | Mandatory | Mandatory | Mandatory | Mandatory |

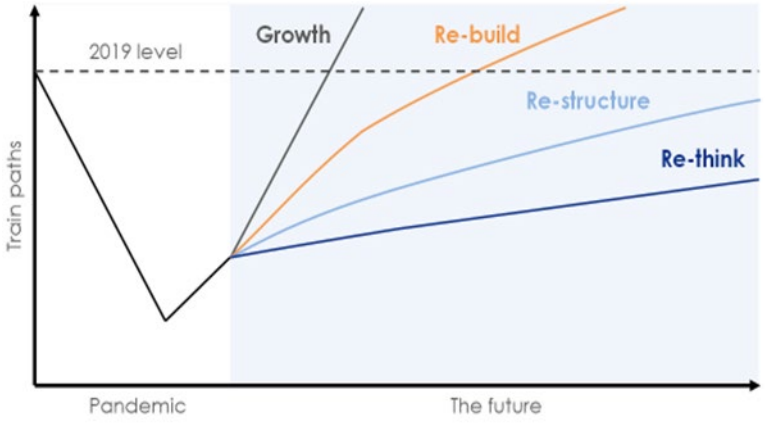
## 10.5 Recovery scenarios

The Covid-19 pandemic, lockdowns and travel restrictions had a severe impact on passenger numbers using the HS1 system. In June 2022 there was still significant uncertainty around potential future Covid-19 variants and the likely timescale for passenger and train path recovery.

However, we needed to publish the HS1 SAMP to allow asset strategies to be developed to meet PR24 timelines.

To help navigate uncertainty and promote agile decision making, HS1 proposed four recovery scenarios in the HS1 SAMP – Re-think, Re-structure, Re-build and Growth. The four scenarios were considered by all asset groups (both route and stations) in developing their strategies.

**Figure 26: HS1 SAMP recovery scenarios**




The four scenarios represented an extreme range around possible outcomes:

- **Growth:** The most optimistic future, where train paths quickly increase to levels higher than pre-pandemic, followed by strong growth.
- **Re-build:** Train paths return to pre-pandemic levels. Includes additional train paths from a new international operator and new international destinations.
- **Re-structure:** Continued recovery in train paths in the short term, which then stall and track at pre-pandemic growth rates. No recovery to pre-pandemic passenger numbers or train paths before the end of the HS1 concession in 2040.
- **Re-think:** Train paths do not recover to pre-pandemic levels before the end of the concession. A steady but low level of growth in train paths, similar to that experienced before the pandemic.

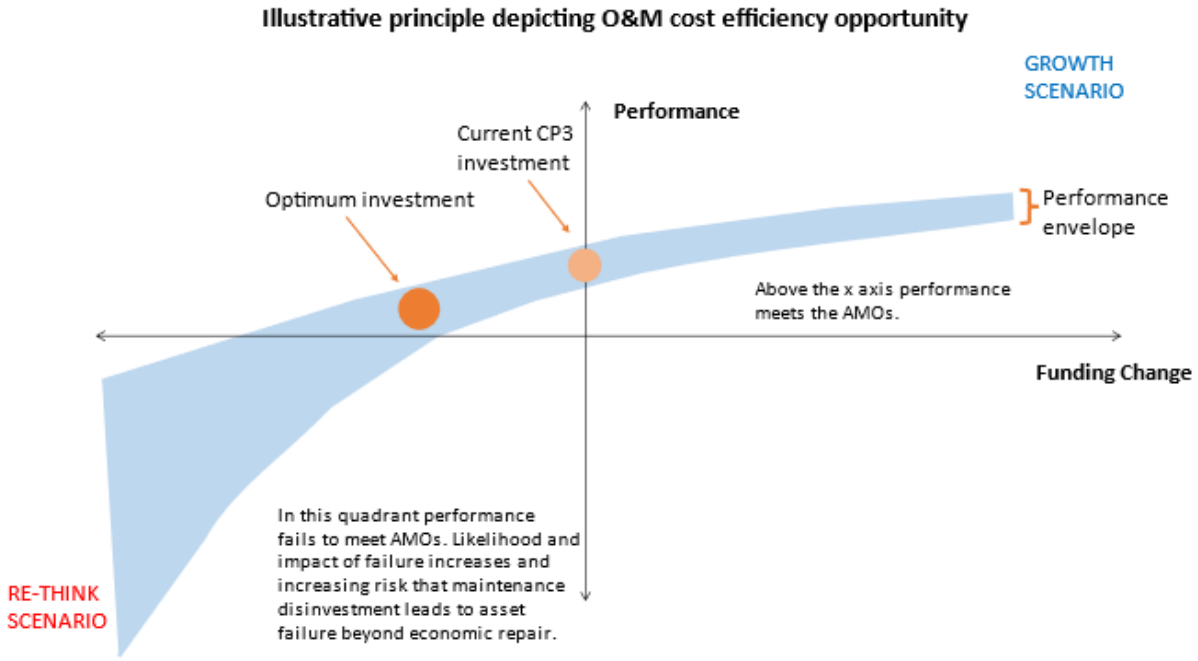
The forecast train paths were agreed between HS1 and NR(HS) following TOC feedback from bilateral meetings at the time. For track assets, where improved modelling allowed a more direct correlation to be established between train paths and asset wear, a fifth scenario was evaluated based on TOC feedback of more realistic, lower train paths over the short term – the **Asset Management scenario**.

The approach differs for (i) assets that are directly affected by the number of train paths and (ii) assets that are not affected by the number of train paths.

- **Asset classes directly affected by train path volumes:** Track assets and Overhead Catenary System (OCS) assets are the two main categories of HS1 assets which are sensitive to the number of train paths operated. Of these two asset classes:
  - The track asset accounted for 75% of the cost of the PR19 route renewals workbank. Therefore, a decision was made to develop a sophisticated track deterioration model to use data to improve correlation of the rate of deterioration of track assets to traffic volumes and support strategic renewal decisions (see Section 10.7).
  - OCS is still relatively early within its asset lifecycle. OCS component replacements (small works) are scheduled throughout the 40 years but there is no major rewirement currently scheduled within the 40 years. Since the major renewals all fall outside the 40-year period, modelling the deterioration rate and renewals options beyond that presented in the SAS is not appropriate at this time.
- **Asset classes not affected by train path volumes:** For these assets the four recovery scenarios have been used to consider how the assets may be managed and renewed differently if there were funding constraints applied to the HS1 system, pushing out the delivery of renewals and/or reductions in maintenance interventions.

NR(HS) undertook bottom-up evaluation for each asset group outlining the 40-year whole life renewal and maintenance approaches for all four scenarios. Using the different scenarios allowed us to fully explore the asset management options and better understand the optimum lifecycle costs for each asset, as indicated in Figure 27. The outcome of the scenario analysis indicated that the asset management approach in the Re-build scenario allows us to meet the AMOs at the most efficient cost while supporting the HS1 system to rebuild to pre-pandemic demand and performance levels.

**Figure 27: Illustration of optimum investment**



The renewals profiles for all five Track scenarios were evaluated at a high level and the renewals volumes are outlined in the SAS. This work allowed us to see the sensitivity of the track renewal volumes to train paths. The Asset Management scenario was deemed the most likely rate of wear and this was carried forward for more detailed analysis and smoothing.

Further analysis and outcomes are detailed in the SASs which are provided as appendices to the NR(HS) Route 5YAMS and NR(HS) Stations 5YAMS. The scenario analysis and resulting asset management approach and outcomes were discussed with stakeholders at several stages in the PR24 process.

## 10.6 Asset data

Good asset information is required to support asset management decision making. Since PR19 we have worked with NR(HS) to improve our asset information capability including the introduction of an Asset Data Dictionary for station assets and improvements to ProjectWise, our common data environment which holds all information related to the design, construction and operation of our asset base.

Independent asset information audits have been completed during CP3. The most recent audit found that asset condition was recorded for 99.5% of assets and identified no major or minor non-conformances.

The electronic Asset Management System (eAMS) holds information related to assets managed by NR(HS) under the Operator Agreement, including maintenance activities and fault data. During CP3, NR(HS) established that eAMS was no longer able to efficiently support the future asset data collection and digital aspirations of HS1. The specification for the new system, EAMS2.0, has been written, allowing procurement work to start. It is currently anticipated that EAMS2.0 will be introduced at the start of CP4. EAMS2.0 will bring many asset management benefits including better integration between renewals planning and maintenance activities.

An asset data quality assessment is planned for the end of CP3 to help prioritise data quality improvement initiatives to support EAMS2.0.

### 10.6.1. Asset capability and condition

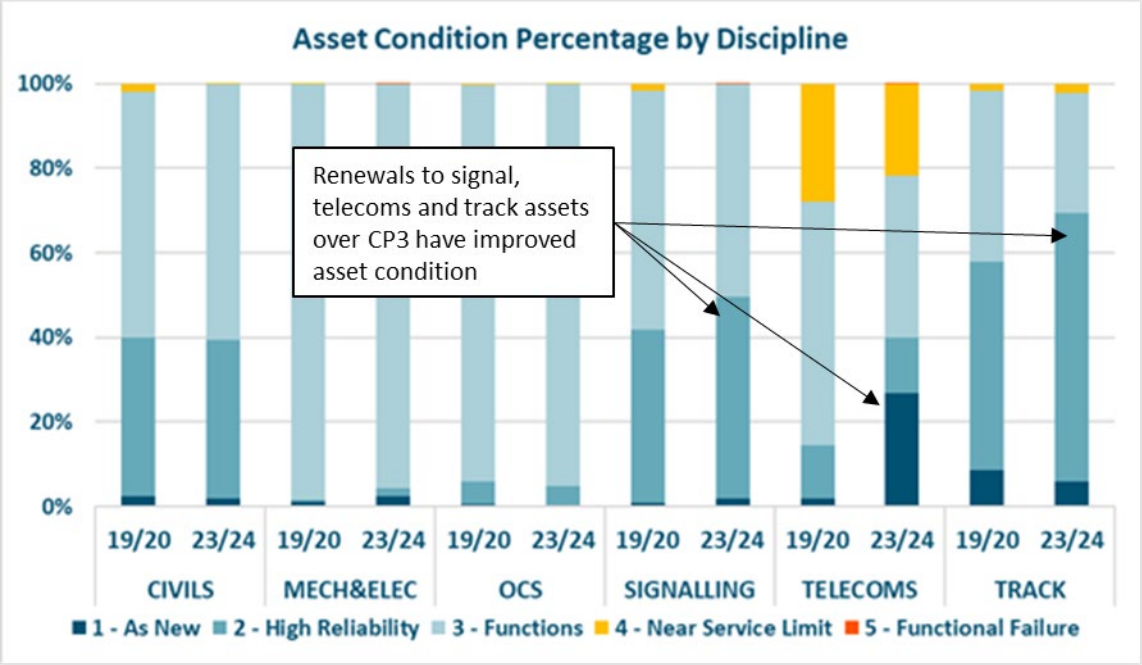
Asset capability has remained constant since commissioning with no projected reductions within the HS1 concession period. The maximum line speed remains the highest in the UK at 300km/h and the route availability meets all passenger and freight customer needs at 22.5 tonnes (axle loading). The maximum number of achievable train paths that the signalling system can deliver remains at 20 trains per hour in each direction.

During CP3, NR(HS) has continued to move from maintenance and renewal interventions based on fixed time intervals to risk-based maintenance informed by improved asset condition and failure risk data.

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. The method of collecting asset condition information varies across the asset disciplines. During CP3 some asset groups have introduced remote condition monitoring and further research and development is planned for CP4 to continue to improve the collection of asset data.

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 28.

**Figure 28: March 2023 Asset condition scores**




NR(HS) is continually improving the quality of asset condition data held for route assets. The SASs have been updated to reflect evolving asset knowledge and this information has been used to drive the CP4 renewal plans. A particular improvement was the deterioration modelling of the track assets completed in CP3 (see Section 10.7). We will continue to work with NR(HS) to drive R&D initiatives, with particular focus on condition recording for track assets.

External consultants undertake a survey of all HS1 station assets every five years. These surveys are currently being procured and the surveys will be completed in 2024.

## 10.7 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 and four SASs for the HS1 stations, one for each of the following asset groups.

Route SASs

- Track
- Civils and Environmental
- Signalling and Control Systems (S&CS)
- Overhead Contact System (OCS)
- Traction Power Supply (TPS)
- Mechanical and Electrical (M&E)

Station SASs

- Station Civils
- Lifts & Escalators (which includes Travelators)
- Data and Communications (D&C)
- Mechanical, Electrical and Plumbing (MEP)

The SASs are written and owned by the NR(HS) Heads of Asset who are also accountable for the delivery of renewals driven by the SASs. The SASs include details of forecast asset condition in 40 years, the introduction of risk-based maintenance as appropriate and optimised asset life modelling.

**Track deterioration model**

During CP3, NR(HS) developed a data-driven track deterioration model to assess future track renewal and maintenance options. The work included processing many existing data sets held in different formats to deliver cleaned and connected data relating to the asset history, generating new insights into the expected lifespans of the assets. This has allowed us to move away from the manufacturers' recommended design life used in PR19.

Track deterioration was modelled in 200m sections and visualisation was introduced to support smoothing of the workbank based upon geographic locations and deliverability. The model supported the evaluation of various disruptive and non-disruptive access options for renewals delivery to support discussions with stakeholders. The model has supported strategic decision making for track assets and has allowed significant reductions in track and ballast renewals and maintenance.

Arcadis was appointed to provide an independent review of the track SAS and the track deterioration model to assure they were consistent with established good practice and industry norms and were developed using valid logical and engineering processes. The Arcadis review included detailed formal comments; the majority of these have been addressed and some recommendations are to be carried forward for further development, validation and refinement of the degradation model in CP4.

The track degradation model was part of the renewals capability development programme (see Section 13.4.1) which was funded from escrow.

The stations SASs have progressed significantly during CP3, having started from a less mature asset management approach compared with the route SASs. The SASs follow the same general contents as the route SASs but draw upon less asset performance data.

The SASs are appendices to the NR(HS) Route 5YAMS and NR(HS) Stations 5YAMS which are provided as supporting documents. Table 30 and Table 31 provide a high-level summary of the asset management improvements in each SAS for route and stations respectively.

**Table 30: Route asset management improvements in CP3 and planned for CP4**

| Asset | AM improvements in CP3 | AM improvements planned for CP4 |
|---|---|---|
| **Track** | Track deterioration model, using wear data to forecast renewals moving away from using manufacturers' design life. Model used to optimise phasing of large renewals volumes.<br><br>Rail head treatment strategy and rail milling trial.<br><br>Use of Pandoscope, non-destructive ballast condition assessment used by SNCF, to better understand ballast degradation. | Refinement to deterioration model, particularly for sleepers and ballast.<br><br>Automated plain line inspections, laser-based switches and crossings inspections.<br><br>Use data to identify deterioration trends<br><br>Remote condition monitoring (RCM) for switches and crossings condition |
| **S&CS** | Risk based maintenance regime.<br><br>RCM introduced for some track circuits allowing condition-based interventions.<br><br>Fibre optic acoustic sensing to monitor S&CS condition changes. | Integration of maintenance and engineering team to improve asset information sharing.<br><br>Further RCM introductions |
| **Civil** | Trials of RCM.<br><br>Introduced risk-based inspection and maintenance.<br><br>R&D trials – cloud and photogrammetry exams for structures and train-mounted video inspections of tunnels. | GIS introduced and integrated to EAMS.<br><br>Develop drone use for vegetation management and major structure exams.<br><br>Introduction of improved condition marking index.<br><br>Major structure asset management plans. |

| Asset | AM improvements in CP3 | AM improvements planned for CP4 |
|---|---|---|
| **M&E** | RCM on fans<br><br>Knowledge sharing with NRIL | Maintenance redesign including standards and training.<br><br>Integrated M&E systems view, including spares holding.<br><br>Better use of asset data to forecast deterioration. |
| **OCS** | Train mounted LIDAR and optical recognition equipment trialled. | Move to automated visual inspections, condition monitoring and contact wire measurements.<br><br>Use of in-service Class 395 rolling stock for constant monitoring<br><br>Data driven maintenance reductions. |
| **TPS** | | Incorporate remote earthing facility into replacement sectioning switches |

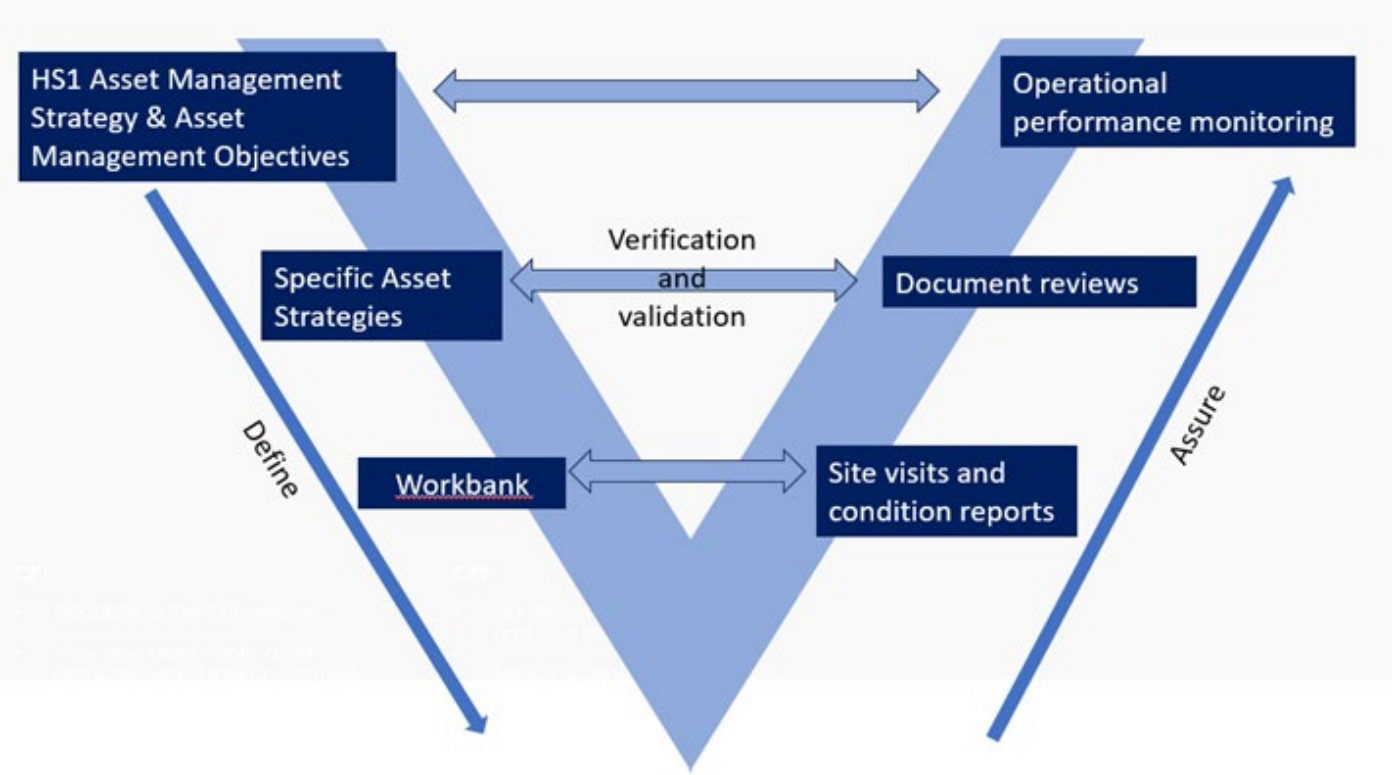
**Table 31: Station asset management improvements in CP3 and planned for CP4**

| Asset | AM improvements in CP3 | AM improvements planned for CP4 |
|---|---|---|
| **Lifts & Escalators** | RCM installed to a small number of assets recording asset performance. | Installation of RCM to more assets. |
| **MEP** | Completed initial baseline risk-based inspection assessment. | Introduce targeted condition monitoring of higher risk assets.<br><br>Align asset information enhancements with route systems. |
| **Data & Comms** | Populated FSI concept (the electronic asset register) with criticality information | Identify further opportunities to combine interventions. |
| **Civils** | Asset information improved.<br><br>Introduction of a risk-based model to forecast renewals. | Develop measurable fault / KPI data.<br><br>Targeted condition monitoring with the use of drones for inspections. |

### 10.7.1. Assurance of the SASs

Learning from previous control periods, HS1 and NR(HS) agreed a joint assurance approach for PR24 as set out in Figure 29 below.

**Figure 29: Joint assurance approach**




The joint assurance of the SASs has been extensive, beginning in August 2022 with a review of the first emerging draft documents and including continuous reviews of the draft and final documents. The assurance included review meetings with NR(HS) Heads of Asset and review of supporting documentation. HS1 shared detailed comments on each version of the SASs which were recorded formally in Document Review Notices. NR(HS) addressed most of these comments in the versions of the SASs which form part of the NR(HS) 5YAMS. The remainder are being taken forward by HS1 Ltd to be addressed through further development in CP4.

The SAS improvements as a result of this assurance include:

- Obsolescence: there is now a consistent approach across all assets;
- Policy on a Page introduced: clearer asset management decision making;
- Asset risks are understood and plans recorded to mitigate; and
- Each asset group has clear plans to improve asset management.

Discussions are ongoing between HS1 and NR(HS) around the efficiency of maintenance strategy and plans; we are awaiting further evidence from NR(HS) to assess this.

NR(HS) also engaged with NRIL to assure its SAMP and all SASs. As a minimum, this process involved document reviews and feedback. Workshops were held to test a number of strategies in greater detail.

An extensive programme of site visits was undertaken for HS1 to review, discuss and challenge the assets proposed for renewal in CP4. TOCs and the ORR were invited to attend a day of route site visits and a day of station site visits.

Overall, for route assets, HS1 has confidence that NR(HS) understands the condition, risks and degradation profiles of the Track, Civil, OCS, TPS and M&E assets, and has made realistic plans. Key outstanding issues for route assets are summarised below:

- HS1 has consistently raised concerns around the lack of visibility of maintenance plans and cost build-up used in the totex modelling.
- HS1 has consistently raised concerns around the strategy for managing S&CS assets and, in particular, the assets affected by obsolescence. NR(HS) has taken HS1's comments on board and sought guidance from manufacturers. The SAS has been revised following manufacturers' advice; however, there remains uncertainty around ongoing manufacturer support for obsolete control systems assets which, if resolved, could result in workbank reductions in CP4.
- Limited data has been used to support how assets affect achievement of AMOs and forecast asset performance is based on engineering judgement. This is an area for further development during CP4.

Compared to PR19, the SASs for the three stations managed by NR(HS) are now developed and owned by NR(HS), allowing HS1 to undertake more independent assurance of the proposals. Risk-based deterioration models have been developed for all station assets following a similar format, supporting a consistent approach for all assets. HS1 supports the resulting CP4 volumes. Key outstanding issues for station assets are summarised below:

- Limited data has been used to support how assets affect the achievement of AMOs and forecast asset performance is based on engineering judgement. This is an area for further development during CP4.
- The Policy on a Page that was introduced in the route SASs would be beneficial to support consistent asset management decision making for station assets.

# 11 Route Operations and Maintenance

This section outlines the approach to the operation and maintenance of the HS1 route in CP4.

The Operations Strategy and the associated Engineering Access Strategy for CP4 have been developed by NR(HS) in close consultation with HS1 and with a wide range of stakeholders (train operators, UKPNS, Eurotunnel, NRIL Kent Route and external rail operations experts). The strategy reflects the increasing capability of NR(HS) and learnings from other businesses, supported by the introduction of the new NR(HS) Target Operating Model in CP3 which includes a new operational management team.

The Operations Strategy defines how we are proposing to operate the railway to achieve a performance target of better than 7,500 minutes delay per year whilst maintaining a high standard of safety, asset condition and performance. The delay target is the same as in CP3 but is set in a context of increasing renewals and ageing assets. CP4 will also see the commencement of ballast renewal, the first of the significant intrusive renewals projects since the start of operations on HS1. A performance standard of under 7,500 minutes delay continues to be industry leading and significantly below the requirements of the HS1 concession.

## 11.1 Operations Strategy

Operations has a critical role in delivering a safe, on time and reliable train service with HS1 system partners, through the delivery of optimised railway operations, with supporting capability from infrastructure and assets.

NR(HS) has comprehensively reviewed and updated its Operations Strategy. The updated strategy was developed with key system stakeholders; the Operations Strategy Steering Group (OSSG) included representatives from train operators, HS1, UKPNS, Eurotunnel and NRIL Kent Route. HS1 supports the step change in maturity that is being delivered through the Operations Strategy.

The Operations Strategy covers the last two years of CP3 and all of CP4. It integrates route and station operations and aligns with infrastructure and asset management to ensure cross-functional working and promote synergies and efficiencies. It ensures that NR(HS) maintains current performance levels throughout CP4 whilst delivering for lower cost.

The approach focuses on developing strong interfaces across the NR(HS) organisation including a joint approach between Operations and Infrastructure in the areas of planning, resourcing, incident response and recovery, performance capability and management.

The starting point for the development of the strategy was an ‘as is’ landscape assessment and assessment of future risks from which NR(HS) developed problem statements summarising the main challenges. NR(HS) worked with enabling partners and European partners to understand

potential solutions. These were assessed to develop the right solutions to the problem statements.

This assessment evidenced the need to accelerate capability within the NR(HS) Operations organisation by the end of CP3 to successfully deliver the strategic outcomes, performance measures and commitments in CP4. To address this need, the strategy is being delivered in three stages as set out in Figure 30.

**Figure 30: Operations Strategy stages**


Stage 1, in 2023, focused on enhancing NR(HS) capabilities in the following areas identified in the 'as is' assessment to ensure a strong foundation for delivery of the strategy in CP4:

- Strategic planning: supporting timetable development to optimise capacity, improve journey times and develop routing strategies for engineering access.
- Resourcing: optimised capabilities to improve efficiency on stations using innovative approaches to workload management and automation of rostering processes.
- Dynamic performance modelling: the NR(HS) performance model has been enhanced to forecast the performance baseline and the impact of identified risks and associated performance improvement initiatives. The model can be used to develop a range of potential performance scenarios to plan for. The Dynamic Performance Model will be introduced into business as usual and enhanced to encompass the whole HS1 system.

Stage 2 (CP3 exit) will accelerate capability by developing and embedding new ways of working and competencies required to deliver differently in CP4. It includes some of the immediate priorities identified in the 'as is' assessment that have clearly defined solutions that can be readily implemented.

Stage 3 (CP4) builds on the CP3 exit position. It is characterised by transformational initiatives to mitigate risks identified in the 'as is' assessment, with a focus on incident management and train service recovery.

Figure 31 sets out the Operations Strategy initiatives to be delivered in CP3 and CP4.

**Figure 31: Operations Strategy initiatives**

| | CP3 | CP4 |
|---|---|---|
| People and culture | ▪ Accelerating strategic timetable planning capacity<br>▪ Optimising resourcing capability across route and stations<br>▪ Embedding new, fit for purpose competencies and capabilities | ▪ Embedding a continuous improvement culture in operations |
| Practice and process | ▪ Commencing tactical performance improvement initiatives<br>▪ Automating rostering processes<br>▪ Dedicated route and stations resourcing capabilities | ▪ Fully integrated incident response and service recovery<br>▪ Embedding proactive performance and risk management |
| Data and systems | ▪ Embedding dynamic performance modelling approach<br>▪ Embedding new competency management tools | ▪ Performance monitoring for incident management and recovery |
| Innovation | ▪ Fostering relationships with industry partners<br>▪ Performance-focused stakeholder engagement | ▪ Pioneering innovation and R&D through RSSB<br>▪ Driving lessons learned and improvement from NRIL 21st Century Operations |

Further details are available in the Operations Strategy which is Appendix 9 of the NR(HS) Route 5YAMS.

## 11.2 Engineering Access Strategy

NR(HS) has developed an Engineering Access Strategy (EAS) to support the delivery of CP4 maintenance and renewal activities. The strategy seeks to balance the delivery of a 7-day railway with the increasing engineering access requirements for renewals works as the HS1 asset ages while minimising disruption. The strategy considers both route and stations access.

The EAS considered a number of ways of working on the track, including the use of single line working which, in theory, would minimise the impact of works on operations. The exact methodology to be used will be determined during the developmental stages of the renewal projects and in consultation with all stakeholders. Single line working has never been implemented on HS1 and the impact it might have on the safety of the operation will need careful consideration.

HS1 supports the NR(HS) EAS for CP4; it represents a step change in the maturity of access planning using a more sophisticated, data-led approach. For the first time, NR(HS) has used a

modelling tool to understand access intervention impacts and provide engineering access options which:

- Protect the timetable and minimise disruptive access;
- Deliver renewals efficiently, providing whole life value to the HS1 system;
- Optimise maintenance and renewals planning to maximise utilisation of available engineering access windows;
- Enable informed and balanced decisions to be made for optimum engineering access in CP4.

The modelling divides the infrastructure into sections with access scenarios modelled on each section to understand timetable impacts on operators' services. The modelling considered minimum and maximum possession windows for midweek night possessions, to produce two options for each section; one represented the optimum time and lowest cost for renewals work, and the other represented maximum protection to the timetable for the flexing and/or cancellation of passenger and freight services.

The analysis has enabled NR(HS) to provide an initial view of the expected scale of disruptive access required in CP4. It has also enabled NR(HS) to identify where investment in access is required to improve productivity and efficiency. Access modelling concluded that engineering works in CP4 can be accommodated with minimal train path cancellations.

NR(HS) initially developed its EAS around the track workbank, which will have the greatest impact on the timetable and access requirements in CP4. The principles developed were applied to other disruptive workbank activities as the access planning process progressed. Detailed planning will continue as NR(HS) progresses its plans for CP4.

Further details are available in the EAS which is Appendix 12 of the NR(HS) Route 5YAMS.

The EAS will require revisions to the possessions allowance within the HS1 Passenger Access Terms and HS1 Freight Access Terms to ensure engineering access provision in CP4 is sufficient reflecting the increase in works to be delivered relative to previous control periods. This is discussed in Section 18.2.

## 11.3 Maintenance

This section summarises, for each asset discipline, the approach to maintenance and inspection activities and improvements made in CP3 and planned for CP4. Further information is available in the SASs, which are Appendices 3 to 8 of the NR(HS) Route 5YAMS.

The approach (for all asset classes) is in line with that which would be required to meet the train operators' stated performance requirement and the Asset Management Objectives.

The level of current performance in all asset classes reflects that of a well-maintained system that is not in need of radical change, but can be improved to reflect new maintenance techniques.

HS1 notes the general drive by NR(HS) to automate inspections and condition monitoring and that this will lead to efficiencies in CP4 and beyond.

We are awaiting further evidence from NR(HS) on the buildup of the NR(HS) O&M costs to enable us to assess whether the NR(HS) O&M costs for CP4 reflect a cost effective maintenance approach.

### 11.3.1. Track

Track maintenance supports the operation of the network by:

- Regular inspections, both pedestrian and trainborne, to identify and repair defects such as surface defects or loose components; and
- Mechanised preventative maintenance through tamping and grinding to provide a smooth ride for passengers and minimise wear due to traffic.

Maintenance strategies vary by sub-asset type and are a combination of risk-based (e.g. grinding linked to tonnage or to optimise wheel-rail contact, long wave tamping to maintain ride quality), works arising (e.g. repair of localised defects), reactive (e.g. replacement of failed components) and time based (maintenance visits for hot weather resilience).

NR(HS) has used the knowledge and experience gained from operating HS1 to refine the technical standards and inspection frequencies from those provided during construction to a risk-based approach. This transformation began in 2019, with new technical standards issued in 2021 and further refined in 2022. The maintenance approach is in line with the track deterioration modelling that has been done in CP3, the results of which have been shared with the ORR and operators and recognised as industry leading.

The inspection regime is supported by an increasing number of remote condition monitoring devices. Temperature monitors were deployed for summer 2022. Multiple site-specific measurement solutions have been deployed around switches and crossings. A small-scale rollout of monitors for switches and crossings vibration has taken place and its effectiveness is being monitored. The upcoming fibre optic acoustic sensing trial presents an opportunity to continuously monitor long lengths of track for defects and deterioration.

### 11.3.2. Civils and Environmental

The approach for civils assets is predominantly to use inspection data to drive maintenance volumes. A risk-based approach to maintenance is employed for the majority of civils assets and this will continue to be enhanced in CP4. The approach and proposed improvements to maintenance effectiveness have been reviewed and accepted by HS1.

During CP3, NR(HS) has:

- Transitioned to risk-based inspection and maintenance regimes for structures, drainage and earthworks; and,

- Investigated R&D projects including cloud and photogrammetry examinations of structures, and train-mounted video inspections of the tunnels.

### 11.3.3. Signalling and Communication Systems (S&CS)

S&CS maintenance activities are a mix of preventative and corrective maintenance. Preventative maintenance follows a defined schedule and includes any testing and inspecting required to assess the condition and remaining life of the asset. It also includes the cleaning and consumable asset replacement required to keep the asset functioning optimally.

- For signalling assets, routine maintenance and inspection 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.
- Control systems do not require extensive planned maintenance. Typically planned maintenance covers daily, weekly and monthly system checks.
- Communication system assets follow a preventative maintenance approach.

Following a number of problems with the maintenance of the points systems, NR(HS) has arranged additional training for its points maintenance teams from the manufacturer.

The R&D programme is exploring more effective management of high-speed point equipment through three projects:

- Remote condition monitoring for high-speed point operating equipment: the aim of this project is to understand the cause of damaged components and monitor their condition to plan intervention before the component fails.
- Application on HS1 of fibre optic acoustic sensing technology: the purpose of this project is to demonstrate how the technology can be used as a distributed track-side acoustic and movement sensor, to monitor the condition of high-speed switches and crossings.
- Two sensor systems are planned to be fitted to the HS1 MPV inspection module to monitor the health of track circuit equipment and KVB balises.

### 11.3.4. Overhead Contact System (OCS)

There is little to no redundancy in OCS assets, meaning that failures and faults can pose an operational risk to the railway. The current maintenance strategy for the OCS assets is based on planned preventative maintenance, designing out fault modes, reaction to faults and early intervention/prediction where possible. Planned preventative maintenance of the OCS asset is performed either via ground level visual inspections or through at-height maintenance. Much of the maintenance of OCS assets is performed as part of a yearly cycle; annual maintenance passes provide assurance on condition and geometry.

In CP3, NR(HS) is undertaking two R&D projects designed to deliver more remote inspection and improved data. This will facilitate smarter, targeted interventions and predictive maintenance,

reducing the risk of asset failure, optimising the number and type of maintenance interventions required and significantly reducing the requirement for staff access to the operational railway.

- Lidar and optical recognition equipment mounted upon one of the maintenance vehicles was successfully trialled during 2022. The equipment has the potential for automation of visual inspection and monitoring and accurate measurement of the contact wire geometry in relation to the track. Further trials have been completed and the system implemented; we are now embedding the system into the operation by the end of CP3.
- NR(HS) is also working with SETL and Hitachi to fit equipment to in-service Class 395 rolling stock, which will constantly monitor the dynamic performance of the contact wire/ pantograph interface and generate alarm notifications, with associated GPS coordinates, as any pre-set threshold exceedance is identified.

If successful, these initiatives will become key components of the OCS asset management strategy, triggering a fundamental shift in OCS maintenance from a periodic, interventionist regime to one that only requires intervention by exception. It is anticipated that this will drive savings in CP4.

There have been several recent issues which have caused damage to the overhead contact system. It is important to note that these were issues with the rolling stock and were not due to any deficiencies in the maintenance regime.

### 11.3.5. Traction Power Supply (TPS)

The level of redundancy built into the design of the TPS system means that, in most cases, asset failures do not have an immediate operational or safety impact. This is a significant driver of the maintenance strategy.

The maintenance strategy is based on routine planned maintenance and reaction to faults. Limited prediction of failure is undertaken, an example of this is oil analysis on the large AC/DC isolation transformers. 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 and tested in accordance with NR(HS) standards. A number of asset-specific inspections and tests are used to assess condition and identify faults.

### 11.3.6. Mechanical and Electrical (M&E)

There is a varied approach to inspection of M&E assets. Where there is significant economic benefit, remote condition monitoring is used, for example, to measure key data such as fan vibration and pressure readings on larger fans and air conditioning units.

A risk-based maintenance approach is deployed for all M&E assets. The approach for each sub-asset class depends on criticality and the level of redundancy in the systems. Asset design,

failure modes, obsolescence and historic asset performance drive the asset specific maintenance and renewal requirements.

### 11.3.7. 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.

To inform the development of its Rail Plant Strategy, NR(HS) commissioned an independent review of the options for rail plant required for CP4 and the following 35 years. Based upon the conclusions and recommendations of this review, NR(HS) proposes the following strategy for the remainder of CP3 and CP4:

- Upgrade the current MPV fleet and purchase adequate spares during CP4 to continue to operate the vehicles until the introduction of a new ERTMS signalling system on HS1, when they will be retired and replaced with new or leased vehicles;
- Replace the current SRS road-rail vehicles during CP4 for either new or refurbished used vehicle, if available; and
- Continue to consider and, where appropriate, develop business cases for additional opportunities and efficiencies.

# 12 Route 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 CP4, how we will continue to drive efficiency during the control period and our forecast of O&M expenditure for CP4.

## 12.1 Identifying efficient costs for CP4

In developing the O&M costs for CP4, 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 CP4 costs bottom up, based on our experience in previous control periods.

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 lifecycle costs.

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. We will continue to pursue improved efficiency throughout CP4, challenging NR(HS) to outperform its Annual Fixed Price, identifying opportunities to reduce HS1 Ltd costs and working to minimise costs which are passed through to train operators.

A high level breakdown of cost categories and the benchmarking and efficiency approach taken for each is shown in Table 32. Further details are provided in the remainder of this section.

**Table 32: Efficiency approach by category of cost**

| Cost category | Approach |
|---|---|
| NR(HS) Annual Fixed Price | NR(HS) efficiency initiatives with cost efficiency benchmarked against NRIL and other UK regulated infrastructure<br><br>Benchmarking to international comparators (OMR Effectiveness Study by Rebel)<br><br>Assurance of NR(HS) asset management proposals<br><br>HS1 review and challenge of NR(HS) O&M costs (ongoing)<br><br>Critical review of NR(HS) management fee<br><br>Review and challenge of NR(HS) contract risk |
| 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 CP4 to the resources required to deliver them<br><br>Efficiency review of HS1 organisation and IT infrastructure<br><br>Benchmarking to international comparators (OMR Effectiveness Study by Rebel)<br><br>More efficient ways of working – reduced use of consultants as more work delivered in house |
| Pass through costs | These cost forecasts are indicative. During CP4, we will work to minimise the outturn costs passed through to operators through:<br>• Efficient procurement strategies (insurance, electricity); and<br>• Robust negotiation on rates revaluation. |
| Traction electricity | Reducing consumption through Energy Strategy initiatives<br><br>Minimising unit costs by ongoing efficiency in purchasing |
| Freight-specific costs | Efficiencies achieved in NR(HS) Annual Fixed Price and HS1 costs (subcontract and internal) flow through to freight |

Table 33 summarises our CP4 O&M cost forecasts. These are discussed in Sections 12.3 and 12.4. 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 12.5). 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 above RPI and the freight-specific element of the NR(HS) costs (see Section 12.3.8 for further details of this adjustment).

**Table 33: CP4 O&M cost summary (£m, February 2023 prices)**

| | 25/26 | 26/27 | 27/28 | 28/29 | 29/30 | Total |
|---|---|---|---|---|---|---|
| NR(HS) costs | 55.3 | 53.0 | 51.6 | 49.8 | 49.0 | 258.6 |
| R&D costs | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 4.0 |
| HS1 costs | | | | | | |
| Subcontract | 4.1 | 4.1 | 4.2 | 4.2 | 4.2 | 20.8 |
| Internal | 10.1 | 10.4 | 10.5 | 10.4 | 10.0 | 51.4 |
| Pass through costs | 24.5 | 24.4 | 24.3 | 24.3 | 24.3 | 121.7 |
| Freight costs | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 1.5 |
| **Total O&M cost** | **95.0** | **92.9** | **91.6** | **89.8** | **88.6** | **458.0** |

We forecast an overall reduction of 4% in O&M costs between the CP3 efficient budget and the CP4 forecast as shown in Table 34.

**Table 34: CP4 v CP3 efficient budget O&M costs (£m, February 2023 prices)**

| | CP3 efficient budget | CP4 | Difference | % difference |
|---|---|---|---|---|
| NR(HS) costs | 269.5 | 258.6 | -10.9 | -4% |
| R&D costs | 2.6 | 4.0 | 1.3 | +51% |
| HS1 costs | | | | |
| Subcontract | 24.5 | 20.8 | -3.7 | -15% |
| Internal | 54.0 | 51.4 | -2.6 | -5% |
| Pass through costs | 123.6 | 121.7 | -1.8 | -1% |

| | CP3 efficient budget | CP4 | Difference | % difference |
|---|---|---|---|---|
| Freight costs | 2.2 | 1.5 | -0.7 | -32% |
| **Total O&M cost** | **476.4** | **458.0** | **-18.4** | **-4%** |

## 12.2 OMR effectiveness study

We commissioned Rebel to undertake an OMR Effectiveness Study comparing the costs of HS1 with other European high-speed lines to identify cost optimisation opportunities. The study is based on the outturn data for 2021/22 and included 15 high speed rail lines from six participant organisations in five European countries (UK, Belgium, France, Netherlands and Spain). The OMR Effectiveness Study is provided as a supporting document to this Draft 5YAMS.

The OMR Effectiveness Study is the fourth study of its kind undertaken by Rebel for HS1 and builds on previous studies, using the same cost driver framework. Rebel updated its approach for this study to better reflect the uncertainties of efficiency analysis, to aid HS1 and NR(HS) analysis as well as ORR consideration.

Rebel identified four areas where efficiencies could be achieved by adopting best practice:

- Reduce the size of the signalling maintenance organisation and management organisation;
- Optimise HS1 Ltd and NR(HS) indirect staffing;
- Lower management fee for NR(HS); and
- Provide a better framework for cost reductions over time that reduces consistent outperformance.

The study outlined several dependencies which influence the efficiencies that can be achieved in practice. Additionally, the efficiencies are presented on a gross basis and do not consider the investment that is likely to be required to achieve them.

Rebel identified efficiency opportunities for both NR(HS) and HS1. Table 35 sets out the findings of the OMR Effectiveness Study along with NR(HS) and HS1 responses. The OMR Effectiveness Study was undertaken in 2023 while both NR(HS) and HS1 were pursuing the sprint initiatives; as a result of this, some of the efficiencies have already been delivered.

**Table 35: OMR Effectiveness Study findings and NR(HS)/HS1 responses**

| Opportunity and value (relative to 2021/22) | | NR(HS)/HS1 response | |
|---|---|---|---|
| Reduce in size the signalling maintenance organisation and management organisation | £2.3m - £4.5m by CP5 | £2.6m by CP4 | NR(HS) already recognises the opportunity to optimise its maintenance organisation, not just within the signalling discipline. The range of reduction in signalling maintenance identified by Rebel is deemed unlikely due to the desired performance levels. NR(HS) is developing proposals to review its entire maintenance organisation as part of its Infrastructure Evolution programme. |
| Optimise NR(HS) indirect staffing | £0.2m - £0.5m by CP4 | £0.5m by CP4 | NR(HS) has already recognised this as a focus area and progress has been made through the implementation of the TOM Phase 1. NR(HS) completed a reorganisation in 2022/23 and has delivered this efficiency within CP3. |
| Optimise HS1 Ltd staffing | £0.6m - £1.5m by CP5 | £0.6m by CP4 | As noted in Section 3.4.3, we have reviewed our structure to ensure it is appropriate going forward; the changes identified in the review are expected to be fully implemented by the start of CP4. Total staff numbers following this review lie within the range identified in the study. |
| Lower management fee for NR(HS) | £1.4m - £2.2m by CP4 | £0.4m by CP4 | NR(HS) commissioned Oxera to undertake a benchmarking study comparing NR(HS) to comparable UK organisations with a similar risk profile. The Rebel report contains limited data and compares NR(HS) to organisation(s) with non-relatable contractual arrangements. Since the management fee is a percentage markup on post-efficient costs, the other efficiencies contribute to a slight monetary reduction in the management fee. |

| Opportunity and value (relative to 2021/22) | | NR(HS)/HS1 response | |
|---|---|---|---|
| Provide a better framework for cost reductions over time that reduces consistent outperformance | £1.8m - £3.6m by CP4 | Nil | NR(HS) recognises the opportunity to review the outperformance mechanism to reduce whole system cost. It should be noted that 2020/21 and 2021/22 were outlier years of particularly high outperformance against the Annual Fixed Price due to Covid-19 and are not representative of underlying performance. During this time NR(HS) absorbed the costs of reopener notices and offered efficiency to TOCs (which was declined). There could be efficiencies in this area aligned to management, incentivisation and appropriate remuneration of HS1 system risk and uncertainty which ORR is continuing to explore with HS1 system stakeholders. |

## 12.3 NR(HS) O&M costs

The NR(HS) Annual Fixed Price for CP4 is discussed in Section 8 of the NR(HS) Route 5YAMS and summarised below.

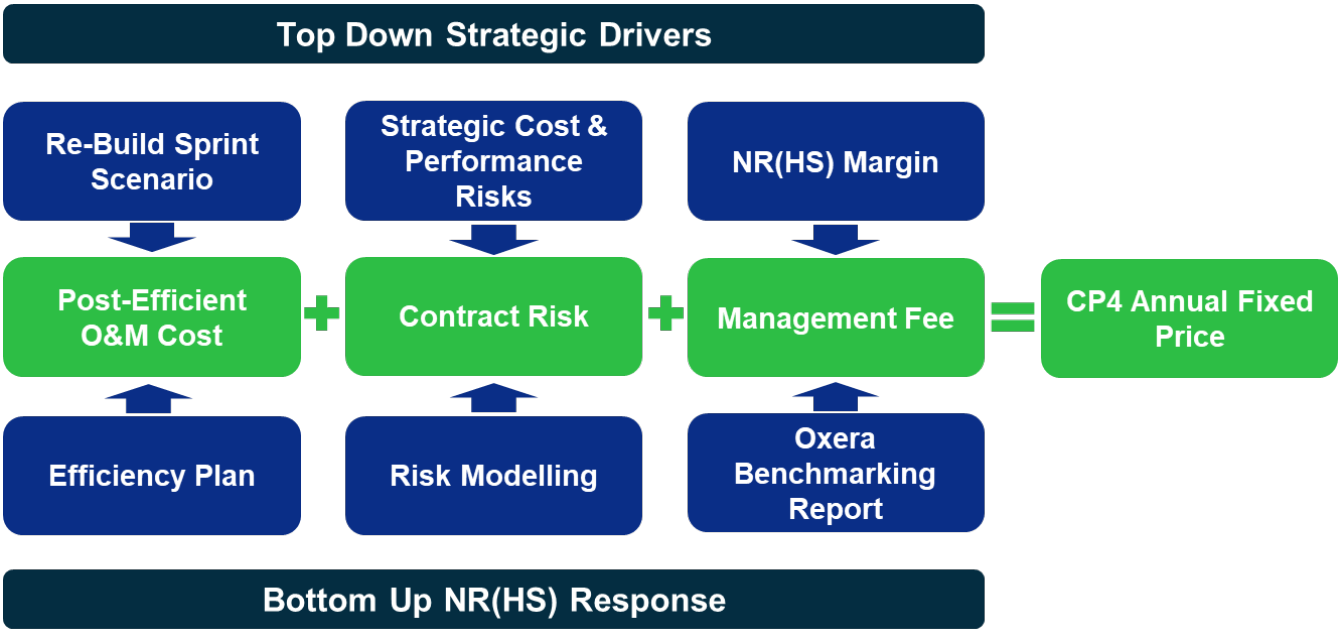
### 12.3.1. Structure of Annual Fixed Price

NR(HS)'s Annual Fixed Price structure for CP4 is consistent with the approach taken in CP2 and CP3. It consists of:

- Post-efficient O&M cost;
- Management fee: NR(HS)'s profit margin; and
- Contract risk: provides for downside risks from external events outside NR(HS) control.

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

**Figure 32: Build up of NR(HS) Annual Fixed Price**




### 12.3.2. Post-efficient O&M cost

In developing its AFP, NR(HS) made an initial top-down strategic evaluation of efficiency opportunities for the recovery scenarios in the HS1 SAMP (see Section 10.5). In October 2022, to give early visibility of emerging costs to stakeholders, NR(HS) provided an AFP target cost envelope of £241m to £267m.

These initiatives were further developed function by function during the detailed PR24 planning process in consultation with stakeholders and budget holders throughout the NR(HS) business to validate the efficiencies bottom-up and identify the requirement to invest in innovation and new ways of working to unlock efficiencies. This resulted in an AFP for CP4 of £255.9m.

The enablers identified by NR(HS) reflect its understanding of the upfront investment required to continue to unlock and deliver financial efficiency. Investing in key areas such as eAMS system upgrades and delivery of the Infrastructure Evolution programme will ensure that NR(HS) delivers true, repeatable financial efficiency rather than short term cost avoidance.

NR(HS) also analysed headwinds and tailwinds, recognising the potential impact of changes to national rostering principles on its signalling organisation and the potential benefits from system wide cost reductions. The efficiencies, enablers, headwinds and tailwinds are summarised in Figure 33.

**Figure 33: NR(HS) efficiency summary**

| | Within NR(HS) control | Out of NR(HS) control |
|---|---|---|
| Cost increase | **Enabler 3%**<br>*Positive management actions which increase equivalent costs or risk provision to facilitate efficiencies or enhanced business capabilities*<br>• **Operations Strategy:** Business change & organisational improvement<br>• **Infrastructure Evolution:** RBM & integrated planning & delivery<br>• **Digital asset management:** EAMS & GIS capability<br>• **People and Organisation:** Training capability and competency<br>• **Provision for general safety and sustainability:** locally funded investment | **Headwind 1%**<br>*External factors which increase equivalent costs or risk provision compared to current rates (e.g. external cost pressures])*<br>• **National rostering principles:** Driving requirement for increased signaller resource |
| Cost decrease | **Efficiency 10% (gross)**<br>*Positive management actions undertaken to reduce equivalent costs or risk provision compared to current rates*<br>• **Operations Strategy:** Optimised resourcing and delivery<br>• **Infrastructure Evolution:** Optimised planning, resourcing and ways of working<br>• **Digital asset management:** Data-driven decision-making in asset management<br>• **People and Organisation:** Enhanced capability and TOM implementation<br>• **Commercial efficiency:** Better value frameworks and review of PSA<br>• **Contract risk reduction:** Reassessment of cost and performance risks resulting in a reduced risk allowance | **Tailwind (1%)**<br>*External factors which reduce equivalent costs or risk provision compared to current rates*<br>• **Ongoing PR24 sprint initiatives/ORR risk and uncertainty:** Continue to seek mechanisms to reduce costs as a system<br>• **Rail Plant mothballing**<br>• **Contracting Strategy:** Frameworks beyond the five-year regulatory horizon |

The AFP represents a 7% net efficiency (10% gross efficiency[17]) in terms of the CP4 exit AFP against the CP3 exit AFP determined in PR19.

We have challenged NR(HS) O&M costs; in response NR(HS) provided statements to support how the price was constructed and why it represented good value. This was not sufficient for HS1 to be able to support the NR(HS) submission and we are awaiting further evidence to justify the price. We will provide an update in the Final 5YAMS.

### 12.3.3. 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. The management fee is comparable to profit margins in the private sector.

In CP2 and CP3, the management fee was 8% of the core O&M cost (expressed as a percentage in the Annual Fixed Price) based on recommendations from Oxera analysis of regulatory precedents, comparable companies and comparable contracts.

For PR24, NR(HS) again appointed Oxera to undertake an independent review of the appropriate management fee for CP4. Oxera assessed the economic risks associated with the

[17] Net efficiency = gross efficiency + enablers + headwinds + tailwinds

services that NR(HS) provides, benchmarking NR(HS) against comparator organisations, taking into account NR(HS)'s contractual commitments to HS1 Ltd.

Oxera's analysis provided a benchmark range of 4.1% to 10.2%; however, the first and fourth quartiles were deemed inappropriate based on business characteristics and risk profiles. The Oxera report recommended a narrower range of 7.2% to 8.7%. As its contractual performance requirements remain the same and NR(HS) is committed to either maintaining or improving outcomes in CP4, NR(HS) considers that 8% of the post-efficient O&M cost remains an appropriate level of management fee for CP4.

HS1 commissioned Frontier Economics to undertake a critical review of the Oxera analysis. Frontier suggested several improvements and NR(HS) has worked with Oxera to incorporate these. In particular, in the revised report, Oxera provides additional justification around why the comparators and ranges identified are appropriate. Oxera has also provided additional narrative to explain why it judges that the comparators face similar risk to NR(HS). It should be noted that the Oxera report provided to HS1 is in redacted form[18], therefore HS1 has only been able to review the information contained within this version. We have therefore not changed the NR(HS) assumption of the management fee being 8% of the post-efficient O&M costs. As the NR(HS) O&M costs are reducing in real terms through the efficiencies identified (as described in Section 12.3) this represents a slight reduction in the management fee over the CP4 compared to CP3.

### 12.3.4. Contract risk

The Annual Fixed Price also includes contract risk which provides for downside risks from externally caused events that are outside the control of NR(HS). It is split into:

- Cost risk: provision for costs of rectification of a risk that has occurred or to proactively mitigate against occurrence; and
- Performance risk: provision for payments to operators as a result of disruption caused by risks outside of NR(HS) control.

For cost risk, we have been through an iterative process of clarification, validation and challenge of NR(HS)'s contract risk pricing. NR(HS) undertook a Quantitative Cost Risk Assessment (QCRA), reviewing current risk profiles and risks that materialised in CP3. This comprehensive review, with particular focus on insurance, claims and reopeners under the Operator Agreement, identified c. £3.7m of risk that can be removed as there are other mechanisms in place to recover costs, resulting in a reduced cost risk value of £2.5m.

For performance risk, NR(HS) recalibrated the PR19 allowance on the basis of historical performance data, to calculate a performance risk value of £4.1m.

On the basis of this review, NR(HS) calculated a value for contract risk of 2.87% of the post-efficient O&M cost (reflecting P80 risk exposure), reduced from 4.33% in CP3. More detail is provided in a supporting document.

[18] We understand the ORR will have access to the full, unredacted report.

### 12.3.5. Annual Fixed Price for CP4

NR(HS)'s proposed Annual Fixed Price for CP4 is shown in Table 36.

**Table 36: NR(HS) Annual Fixed Price for CP4 (£m, February 2023 prices)**

| | 25/26 | 26/27 | 27/28 | 28/29 | 29/30 | Total CP4 | CP4 exit v CP3 exit |
|---|---|---|---|---|---|---|---|
| Infrastructure | 26.4 | 26.4 | 26.4 | 26.4 | 26.4 | 132.0 | n/a |
| Operations | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 35.0 | n/a |
| Support | 12.9 | 12.9 | 12.9 | 12.9 | 12.9 | 64.4 | n/a |
| **Total O&M (pre-efficient)** | **46.3** | **46.3** | **46.3** | **46.3** | **46.3** | **231.4** | **-3.3** |
| Net efficiency | 3.1 | 1.1 | (0.3) | (1.9) | (2.6) | (0.6) | +0.7 |
| **Total O&M (post-efficient)** | **49.4** | **47.3** | **46.0** | **44.4** | **43.7** | **230.7** | **-2.7** |
| Management Fee | 4.0 | 3.8 | 3.7 | 3.5 | 3.5 | 18.5 | -0.2 |
| Contract risk | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 6.6 | -0.7 |
| **Annual Fixed Price** | **54.7** | **52.4** | **51.0** | **49.2** | **48.5** | **255.8** | **-3.6** |

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

Any outperformance against the Annual Fixed Price in the last three years of CP4 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 CP4 and we pass on 60% of our share to the train operators.

### 12.3.6. R&D funding

As discussed in Section 10.3, we propose that NR(HS) holds the funding for delivery of the Joint R&D Strategy in CP4. This will be a ring-fenced budget which is not part of the NR(HS) Annual Fixed Price and does not therefore attract the management fee and contract risk applied to the NR(HS) O&M costs. Total R&D funding for CP4 is proposed to be £3.995m. Our intention is that

the full amount will be spent in CP4; if this is not the case, any of the R&D budget not spent will be rolled over to CP5.

### 12.3.7. Adjustments to the 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 above RPI which has been added to the Annual Fixed Price; and
- The element of the NR(HS) costs allocated to freight (as calculated in the HS1 Route Charging Model for PR24) has been netted off the Annual Fixed Price (and included in the separate "freight-specific costs" category).

This calculation is shown in Table 37.

**Table 37: Adjustments to the Annual Fixed Price (£m, February 2023 prices)**

| | 25/26 | 26/27 | 27/28 | 28/29 | 29/30 | Total |
|---|---|---|---|---|---|---|
| Annual Fixed Price | 54.7 | 52.4 | 51.0 | 49.2 | 48.5 | 255.8 |
| + 1.1% escalation | +0.6 | +0.6 | +0.6 | +0.5 | +0.5 | +2.8 |
| - allocated to freight | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.4 |
| **Adjusted AFP** | **55.2** | **52.9** | **51.5** | **49.7** | **48.9** | **258.2** |

## 12.4 Other O&M costs

### 12.4.1. HS1 costs

We have split HS1 costs into HS1 subcontract costs and HS1 internal costs. The breakdown of CP4 costs for both of these categories is shown in Table 38. The variance compares the costs for the five years of CP4 with the CP3 efficient budget.

**Table 38: HS1 costs forecast (£m, February 2023 prices)**

| | 25/26 | 26/27 | 27/28 | 28/29 | 29/30 | Total | CP4 v CP3 efficient budget |
|---|---|---|---|---|---|---|---|
| **HS1 subcontract costs** | | | | | | | |
| NR costs | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 9.8 | -0.4 |
| NR GSM-R | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 1.8 | 0.0 |
| NGC connection fees | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 2.1 | -1.1 |
| BTPA | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 5.1 | -1.6 |
| ORR regulatory & safety | 0.3 | 0.3 | 0.4 | 0.5 | 0.5 | 2.0 | -0.6 |
| **Subtotal** | **4.1** | **4.1** | **4.2** | **4.2** | **4.2** | **20.8** | **-3.7** |
| **HS1 internal costs** | | | | | | | |
| Staff | 5.8 | 6.1 | 5.9 | 6.0 | 6.1 | 30.0 | +1.1 |
| Technical support/ consultancy | 1.2 | 1.2 | 1.5 | 1.3 | 0.8 | 6.0 | -1.2 |
| Office running | 1.2 | 1.2 | 1.3 | 1.3 | 1.2 | 6.2 | -1.6 |
| Other: Concession | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 6.9 | +0.4 |
| Other: Railway | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 2.2 | -1.3 |
| **Subtotal** | **10.1** | **10.4** | **10.5** | **10.4** | **10.0** | **51.4** | **-2.6** |
| **Total** | **14.1** | **14.4** | **14.7** | **14.6** | **14.2** | **72.2** | **-6.3** |

We forecast a £6.3 million (8%) reduction in HS1 costs compared with the CP3 efficient budget (excluding R&D).

The remainder of this section sets out the rationale behind the CP4 forecasts for each category of cost.

HS1 subcontract costs are primarily single choice supplier long term RPI-linked arrangements with limited potential for future savings. Our focus is on delivering value from each of the contracts. Table 39 sets out the rationale behind the CP4 forecasts for each category of HS1 subcontract costs. While we use prices in real terms to calculate charges, we have noted where inflation is expected to have an impact on the real costs.

**Table 39: HS1 subcontract costs in CP4**

| Cost category | Comments |
|---|---|
| NR costs | Various contracted costs with NRIL. Our forecast for CP4 assumes that these charges will continue at the same level as 2024/25, resulting in a £0.4m (4%) reduction from the CP3 budget, including:<br><br>**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 CP4 is based on NRIL's indication that that OMA costs will continue at the current level (£1.7m p.a.).<br><br>**Ripple Lane:** NRIL provided Ripple Lane exchange sidings mothballing costs of £0.2m p.a., as in the CP3 submission.<br><br>**Safety audit:** High level safety audit costs of £0.1m in total for CP4. |
| 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.<br><br>Our forecast for CP4 is that these costs will continue at the 2024/25 forecast outturn level (£355k p.a.). |
| 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 CP4, we have assumed that these charges will continue at the same level as the 2024/25 forecast outturn level based on our expected usage.<br><br>This is a £1.1m (35%) reduction over the 5 years compared to the CP3 efficient budget. |

| Cost category | Comments |
|---|---|
| BTPA | Our forecast for CP4 assumes that costs will continue at the forecast CP3 exit level given no material changes to the scope of the contract. This is a £1.6m (23%) reduction over the five years compared to the CP3 efficient budget.<br><br>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. |
| 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.<br><br>For CP4, we have assumed that these charges will continue at the same underlying level as the CP3 exit forecast outturn (i.e. the level that excludes PR24 project-related fees). We have also included PR29-related project fees based on estimates provided by the ORR for CP4 as these are material costs that will be incurred by HS1.<br><br>We have also included the following costs (based on CP3 outturn):<br>• £161k p.a. for the ORR safety levy; and<br>• £38k p.a. relating to the Access Disputes Committee. |

Table 40 sets out the rationale behind the CP4 forecasts for each category of HS1 internal costs. We have built CP4 efficient costs bottom up by cost category.

**Table 40: HS1 internal costs in CP4**

| Cost category | Comments |
|---|---|
| Staff | As noted in Section 3.4.3, we have reviewed our structure to ensure it is appropriate for a steady-state business. Entering CP4, the total staff numbers have been reduced by five from the 2022/23 peak of 41 employees. This is within the efficiency opportunity range identified by Rebel OMR Effectiveness Study. This is despite significantly more complex processes including invoicing for spot bids, enhanced escrow management, and track access under different charging models.<br><br>We believe this headcount is appropriate for CP4, anticipating a steady-state HS1 asset. This gives us a CP4 entry cost aligned to the CP3 efficient budget. |

| Cost category | Comments |
|---|---|
| | Wage inflation marginally above general inflation is assumed, leading to a slight increase across CP4 in real terms.<br><br>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 a certain level of staff turnover for staff costs to reflect market rates.<br><br>As demonstrated over CP3, we will undertake work to manage the external costs on behalf of the train operators and to their benefit. Example of this are negotiating business rates with support from advisers to limit the pass through cost increase and managing the electricity hedging to provide more certainty on prices.<br><br>Staff costs for CP4 are forecast to be £1.1m higher than the CP3 efficient budget. This is due to salary increases at a senior management level, with the CEO and CFO leaving the business in 2024. Headcount is forecast to be +1.8 above the CP3 budget, with the reduction in technical support being partly offset by permanent staff.<br><br>We will continue to require the current staff resource through CP4 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. We would need to consider additional resource to support new operators. |
| Technical support/ consultancy | We conducted an efficiency review and plan to start CP4 without reliance on technical and consultancy support, other than in a few specific areas. Technical support in CP4 will focus on:<br>• Consultancy support for PR29; and<br>• Engineering and safety assurance to ensure we meet the obligations of the Concession Agreement.<br><br>In CP3, we invested in a consultant CIO to complete a strategic review of our IT infrastructure: Managing cyber risk whilst rationalising our systems and improving contracts. This has allowed us to enter CP4 with robust processes, allowing us to do more for less. |

| Cost category | Comments |
|---|---|
| | Our forecast of total spend in CP4 is around half the CP3 outturn cost. Total CP4 consultancy costs are now forecast to be £1.2m (17%) lower than the total CP3 efficient budget costs. |
| Office running | Our forecast for CP4 shows a £1.6m reduction compared with the CP3 efficient budget. The costs included in this category are:<br>• Rent and service charge (44% of total)<br>• IT/telecoms (45% of total)<br>• Other running costs (11% of total).<br><br>We have been able to fix our office rent until 2027/28 and expect a 15% increase at this point. This is significantly below comparable office space, which has seen up to 30% of rent increases over CP3. We are forecasting a £1.2m cost reduction in CP4 vs our CP3 efficient budget.<br><br>We have rationalised and improved our IT infrastructure, this has resulted in a £0.5m reduction in forecast CP4 costs (vs our CP3 efficient budget). |
| 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.<br><br>Our forecast for CP4 shows a £0.4m increase compared with the CP3 efficient budget, driven by environmental initiatives. This represents a saving against CP3 outturn of £0.5m, driven by savings on senior recruitment. |
| Other: Railway | The main costs included in Other: Railway are:<br>• £1.2m over 5 years for the rescue locomotive; and<br>• £0.9m over 5 years for route-specific PR and marketing.<br><br>Our forecast has CP4 exit costs equal to CP3 exit, which is £1.3m (37%) lower than the CP3 efficient budget, due to the removal of the Ashford IECC contract. |

### 12.4.2. Pass through costs

Our forecasts of pass through costs for CP4 are shown in Table 41.

**Table 41: Pass through costs forecast (£m, February 2023 prices)**

| | 25/26 | 26/27 | 27/28 | 28/29 | 29/30 | Total | CP4 v CP3 budget |
|---|---|---|---|---|---|---|---|
| Non-traction electricity | 2.5 | 2.3 | 2.3 | 2.3 | 2.3 | 11.6 | -0.1 |
| Energy saving projects | 0.05 | 0.04 | 0.04 | 0.04 | 0.04 | 0.2 | +0.2 |
| Insurance | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 18.8 | -0.8 |
| UKPNS O&M and renewals | 7.3 | 7.4 | 7.3 | 7.4 | 7.4 | 36.8 | -0.1 |
| Rates | 10.9 | 10.9 | 10.9 | 10.9 | 10.9 | 54.3 | -1.0 |
| **Total** | **24.5** | **24.4** | **24.3** | **24.3** | **24.3** | **121.7** | **-1.8** |

Table 42 sets out the rationale behind the CP4 forecasts for each category of cost.

**Table 42: Pass through costs in CP4**

| Cost category | Comments |
|---|---|
| Non-traction electricity | The forecast for CP4 is based on electricity price forecasts provided by our current supplier, npower, and volumes remaining constant at the CP3 level. |
| Energy saving projects | REACT was set up to consider smaller scale energy reduction initiatives to complement larger schemes (see Section 9.2). These projects are funded as pass through costs. |
| Insurance | We have assumed we will be able to continue to procure insurance at the CP3 exit rate for the remainder of CP4 with no increase in real terms. |
| 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. |

| Cost category | Comments |
|---|---|
| Rates | During CP3, HS1's business rates were moved from the control of the London Borough of Camden to the Department for Levelling Up, Housing and Communities.<br><br>The methodology for calculating business rates is de novo, meaning the methodology can change at each rates valuation. We have approached the Valuation Office to get more certainty on future revaluations; however, in the absence of any evidence to the contrary, we have assumed that the rates revaluations in CP4 will be on the same basis as the 2023 valuation i.e. a payments less receipts methodology.<br><br>For CP4, we have therefore assumed that rates will continue at the CP3 exit level with no increases in real terms (but increasing with RPI as this is the main driver of our costs and revenues). |

### 12.4.3. Freight costs

Forecast freight-specific O&M costs for CP4 are shown in Table 43.

**Table 43: Freight-specific O&M cost forecast (£m, February 2023 prices)**

| | 25/26 | 26/27 | 27/28 | 28/29 | 29/30 | Total | CP4 v CP3 budget |
|---|---|---|---|---|---|---|---|
| NR(HS) | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.39 | -0.30 |
| NRIL Ripple Lane | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 | 0.78 | -0.36 |
| HS1 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.30 | -0.03 |
| **Total** | **0.29** | **0.29** | **0.29** | **0.29** | **0.29** | **1.47** | **-0.69** |

In PR14, we agreed the treatment of freight mothballing costs with ORR. 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 long term avoidable costs category and allocated to long term common costs.

Table 44 sets out the rationale behind the CP4 forecasts.

**Table 44: Freight-specific O&M costs in CP4**

| Cost category | Comments |
|---|---|
| NR(HS) costs | This is an allocation of the costs within the total NR(HS) O&M 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.<br><br>For CP4 this is a total cost of £78k p.a. comprised of £33k p.a. variable O&M cost plus £45k p.a. long term avoidable O&M cost (exclusive of mothballing costs). |
| NRIL costs (Ripple Lane) | NRIL operates, maintains and renews the freight assets at Ripple Lane exchange sidings under a contract with HS1. For CP4, the cost of operations, inspections, regular proactive and reactive maintenance and vegetation clearance is forecast to be £332k p.a. based on indications the costs will remain flat in terms. There is also a smoothed allowance of £45k p.a. for heavy maintenance works.<br><br>Mothballing costs of £220k p.a. are subtracted from total Ripple Lane costs, with the remaining cost of £156k p.a. charged to freight operators. This is a reduction of 32% compared with CP3.<br><br>In the freight charging calculations (see Section 15.4.2), Ripple Lane costs are split between freight trains travelling to/from HS1 network via Ripple Lane onto the NRIL network (costs recovered under OMRC) and freight trains that use Ripple Lane from the NRIL network to stop/turnaround and do not access the HS1 network (costs recovered under the Ripple Lane (Domestic Sidings) charge) in proportion to the forecast number of trains operated in CP4. |
| HS1 costs | This is an allocation from total HS1 costs of those costs which are specific to freight operations.<br><br>Total HS1 costs for CP4 are forecast to be 8% lower than the CP3 efficient budget in real terms. We have therefore applied this 8% reduction to the freight element of HS1 costs in real terms; this gives a total cost for freight of £60k per annum. |

## 12.5 Traction electricity costs

### 12.5.1. Traction electricity cost forecast

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.

Forecast traction electricity costs for CP4 are shown in Table 45. This forecast is indicative only; train operators will pay for traction electricity on the basis of actual prices.

**Table 45: Traction electricity cost forecast (£m, February 2023 prices)**

| | 25/26 | 26/27 | 27/28 | 28/29 | 29/30 |
|---|---|---|---|---|---|
| Total cost | 34.7 | 29.6 | 28.7 | 28.0 | 27.3 |

This indicative forecast is based on the traffic volumes set out in Section 7.1 and electricity price forecasts provided by our current supplier, npower.

### 12.5.2. Energy Purchasing Strategy

HS1 has developed its Energy Purchasing Strategy (EPS) in response to extreme market conditions. The EPS is designed to deliver both cost and carbon benefits through:

- Purchasing 100% renewable electricity by April 2030, through the progressive introduction of PPA volume; and
- Minimising unit costs by ongoing efficiency in purchasing.

The HS1 EPS was introduced in April 2020 and has been developed in support of the HS1 Sustainability Strategy. The EPS has been reviewed and assessed by HS1's independent energy advisor, Energy Bridge UK, and endorsed as fit for purpose. Further reviews will take place on a six-monthly basis.

**Cost efficiency**

HS1 has a well-established hedging strategy, introduced in 2015, which was agreed and is regularly reviewed with TOCs. The strategy is implemented with HS1's licensed supplier, npower, through the Electricity Supply Contract (ESC).

The hedging strategy has provided mitigation against short term electricity price volatility since 2015. The market changed significantly in 2022, due to the conflict in Ukraine, and although there are now signs of current market softening it is likely that electricity prices will remain high and volatile for the foreseeable future. In response to this volatility, and to address TOC feedback, HS1 is considering refinements to the hedging strategy.

The purchasing mandate provided to npower includes choices around risk, complexity and renewable energy. The purchasing strategy sets the parameters for npower to leverage its specialist experience and capability in purchasing wholesale electricity on behalf of HS1 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. Given that the cost is passed through to our customers, HS1 places significant weight on their views in determining which strategy to adopt. We review the purchasing strategy every six months in conjunction with TOCs.

The phased procurement and implementation of PPAs providing long term (10 year) price certainty is also part of the purchasing strategy agreed with the TOCs.

As in CP2/3 HS1 remains open to changing the approach to purchasing under its ESC and notes 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.

Our hedging strategy applies to wholesale commodity prices and has no impact on non-commodity charges imposed by government, which are either directly proportional to consumption or contain both fixed and variable elements, and which typically make up c 50% of the total unit cost of electricity. HS1 is considering future mitigation of non-commodity charges by exploring the feasibility of a private wire PPA which involves commissioning a direct connection from a Kent solar installation adjacent to the route into the HS1 power distribution system, working in collaboration with UKPNS. This would avoid significant non-commodity charges and strengthen HS1`s green energy credentials by having a fully traceable renewable source of supply direct into the HS1 network. A private wire feasibility study in 2021 concluded that the cost for the physical connection to UKPNS assets was prohibitive. HS1 is now pursuing this scheme through a different technical approach and, subject to feasibility, the scheme will be developed during CP4.

We have introduced regular monthly reporting and meetings at operational and senior level. We have also accepted the recommendation from our independent energy advisor to introduce a Quarterly Energy Risk Management Committee, to oversee the electricity hedging process and strategic direction. The first meeting was in September 2023 and was attended by senior representatives of EIL and SETL.

**Renewable sourcing**

In April 2020, HS1 purchased general Renewable Energy Guarantees of Origin (REGOs) for two years. During this time the unit price of REGOs rose from £0.45/MWh to £5.50/MWh; as a result we did not renew them in April 2022.

HS1 has now procured (in 2021) and traded (in 2022), its first Corporate Power Purchase Agreement with a renewable generator. This is now in operation, providing 10MW (c. 40% of total volume) of renewable baseload electricity for a fixed term of 10 years (5MW from October 2022 and a further 5MW from April 2023) at a fixed price allowing for a fixed level of seasonal

indexation at 1.425%, providing TOCs with price certainty in what is set to remain a volatile commodity market.

Subject to TOC agreement, the intended next phase of PPA development will be to secure a further 40% for 10 years from April 2025, noting also the private wire aspiration referred to above. HS1 will find a suitable solution for the residual supply (not provided by renewable PPAs) by 2030. The HS1 100% renewable target by 2030 is ambitious and is ahead of the National Grid decarbonisation target of 2035.

**Electricity Supply Contract (ESC)**

The current ESC with npower has been in operation since 2015 and will operate until the end of its full 10 year term in March 2025. HS1 completed the procurement of the next generation in order to be available for forward purchasing from spring 2024, and supply from spring 2025. The contract duration is five years with options to extend up to ten years.

Electricity Risk Management services (ERMC) have been separately awarded. This ensures this service, which was previously also supplied by npower, is fully independent.

These awards are expected to generate savings compared to the existing contract as a result of the competitive tenders undertaken. HS1 will work collaboratively with its customers and the ERMC supplier to formulate and implement an electricity hedging strategy to achieve the optimum outcome in balancing cost and risk.

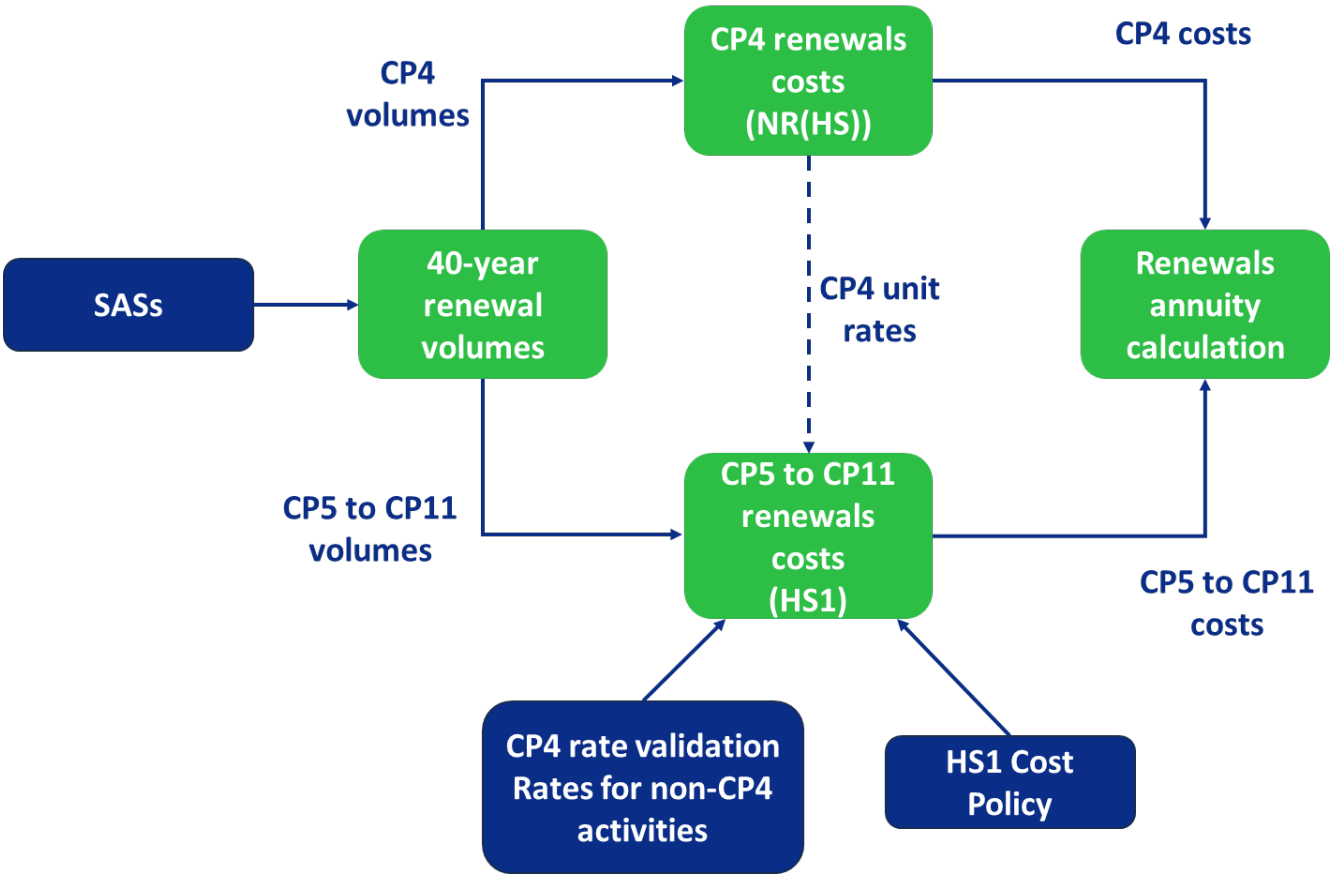
# 13 Route renewals

## 13.1 Overview

The HS1 route is now over 15 years old. As the asset ages, renewals volumes are increasing. To meet our 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 their delivery.

Figure 34 summarises the process by which we have developed the long term renewals volumes and costs which feed into the renewals annuity calculation.

**Figure 34: Process for developing long term renewals volumes and costs**




During CP3, there have been significant improvements in asset management capability (as discussed in Section 10) which have supported NR(HS)'s approach to developing the 40-year renewals workbank. The 40-year renewal volumes (CP4 to CP11) are based on the NR(HS) SASs and are discussed in Section 13.2.

Section 13.3 describes how NR(HS) has developed, and HS1 has assured, the CP4 renewals cost estimate. With HS1 support, NR(HS) has moved from a project level workbank to a portfolio-based packaging approach to ensure the efficient management and delivery of renewals. The most significant cost in CP4 is the ballast cleaning programme; work is ongoing to validate the current cost estimate and delivery strategy. This section also summarises progress made by NR(HS) in developing its strategy for CP4 renewals; and HS1's proposed refinements to renewals governance to improve efficiency, building on maturity improvements in CP3.

Section 13.5 sets out how HS1 has established the renewals cost estimate for CP5 to CP11. For PR24, HS1 has funded and developed the Cost Policy which provides a structured and transparent approach to pricing long term renewals, recognising the inherent uncertainty of forecasting so far into the future.

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 CP4 are discussed in Section 13.6.

## 13.2 Renewals volumes

Significant improvements in asset management capability in CP3 have supported NR(HS)'s approach to developing the renewals workbank. Renewals volumes developed by NR(HS) for PR24 are better informed than at PR19 and, in some cases, the volume of renewals forecast to be required is lower than at PR19. The renewals volumes proposed by NR(HS) were subject to assurance by HS1, as discussed in Section 10.7. This included an iterative process of document reviews, meetings with NR(HS) Heads of Asset and an extensive programme of site visits. In addition, Arcadis provided an independent review of the track SAS and track deterioration model. As a result of HS1 challenge, further reductions in renewals volumes have been achieved.

**Track assets:** The assurance did not identify reasons to challenge the renewal volumes proposed by NR(HS), given the iterative assurance undertaken during the development of the track deterioration model. It should be noted that, subsequently, some ballast renewal volume was moved from CP4 to CP5 to support deliverability (see Section 13.3.2).

**Civils, OCS, TPS, M&E assets:** As a result of the assurance process some renewals have been moved from CP4 to CP5, and there have been reductions in renewals volumes both over CP4 and over 40 years. Agreement has been reached between HS1 and NR(HS) on the workbank for these asset classes.

**S&CS assets:** There have been some reductions in renewals volumes in CP4 and over 40 years. NR(HS) has taken HS1's feedback on board and sought guidance from manufacturers. The SAS has been revised following manufacturers' advice. There remains uncertainty around assets which will likely be replaced by ERTMS and the management of obsolete control system assets. These are summarised below.

- The **Signalling System** is expected to be upgraded to ERTMS in CP5, with a full transition completed by CP6. ERTMS early planning and design works in 2024 will provide the necessary information to take an informed view about the timing and approach to ERTMS implementation (see Section 3.7.1). All of the signal renewals proposed over the next 40-years will be impacted by the transition to ERTMS. The following renewal volumes and costs remain in our renewals workbank but will be reviewed as the ERTMS scope is developed:
  - Signalling relays;
  - Integrated Train Control System (ITCS);
  - Train protection;
  - EZP 4 foot plaques and marker boards; and
  - Vehicle Health Monitoring Equipment (VHME).
- **Control Systems** include the Route Control Command System (RCCS), Electrical Maintenance Management Information System (EMMIS) and Ventilation Control System (VCS). All three are obsolete or will become obsolete during CP4. NR(HS) has asked Hitachi if it has enough spare parts available and will enter into a contract to support these systems until 2033. Hitachi has not yet confirmed whether it can support these systems. In the absence of Hitachi support, NR(HS) has included replacement of the EMMIS, VCS and RCCS systems in the CP4 workbank. If Hitachi confirms that any of the systems will be supported, the workbank will be adjusted.

A summary of the key CP4 renewals and 40-year renewals by asset type is set out in Table 46 More detail is set out in in Sections 5 and 6 of the SASs.

It is not possible to make direct comparisons with PR19 volumes on all asset classes, as the baseline measures have changed and new work types have been identified. However, a high level summary of the key changes over 40 years is set out below:

- **Track:** Deterioration modelling has allowed an 18% reduction in ballast, 31% reduction in re-railing and 43% reduction in sleeper renewals;
- **Civils:** Units of measurement have changed making direct comparison difficult. There are additional renewals for mid-life refurbishment of a proportion of overbridges, underbridges, earthworks and retaining walls.
- **OCS:** Volumes have reduced as full renewal is now outside the 40-year period based on current condition and wear rate.
- **Signals:** Reduction in points operating equipment renewals based on refined condition and performance information.
- **Plant:** Volumes have increased as Multi-Purpose Vehicles (MPVs) and associated modules are renewed in CP11.

**Table 46: Key route renewals in CP4 and over 40 years**

| Asset | Overview | Key CP4 renewals | 40-year renewals |
|---|---|---|---|
| **Track** | Track assets deteriorate relative to tonnage carried. Significant renewals to ballast and rail are planned for CP4 and beyond. | Ballast half-life refurbishment, small lengths of rail, switches and crossings around St Pancras. | All assets reach end of life and significant renewals programmes needed to rail, ballast, sleepers and switches and crossings.<br><br>Renewals optimised through modelling to consider supply chain capacity, access windows and intervention methodology. |
| **S&CS** | Many S&CS assets are affected by obsolescence which is driving a significant number of renewals where manufacturers no longer provide support for critical assets.<br><br>Following an increasing trend in S&C defects during 2023, RCM, training and planned maintenance activities have been improved.<br><br>We plan to replace our TVM430 signalling system with ERTMS in CP5. Prior to this, obsolete assets will be managed where safe and reliable to do so. | Points operating equipment, ERS / EZP switches – obsolescence and condition driven renewals.<br><br>GSM-R to be managed at lowest cost until ERTMS is introduced.<br><br>Controls – renewal of RCCS, EMMIS, VCS and Dewatering due to obsolescence. | ERTMS planned for CP5.<br><br>(Note that ERTMS is treated as a Specified Upgrade) |

| | | | |
|---|---|---|---|
| **Civils** | Civils assets are generally long life assets and are performing well.<br><br>Design life, asset degradation rates and AMO criticality drive renewals forecasts using inspection condition information. | Drainage, acoustic barriers, fencing, earthworks and retaining walls. | Mid-life refurbishment to many long life assets such as bridges, viaducts and retaining walls. Extensive renewal volumes for end of life assets including fencing, acoustic barriers, tarmac. |
| **M&E** | Covers a broad spectrum of assets including fire detection, lighting, heating, pumping and tunnel ventilation.<br><br>Assets have a relatively short life typically between 20-40 years with many already reached end of life and replaced in CP3, further renewals planned for CP4 and beyond. | Renewals to a range of assets driven by condition or obsolescence including UPS, pipework, pumps, cooling and ventilation. | Steady rate of renewals across all asset types driven by either condition or obsolescence. |
| **OCS** | The overhead catenary system is considered to be in a relatively good condition with limited signs of ageing. It is relatively early in the asset lifecycle. | Minor section insulator renewals. | Section insulator renewals. |
| **TPS** | TPS assets are generally in a condition commensurate with their age, with no significant degradation.<br><br>However, the FBM 97 sectioning switches are at the end of their service life and need to be renewed. | FBM 97 sectioning switches. | Switchgear and AC/DC isolation transformers. |

## 13.3 CP4 renewals

### 13.3.1. HS1 assurance of CP4 renewals costs

HS1 has assured the CP4 renewals pricing through scrutiny and challenge of the NR(HS) estimating methodology and its application as part of our joint three stage assurance process:

- Level 1 NR(HS) Internal Assurance
- Level 2 Internal Corporate Oversight: Joint assurance from HS1 and NRIL, with a specific focus on proposed unit rates, the cost build-up process, historical delivery comparators and efficiency stretch targets (i.e. ballast unit rates).
- Level 3 External Challenge (HS1 Assurance): HS1's holistic review of the NR(HS) Route 5YAMS submitted to HS1 in September 2023.

HS1 focused on challenge and review of each of the 18 renewals that was over £3m in value, which in total equated to c. 85% of the workbank. The line of enquiry followed a pre-project gate business case methodology. In parallel to the pre-project gate review, HS1 analysed the NR(HS) cost build up; examples of issues considered are:

- The type of renewal or replacement i.e. component replacement or full renewal;
- For each volume, comparing the total indirect cost as a percentage of direct costs;
- The design effort required where design work is repetitive and standardised;
- Known recent costs from year 4 of CP3, delivery and management; and
- Challenging the methodology for indirect cost application.

HS1 also reviewed where volumes could be smoothed where they spanned control periods, considering the total volumes required to be delivered and market interest, i.e. short intense periods of delivery vs longer regular work. The main outcome of this work was a transfer of 25% of the CP4 ballast cleaning programme to early in CP5.

As a result of this assurance, the CP4 renewals cost estimate reduced from £325.0m in April 2023 to £216.6m in January 2024. Section 9.5.6 of the NR(HS) Route 5YAMS gives further detail of the assurance process and the reduction in the CP4 renewals cost estimate at each stage of the process. Based on the methodology followed by NR(HS) and the changes it made during the assurance process, HS1 supports the CP4 renewals costs as presented in the NR(HS) Route 5YAMS.

### 13.3.2. CP4 renewals costs

The CP4 renewals cost estimate was developed in accordance with the Rail Method of Measurement (RMM1). This method was developed by NRIL in collaboration with the wider industry to ensure transparency, consistency, and comparability for railway project delivery. NR(HS) engaged PA Consulting and Mott MacDonald, a professional estimating body, to

undertake the CP4 renewals estimate modelling. Mott MacDonald built on its experience of working with NR(HS) on CP3 renewals cost estimating.

With HS1 support, NR(HS) has moved from a project level workbank to a portfolio-based packaging approach to ensure the efficient management and delivery of renewals. Where, practical, this includes integration across route and stations.

As noted in Section 3.5.3, we undertook a CP3 renewals workbank review in 2022/23, as a result of which some renewals volumes were deferred to CP4. These deferred volumes have been reviewed and, where required, included as CP4 volumes and phased according to their updated engineering priority. The most significant change was the deferral of the 30km ballast refurbishment project to CP4.

The CP4 renewals cost estimate is made up of three major components: base cost, risk allowance and mark-up, each of which is explained below.

**Base cost**

The base cost includes all direct and indirect costs associated with delivery of the work (direct construction works, contractors' preliminaries and temporary works, PMO/General management, design, contractors' overheads and profits and engineering access).

Direct construction costs were developed using sources appropriate to the scale of the workbank, scope detail, and delivery methodology. These include:

- Engagement with supply chain to gain current market information where the likely route to market is known;
- Unit rates and associated learning from work delivered in CP3; and
- Where CP4 work is new to HS1 and the scope and/or methodology are not known to allow NR(HS) to perform a bottom-up cost build, NRIL delivered rates have been used as a benchmark.

Additionally, the cost estimating has been overlaid with additional intelligence where efficiencies and/or cost reductions can be made; for example, via the rail plant strategy, renewals to maintenance initiative, economies of scale through delivery of ballast campaign and workbank validation.

The original approach to PMO and Management was to apply a fixed percentage overhead for all renewals. In collaboration with HS1, NR(HS) updated its approach to apply appropriate percentages for different renewals based on complexity and to align with HS1's application of PMO, in which:

- Portfolio Management (renewals leadership and assurance team) has been costed as a fixed amount for CP4 in line with CP3 actuals; and
- Project Management (Direct management resources allocated to project delivery) has been included in the direct cost of delivery. If volumes are deferred or not required, or there is a

change in quantity, each project can be change controlled in isolation from the 'global' Portfolio Management fixed amount.

**Risk allowance**

In PR19, NR(HS) followed the RMM1 methodology for calculating risk allowance. RMM1 is typically used for large railway construction projects. Whilst RMM1 can provide a sensible portfolio level risk allowance, it does not fully recognise component-based renewal portfolios or annualised programmes, which can result in an overstated risk estimate.

For CP4, an improved methodology has been used by NR(HS) to provide a more appropriate assessment of the required risk budget, considering several factors against the type of project. The three categories of risk and uncertainty considered are:

- **Estimating uncertainty:** the risk that the budget for the work will increase before delivery has started due to unforeseen elements associated with the design, planning and delivery of the works;
- **Delivery risk:** considers complexity, type of access required (disruptive or non-disruptive), resource requirements (plant & people) and delivery approach; and
- **Gate stage:** considers the repetitive renewal nature and volume quantity to determine whether Gate stages can be combined.

When the final out-turn cost for each project is understood, the baseline risk allocation will be evaluated and fed back into future costing models, continuously improving HS1's cost book.

**NR(HS) markup**

Under the Operator Agreement, NR(HS) can charge a 10% mark-up of the final cost.

**Renewals to Maintenance (R2M)**

One of the PR24 sprint initiatives explored with stakeholders was the management and delivery of the less complex and more repetitive asset renewals via the NR(HS) maintenance teams. This would align with the progressive renewals delivery approach implemented in year 4 and 5 of CP3 and would create cost efficiencies through the application of more streamlined governance processes for these renewals. An asset decision tree was designed to mitigate against the differing definitions of maintenance and renewals.

The CP4 costed workbank has categorised volumes as either Renewals or Renewals to Maintenance (R2M) with the indirect cost and risk application taking into account the proposed delivery methodology. This would deliver an efficiency over the course of CP4:

- More streamlined governance process achieves a saving in indirect costs of £1.2m; and
- The differential between the O&M management fee and the Renewals markup would achieve a reduction of £0.9m.

For CP4 we propose to run a trial where the work identified as R2M remains in the renewals workbank but is treated separately from the major renewals. This work will be funded from the renewals escrow account but we propose to use a streamlined funding approval process; we will develop a proposal for the streamlined governance approach for the Final 5YAMS submission. As we propose to retain R2M in the renewals workbank, we have assumed that only the efficiency from streamlined governance is achieved.

**Capability and governance improvements**

In addition to the CP4 costs developed by NR(HS) for the renewals work packages, HS1 has included:

- £2m for progression of the target state Capability Development Partner model developed in CP3; and
- £500k to develop and implement physical, automated project management systems to cater for the increased workbank in CP4 and beyond.

Costs by workbank package are summarised in Table 47. The NR(HS) Route 5YAMS Table 14 provides more detail on the renewals works included in each of the workbank packages.

**Table 47: CP4 renewal costs by workbank package (£ million, February 2023 prices)**

| Workbank package | Direct cost | Indirect cost (exc risk) | Risk allowance | NR(HS) markup | Total cost | Risk as a % of base cost |
|---|---|---|---|---|---|---|
| Ballast | 46.2 | 15.5 | 19.1 | 8.1 | 88.9 | 31% |
| Track | 1.3 | 0.4 | 0.4 | 0.2 | 2.3 | 21% |
| Civils | 11.4 | 4.8 | 2.4 | 1.9 | 20.4 | 15% |
| Control Systems | 5.1 | 2.1 | 1.1 | 0.8 | 9.2 | 16% |
| Data & Comms | 11.2 | 3.0 | 4.0 | 1.8 | 20.0 | 28% |
| Lifts & Escalators | 0.2 | 0.1 | 0.0 | 0.0 | 0.3 | 2% |
| Mechanical & Electrical | 6.1 | 3.7 | 1.1 | 1.1 | 12.0 | 11% |
| Overhead Line | 3.5 | 3.7 | 0.9 | 0.8 | 9.0 | 13% |
| Rail Plant | 12.4 | 0.8 | 1.5 | 1.5 | 16.3 | 11% |
| **Subtotal** | **97.5** | **34.1** | **30.5** | **16.2** | **178.4** | **23%** |

| Workbank package | Direct cost | Indirect cost (exc risk) | Risk allowance | NR(HS) markup | Total cost | Risk as a % of base cost |
|---|---|---|---|---|---|---|
| Renewals to Maintenance | 25.4 | 7.8 | 1.5 | 3.5 | 38.2 | 5% |
| Capability and governance improvements | 2.5 | - | - | 0.3 | 2.8 | - |
| **Total** | **125.4** | **42.0** | **32.1** | **19.9** | **219.4** | **19%** |

Given the significant cost and complexity of the ballast cleaning programme, and the fact that it is new for the HS1 system, HS1 has requested NR(HS) to provide a separate strategy document including a first principles costed worked example. This will be included in the Final 5YAMS.

**Ballast cleaning**

The ballast cleaning programme, a strategic renewal to provide mid-life intervention and extend asset life on 45km of track, is the largest workbank package in CP4. 30km is deferred from CP3 and 15km is new CP4 works. The 40-year renewals volumes show a continued need for a consistent volume of ballast cleaning of c. 40km every control period.

During the development of the ballast cleaning campaign in CP3, an innovative technique using Pandoscope technology (part of our CP3 R&D programme) was integral to the decision to defer work into CP4. The information collected so far represents a snapshot in time and is a function of traffic and maintenance activities. The dataset will be improved through the remainder of CP3 and CP4 to better understand ballast condition and the factors which influence it.

NR(HS) undertook a competitive tendering exercise for the ballast cleaning programme in CP3. There was a low level of market interest in the initial tender due to relatively low volumes compared with other networks. A decision was made to pause the tender to review the contract and scope, taking steps to reduce foreseen contractor risks, such as free issuing, supply and delivery of the ballast. In parallel, NR(HS) undertook additional surveys to validate the ballast condition. As a result, the CP3 ballast cleaning volume was deferred to CP4. As the volume of NRIL ballast cleaning reduces in NRIL's CP7 (2024-2029), NR(HS) is investigating the opportunity to use the available plant and resource within Network Rail High Output division, which could provide an economic option for delivery. This is currently the preferred option being explored by NR(HS).

During the 2023 workbank review, CP3 funding was retained for NR(HS) to undertake further development work for the ballast cleaning programme, this work has focused on the following enabling activities:

- **Operating base:** A feasibility report identified a suite of options to provision an operating base on the HS1 network; this could increase productive time and allow for consecutive nights working. Next steps to realise this have been identified.

- **Commercial mechanism:** Commercial methods are being explored to ensure security of supply and to ensure methods are acceptable for all stakeholders.
- **Delivery team:** Initial competency assessment for the programme considering management and delivery of the work to feed into procurement and scoping documentation.

The current NR(HS) RMM1 base cost of £1.4m per km is a significant increase compared to the PR19 value of £575k per km as a result of changes in productivity, material price and labour cost assumptions. While the base cost is broadly supported by HS1 with the current information provided, the Anticipated Final Cost (AFC) rate of £1.97m per km (when risk and NR(HS) markup is added) is a significant cost per track km. As ballast cleaning makes up c. 25% of the cost of the 40-year workbank, it is important to better understand the costs.

HS1 has scrutinised the base cost and AFC rate with NR(HS). NR(HS) has undertaken benchmarking and fact-finding exercises over the last six months in order to assure the rate being proposed for delivery in CP4. An analysis of NRIL-delivered high output ballast cleaning campaigns has been undertaken to compare the bottom-up rate to that delivered by NRIL in its CP6. There was a significant range of delivered rates across the NRIL Routes and Regions, which is reflective of the different delivery conditions (e.g. access, worksite size, asset condition, operating base locations) across such a varied geography and asset base. NR(HS) has stated that its costs are comparable with costs on the NRIL network but has not shared the analysis with HS1.

HS1 is collaborating with the Railway Industry Association (RIA), to explore a joint challenge with RIA members, to assist in validating the current cost estimate, delivery strategy, innovation applied (both methodology and solutions), constraints and opportunities of the HS1 system and to understand the benefits of combining with other workbank volumes. The engagement will include:

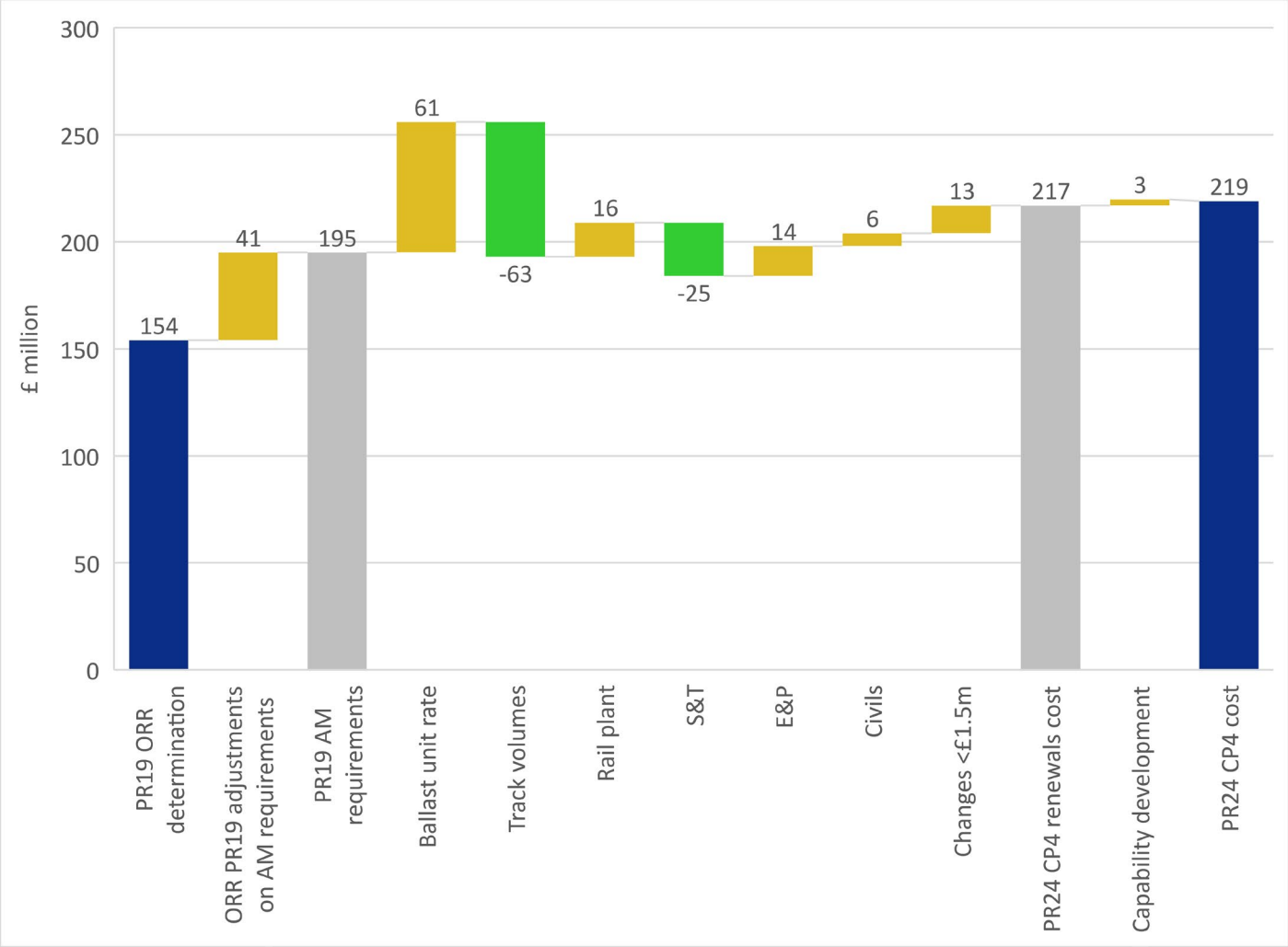
- RIA hosting a round table event to frame the problem – March 2024
- Bi-lateral meetings with selected supply chain to discuss volumes, efficient packaging of work and conditions to establish best cost – April 2024
- Refining the approach to establishing a more accurate cost. – May 2024

It is anticipated that by September 2024 we will have greater certainty on time, cost and deliverability, and this will feed into the ORR's Final Determination.

**Comparison with the PR19 estimate of CP4 renewals costs**

Figure 35 compares our forecast of CP4 renewals with the PR19 estimates for CP4 renewals (inflated to February 2023 prices).

**Figure 35: CP4 renewals comparison PR19 to PR24 (£million, February 2023 prices)**

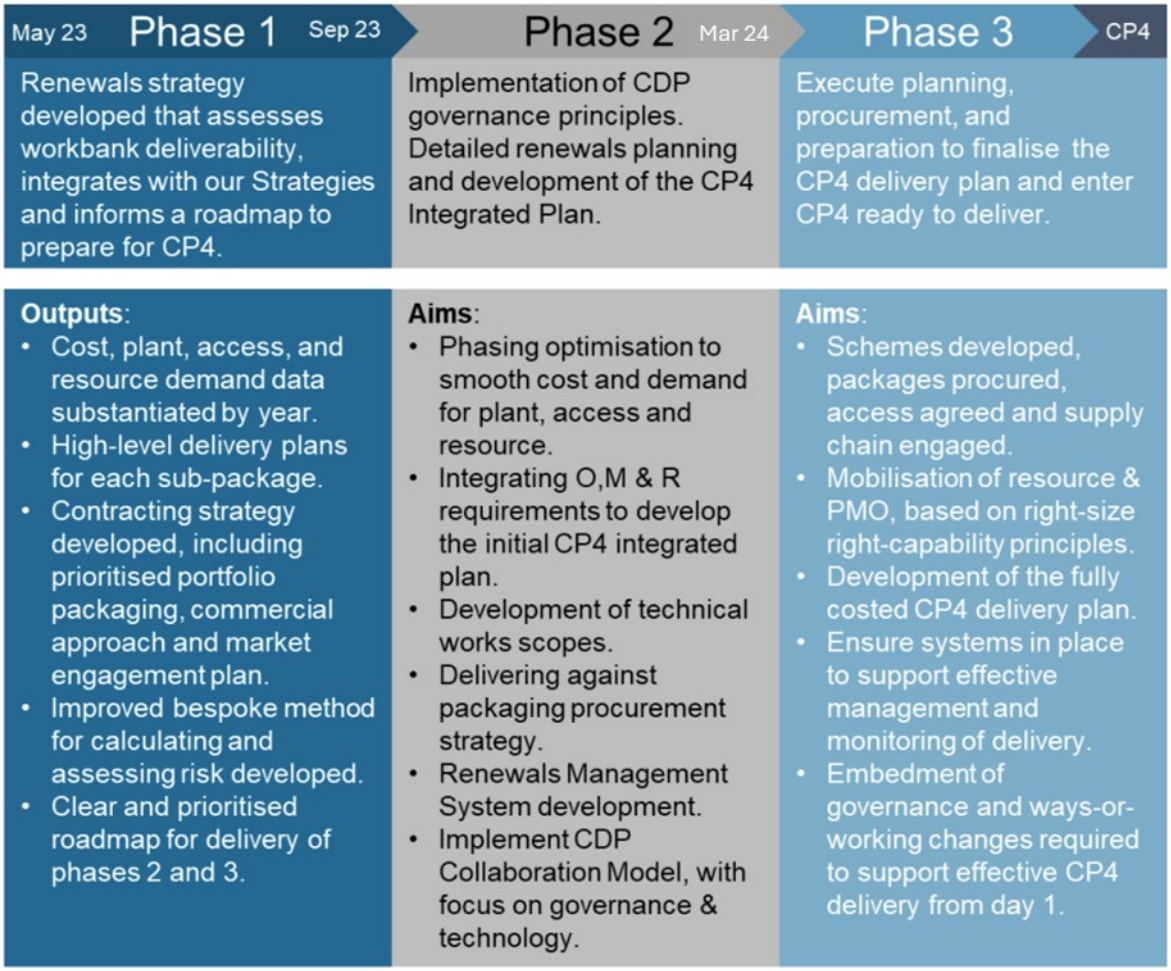



### 13.3.3. CP4 project delivery

There is a significant increase in renewals volumes in CP4 compared with CP3. This increase will require focused effort to ensure success in CP4, including readiness of delivery plans, capability, changes in ways of working and proactive stakeholder engagement.

Supported by HS1, NR(HS) has made substantial progress in developing its strategy for CP4 renewals. The three phase approach started with the development of a Renewals Strategy and will continue with readiness planning and execution as shown in Figure 36. The NR(HS) Renewals Strategy (see Appendix 15 of NR(HS) Route 5YAMS) is a step change in the maturity of renewals planning. HS1 will ensure Phases 2 and 3 are undertaken in line with the plan set out in the Renewals Strategy.

**Figure 36: CP4 renewals strategy**




In parallel with the work on the Renewals Strategy, HS1 will sponsor NR(HS) in the CP4 readiness works; these are planning, scoping and procurement strategies for CP4 renewals projects to ensure seamless delivery of works as we start CP4. In the March 2023 workbank reconciliation, £1.4m was allocated by HS1 for the development of CP4 schemes in year 5 of CP3. NR(HS) is producing a Gate 1 paper to draw down on funds for this work.

### 13.3.4. CP4 renewals governance

HS1 has undertaken reviews of the Renewals Governance Handbook implemented in CP3, and feedback from stakeholders at Quarterly Asset Renewal Review meetings to understand areas for maturity development and continuous improvement of governance arrangements. In CP3 we have made the following governance and assurance improvements:

- Improvements in the Renewals Board meeting structure;
- Improvements in the renewals reporting line of sight;
- Introduction of PowerBI to drive renewals reporting;
- Introduction of key milestone metrics;

- Introduction of lead indicator reporting;
- Introduction of Employers Requirement: Project Change;
- Maturity in change management aligning towards NEC best practice;
- HS1 delivering briefings to the NR(HS) Project Management team; and
- Sharing of document review notices (DRNs) with ORR and DfT to provide assurance of HS1 challenge.

HS1 will continue to mature its renewals governance approach to ensure it is fit for purpose for the workbank and aspires to best practice.

The volume and value of renewals in CP4 will be a step change compared with previous control periods as would the volume of gate and change papers requiring regulator review under the current governance framework. This would present a risk of delay and cost increase to renewals delivery. Based on the maturity evidenced by the governance and assurance improvements in CP3, which have grown confidence in HS1's management and governance of renewals, HS1 proposes to further refine the funding pre-approval process by:

- Using the periodic review determination to provide HS1 financial authority for all projects in the control period.
- Moving to a portfolio-level governance approach whereby HS1 manages project variances within the overall portfolio budget and reports quarterly to ORR and DfT on changes or to seek approval where the portfolio budget needs to be increased or where a new project is introduced.
- Continuing towards NEC best practice contracts and change management process, supported by workflow solutions to more efficiently manage gateway and change approvals.

The benefits of moving to this portfolio approach are:

- Greater efficiency through reduced duplication of assurance;
- Reduced risk of cost increases and delay due to governance overburden; and
- More efficient management of a dynamic renewals portfolio focused on ensuring that the asset stewardship responsibility is met.

The governance improvements made in CP3 will be used to provide assurance that the renewals reflect good asset stewardship and will be supplemented by the implementation of a workflow management tool which is currently being investigated. The governance approach will be formalised through a review and update of the Renewals Governance Handbook to ensure that the governance approach is fit for purpose. We are separately engaging with ORR and DfT on the proposed updates to handbook.

Within the NR(HS) 5YAMS, specifically the CP4 Renewals Strategy, NR(HS) has proposed improvements to renewals governance: full project authority granted to NR(HS) via the determination process, and that NR(HS) manages project process/governance gates (with the

exception of significant projects where HS1 requests approval of Gate 4). HS1 does not currently fully support this but will explore how the management and delegation of specific quantified risk allocation could be used to better manage risk on a proactive basis.

## 13.4 Renewals capability development programme

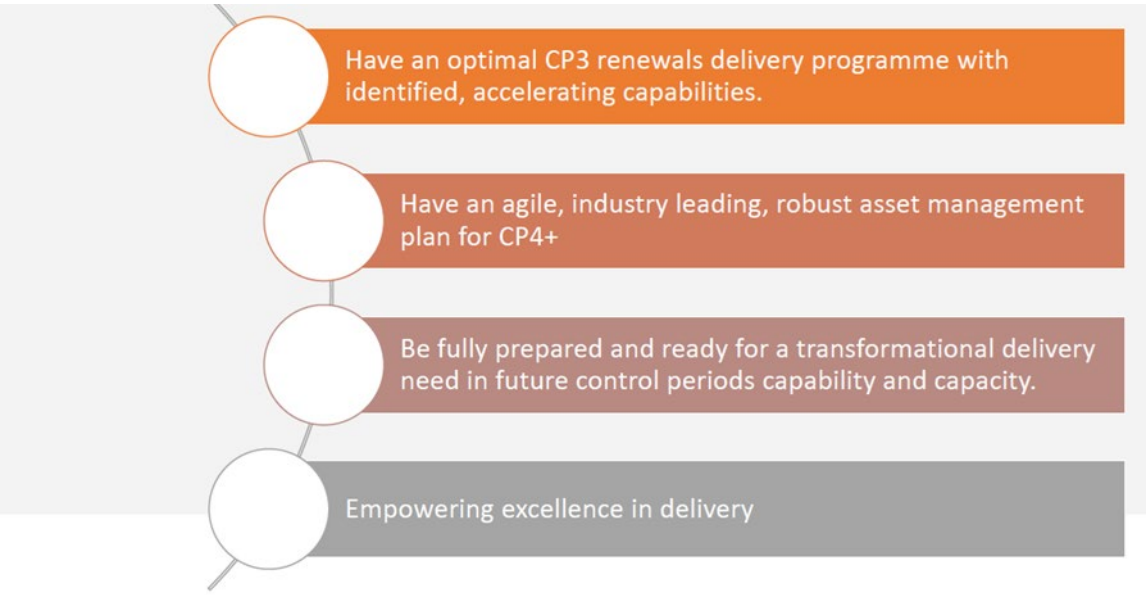
In 2018, to inform the PR19 submission, HS1 appointed Bechtel to undertake a deliverability study, develop a renewals plan and build understanding of:

- What renewals would be deliverable within limited disruptive access under a 7-day railway philosophy.
- What a high-level, cost loaded renewals master plan would look like, considering optimal delivery times, access and delivery models.
- What further work is required to provide a frontier shift.

One of the outputs of this study was the recommendation of a Delivery Integrator model as the most efficient model for the delivery of future renewals. The PR19 Final Determination included funding to further develop long term renewals planning.

In 2021, building on the outputs of the deliverability study, NR(HS) and HS1 jointly agreed with the ORR to progress an investment programme to define, source and embed a Delivery Integrator Partner. PA Consulting and Mott MacDonald were appointed to develop this new capability development programme. Another objective of this work was to bring innovation to how we think about asset management, how we collaborate more efficiently across the system and how we think about the commercial and procurement capabilities that would be required to generate an integrated and efficient system approach. Figure 37 shows the vision of the programme.

**Figure 37: Renewals capability development programme vision**

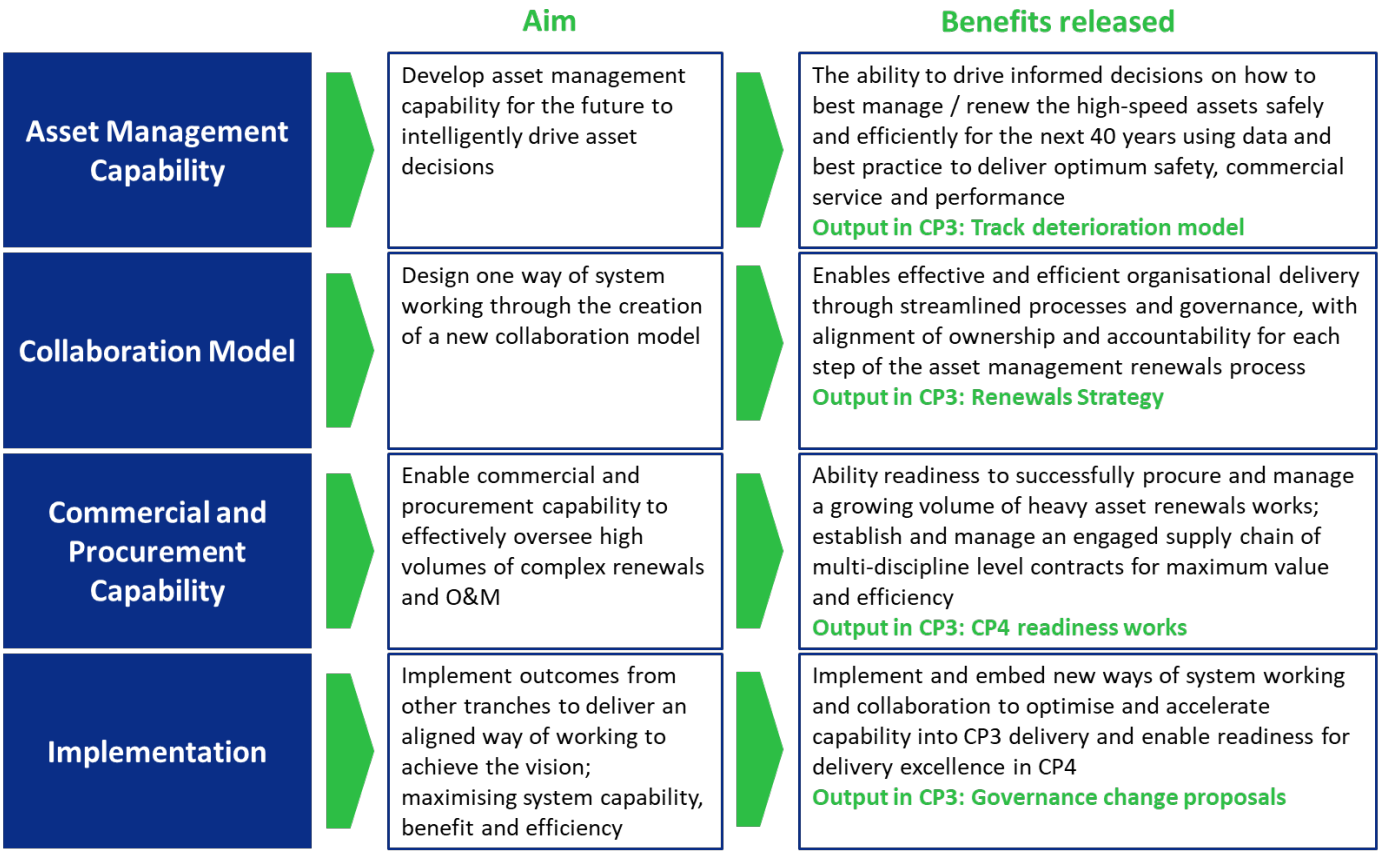


The objective was to develop a plan for capability change in the HS1 system to support the transformation from a railway being operated and maintained, to one that also requires a programme of heavy asset renewal and upgrades. The programme looked to deliver the following:

- To design and create the HS1 system organisation that is fit for purpose to ensure business objectives are met.
- To ensure capabilities are matured in such a way as to drive incremental benefits for each investment made.
- To set out and deliver the prioritised phases of capability change to support the activities of the system to drive the capability, innovation and engineering challenge necessary to maximise renewal effectiveness and cost efficiency.
- To bring confidence, through the use of the best industry expertise supporting the development of the 40-year plan, to a reduced cost of renewals against the alternative base cost assumption.

Figure 38 sets out the aims and benefits of the capability development programme and the outputs delivered to date.

**Figure 38: Renewals capability development programme outputs**



The capability programme, with input from HS1, contributed to the development of NR(HS)'s Renewals Strategy (see Section 13.3.2) where this work will continue in CP4.

During early development of the CP4 workbank, it became clear that the total renewals volume for CP4 was not of significant enough magnitude to warrant a Delivery Integrator. To align with this development, the Capability Development Partner concept was established with two stages: an interim state (pre-CP5) and the target state (CP5 onwards). Optimal timing for implementation of the target state will be reviewed through PR29 development during CP4.

For the interim state, to ensure all enablers and actions are captured, monitored, and delivered where a compelling business case exists, a Renewals Readiness Plan has been developed and is continuously updated. Progress against this plan will be managed in Delivery Readiness Reviews on a periodic basis through to the start of CP4.

## 13.5 40-year renewals

### 13.5.1. Cost Policy

For each periodic review, NR(HS) provides a 40-year forecast of renewals volumes and renewals costs for the next control period only. HS1 establishes the cost estimate for the remaining 35 years. The 40-year renewals cost estimate is a key input into the annuity calculation for the funding of future renewals; the annuity must balance future cost uncertainty with not being uneconomic for train operators.

For PR24, HS1 has developed a structured and transparent approach to pricing long term renewals which recognises the inherent uncertainty of forecasting so far into the future. HS1 funded and developed the Cost Policy which sets out the principles and methodology for forecasting indicative long-term renewals costs for the HS1 route through the assessment and quantification of uncertainty. The Cost Policy was developed with PA Consulting and Mott MacDonald and is provided as a supporting document to this Draft 5YAMS.

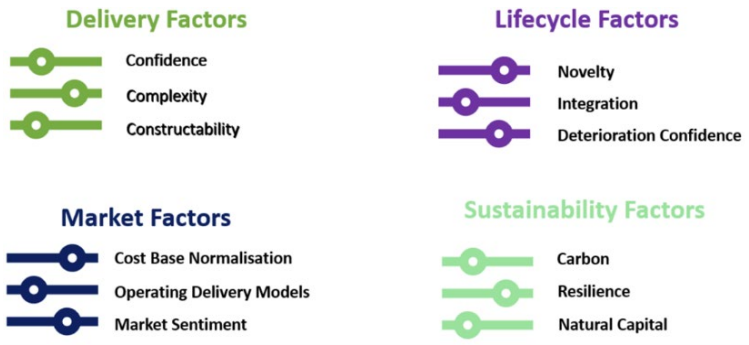
The policy builds on a base cost estimate, derived by applying unit cost rates to the 40-year renewals volumes, and calculates a probabilistic anticipated final cost range which considers long-term future uncertainty scenarios that could impact the base cost estimate over time.

The Cost Policy established four time horizons, to reflect increasing uncertainty over time:

- Immediate CP4 (2025-2030)
- Near-term CP5 (2031-2035)
- Medium-term CP6-CP7 (2036-2045)
- Long-term CP8-CP11 (2046-2065)

It also sets out four adjustment levers (each with three sub-levers) which reflect the factors that are anticipated to contribute to future cost uncertainty.

- Delivery Factors: impact productivity and constructability of assets.
- Market Factors: affect the cost estimate as a result of wider market issues, inflation, bull market etc.
- Lifecycle Factors: impact what the asset looks like over time; innovation, integration to changing wider infrastructure, or how the asset is run.

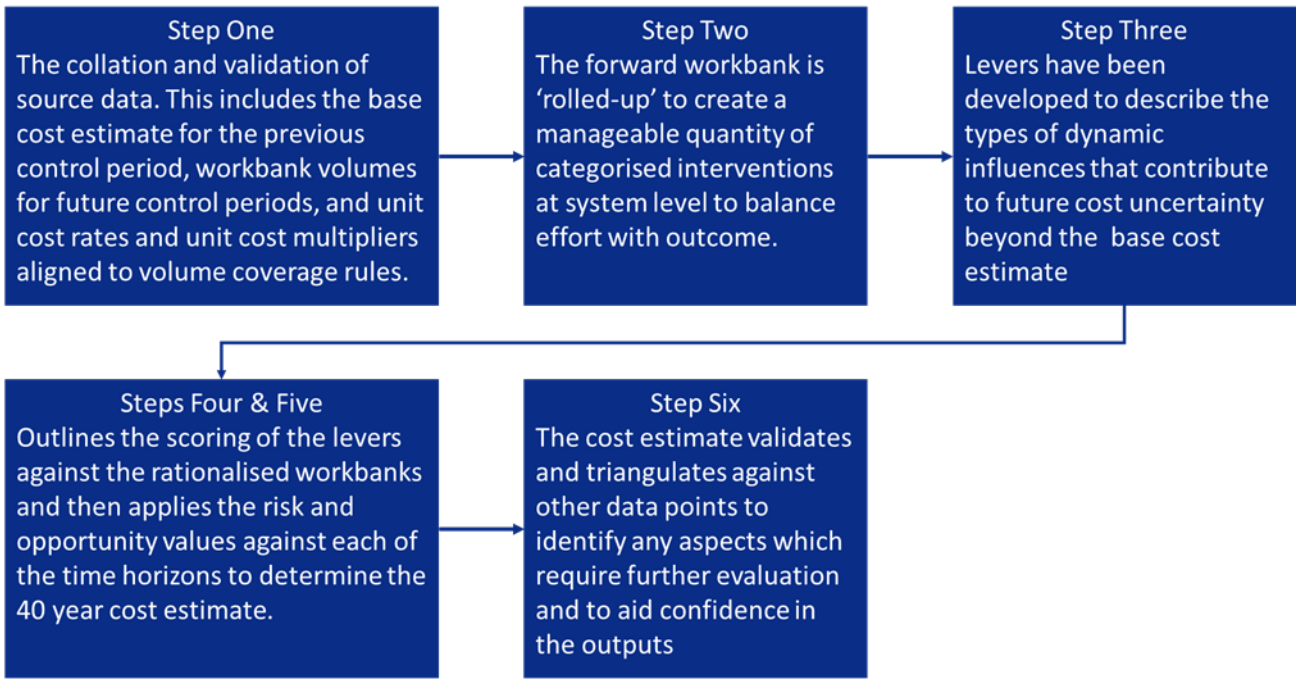



- Sustainability Factors: wider environmental and social factors.

Each renewals workbank category is scored against each adjustment lever for each time horizon. The scores feed into a Monte Carlo simulation to derive probabilistic cost impact outputs.

The methodology is summarised in Figure 39 .

**Figure 39: Cost Policy methodology**




### 13.5.2. CP5 to CP11 cost estimates

The base costs for CP5 to CP11 were built on the bottom-up unit rates developed by NR(HS) for CP4. HS1 appointed the same consultants (PA Consulting and Mott MacDonald) to validate the CP4 direct cost unit rates against the CP5-CP11 interventions and create supplementary unit rates for all non-CP4 activities. This provides consistency and continuity across the 40 years.

Before application of the Cost Policy, HS1 applied four intermediate steps to reduce the CP5-CP11 cost while still delivering on our Asset Stewardship Purpose. These intermediate steps predominantly move away from the pure application of RMM1 and, in some cases, align to the application of indirect costs in PR19. The intermediate steps are summarised in Table 48.

**Table 48: CP5 to CP11 cost estimation intermediate steps**

| Step | Explanation |
|---|---|
| Baseline CP4/RMM1 | Baseline cost for CP5-CP11 using NR(HS) assumptions and RMM1 cost methodology for CP4. |
| 1. Indirect costs normalised | Indirect cost percentages applied for CP5-CP11 are normalised around a common project stage, where the option has been selected and is known. |
| 2. Design costs fixed | Design indirect cost assumed to be a fixed percentage based on design being (i) a simple replacement or (ii) a complex renewal. |
| 3. Indirect not cumulative | All indirect cost mark-ups applied to direct cost (not cumulatively). |
| 4. PMO fixed | Fixed PMO allowance over the 35 years. |
| 5. Cost Policy application | PA Consulting/Mott MacDonald risk/opportunity scenarios. |

The final step in the long term renewals cost estimation was the application of the Cost Policy to the base costs as adjusted by the intermediate steps.

Scoring was undertaken in workshops held in November and December 2023 with representatives from HS1 and subject matter experts from PA Consulting and Mott MacDonald. The detailed scores from the workshops were collated into a master scoring workbook which was loaded into a Monte Carlo simulation tool to derive a range of probabilistic outputs. From this, HS1 selected a suitable risk probability value for the asset type for each time horizon as shown in Table 49; percentage variances are shown against the base cost.

**Table 49: Selected P values by asset type and time horizon**

| | H1 (CP5) | H2 (CP6-7) | H3 (CP8-11) | High level explanation |
|---|---|---|---|---|
| Ballast | P80<br>10% | P50<br>-8% | P50<br>-19% | Assumed by H2 & H3 significant efficiency opportunities are realised (new technology for life extension, rule book harmonisation and methodology). |
| Track | P80<br>2% | P50<br>-8% | P50<br>-23% | Workbank volumes across the 35 years become more repetitive after H2 and construction methodology on HS1 understood. Improved data and predictive modelling output. |
| Civils | P50<br>2% | P50<br>1% | Stretch Range- Min<br>-38% | Drainage renewal is pessimistically profiled. Proactive monitoring and jetting strategy to be in place.<br><br>Earthworks and bridge component renewals in H2 & H3 - some off network therefore lower operations risk profile.<br><br>H3 assumes a step change in the possessions and isolations opportunities coupled with modular replacement. |
| E&P | P50<br>6% | P50<br>6% | Stretch Range- Min<br>-24% | Workbank volumes across the 35 years become more repetitive after H2 and methodology understood.<br><br>The workbank consists of large volumes of component replacements, within H3 it is assumed technology consolidates. |
| S&CS | P50<br>2% | P50<br>17% | Stretch Range- Min<br>N/A | H2 have new volumes, not previously delivered so risk of uncertainty in complexity.<br><br>H3 was not scored due to the uncertainty of ERTMS implementation at the time of the workshops. Post workshops an S&C strategy document has been issued which details the ERTMS implementation plan. The S&CS scores for all horizons will be revised before May 2024. |

The Cost Levers Scoring Report (provided as a supporting document for this Draft 5YAMS) documents the scoring approach process, the decisions made and the scores.

This process has examined long term costs in greater detail than previous periodic reviews. The work has delivered a significant step change in the robustness of the 35-year cost estimation. As part of our commitment to continuous improvement, the Cost Policy will be developed for subsequent control periods.

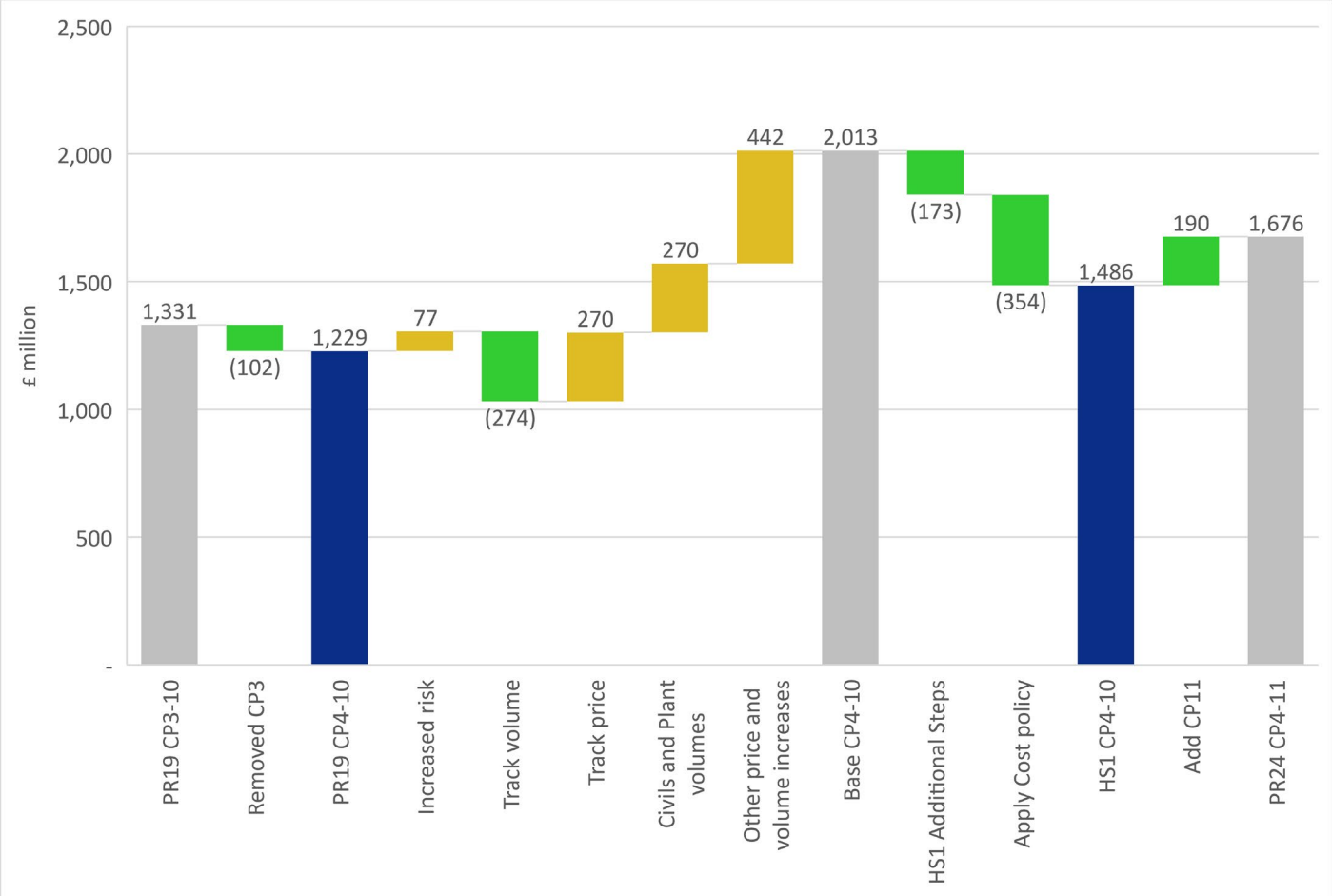
It should be noted that the Cost Levers Scoring Report was prepared by PA Consulting on the basis of available cost estimates in January 2024. NR(HS) subsequently made minor changes to the renewals workbank which affected the base cost. The scoring report has not been re-issued to take into account these changes as the changes are expected to have a minor impact. We will incorporate any amendments to how the Cost Policy is applied at an appropriate time over the coming year once we have received wider stakeholder feedback.

**Comparison with PR19**

Changes from the PR19 estimate of the 35-year renewals costs are set out in Figure 40. The main points are as follows:

- The PR19 Final Determination has been uplifted to February 2023 prices and CP3 renewals removed to give a PR19 comparison of £1.229bn;
- Volume effects are as discussed in Section 13.2;
- The ballast unit rate has more than doubled, offsetting the track volume reduction;
- Other price increases are driven by the RMM1 pricing methodology with improved identification of interventions;
- Increased maturity of risk application (replaced with Cost Policy later in the waterfall);
- The application of the intermediate cost steps and Cost Policy (as discussed above) resulted in a £527m reduction in the renewals costs for CP4 to CP10;
- The above changes resulted in a total renewals cost of £1.486bn for the comparable years (CP4 to CP10), a 21% increase from PR19 estimates;
- The addition of CP11 renewals volumes (with the HS1 additional steps and Cost Policy incorporated) gives an overall 40-year renewals cost of £1.676bn.

**Figure 40: 40-year renewals comparison PR19 to PR24 (£million, February 2023 prices)**

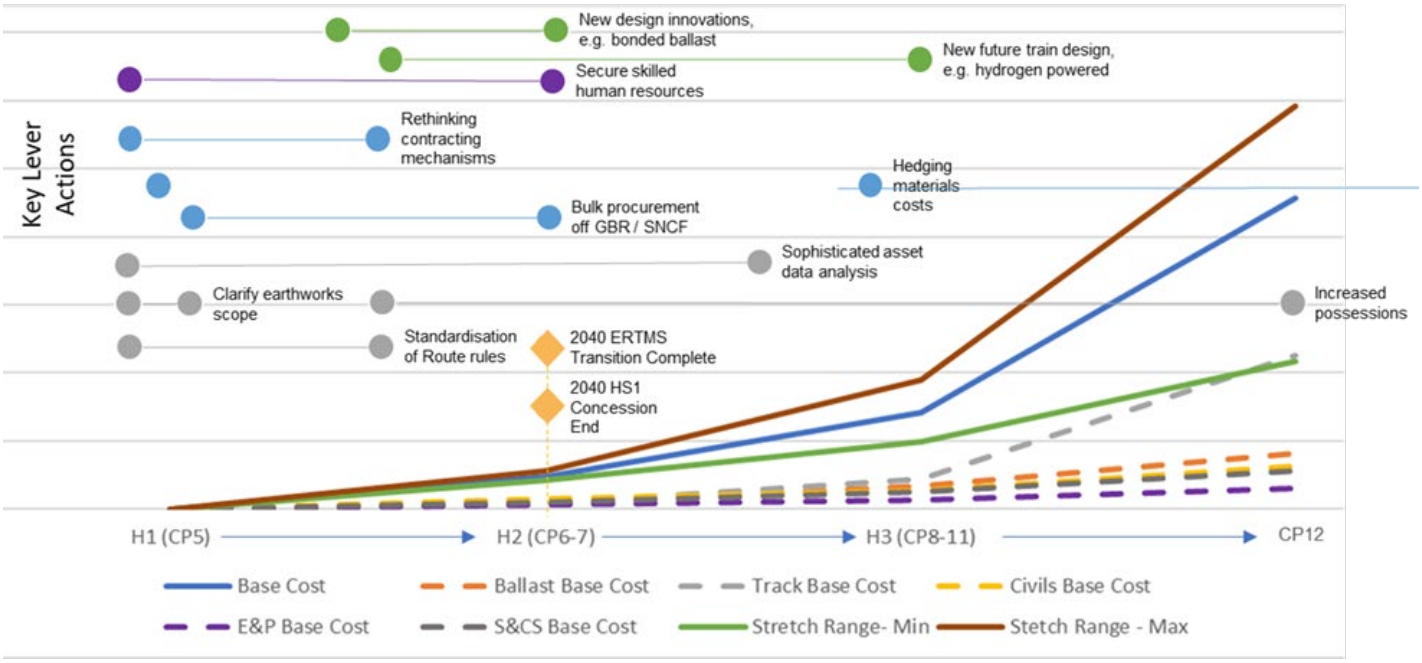



### 13.5.3. 40-year renewal efficiency realisation

Figure 41 below outlines at a high-level the potential timelines for the delivery of key initiatives identified in the Cost Policy to realise the efficiencies and opportunities needed to drive the cost down from the maximum towards the minimum range.

It is recommended that a series of investment cases are developed via the joint R&D Strategy to maximise the potential for realising the efficiency opportunities and minimising the risk exposures identified from the cost levers exercise. These would cover, but are not limited to, increasing possession durations, Integrated Operating Delivery Models and standardisation of the 'rules of the route'.

**Figure 41: Key lever actions and anticipated impact on cost ranges**




## 13.6 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.

### 13.6.1. 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.

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. Under the HS1 Concession Agreement, train operators contribute fairly to the long-term renewal costs in proportion to their actual use, with the funds held in an escrow account. HS1 renewal costs are recovered through an annuity which forms part of the OMRC charges.

The Concession Agreement sets out the framework for the renewals annuity but does not set out the methodology for calculating it. Based on the ORR's interpretation of the annuity framework set out in the Concession Agreement, we have been required in previous Periodic Reviews 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 reaches zero balance at the end of the 40-year period while remaining fully funded (i.e. no negative balances) during this period.

We consider this an expensive approach to the annuity calculation given the long time frame covered and the current constraints on the low returns earned on permitted escrow investments (see Section 20). This is because the funds held in escrow for future renewals are earning negative real returns to the disbenefit of the operators who fund the escrow. We are aware that some operators disagree with the ORR's interpretation of the Concession Agreement.

During PR19 there was extensive discussion between stakeholders on alternative approaches to the annuity methodology. The ORR, however, determined that the alternative approaches were not consistent with the Concession Agreement. In its PR24 Approach and Process document[19] the ORR stated clearly that it intends to maintain the same approach to the renewals annuity as in PR19 but is willing to consider how the annuity could be profiled over time if needed to support operators affordability.

### 13.6.2. Proposal for CP4 renewals annuity

Given the ORR's direction, HS1 has applied the same methodology as PR19 for calculating the renewals annuity for CP4. That is to fully fund the 40-year renewals cost with an annuity that reaches a zero balance at the end of the 40-year period while ensuring there are no negative balances during that period. In line with the ORR's PR19 Determination, we also incorporate the incremental annuity uplift for the underfunding of the escrow account in CP1 and CP2 to be recovered over the life of the Concession Agreement (i.e. by end of CP6).[20]

We have incorporated into this methodology:

- The weighting of the 40-year annuity by the long term forecast of train volumes.

  In previous periodic reviews, the renewals annuity calculation assumed train volumes would be constant over the 40-year horizon. However, the realistic assumption is that train volumes over the 40-year period will grow – as is assumed by the renewals plans the annuity is funding. In line with intergenerational equity, if higher train volumes are reasonably expected in later years, they should bear a proportionate share of renewals costs.

  We therefore propose to weight the renewals annuity by the 40-year train path forecast used to develop our asset management plan and renewals expenditure profile (see Section 7.1 for the traffic forecasts). We also take into account the Government underpin level which is the basis of our billing when domestic passenger services are lower than this level. This approach ensures the most appropriate allocation of costs over time. Operators and the ORR were consulted on this modelling approach through our route charging model rebuild consultation; the operators were broadly supportive (see Section 15.2.2).

[19] Periodic Review of HS1 Ltd 2024 (PR24) - Approach and process paragraph 2.18 and 2.41
[20] HS1 5YAMS February 2020, see sections 12.6.1 and 12.6.2 for details on the underfunding uplift in the annuity.

- Our revised financial assumptions for inflation, discount rate and escrow investment returns that are used in the annuity calculation, which are set out in Section 7.2.

**The resulting renewals annuity charge is £31.5 million per annum.** This is a reduction from £34.0 million per annum in PR19. This is a good outcome given PR24 covers a 40-year period with larger renewal volumes than in PR19 which reflects the ageing asset.

This reflects both our approach to the pricing of the 40-year renewals workbank costs and risk, and to the annuity calculation and assumptions. We believe this strikes an appropriate balance between meeting our asset stewardship purpose and ensuring the necessary works are funded in a sustainable economic way, while supporting affordability for operators. We do not believe that additional risk premium for potential future price shocks is appropriate to include at this time e.g. as an adjustment to our inflation assumption; we set out our reasons for this Section 7.2.1.

Figure 42 shows the renewals costs, annuity payments and resulting escrow balance over the 40 years from CP4 to CP11. We present the renewals costs and annuity *in nominal terms* for consistency with the escrow balance figures – these will not align with the figures reported in real prices above.

**Figure 42: Renewals costs, annuity payments and escrow balance (£m, nominal terms)**

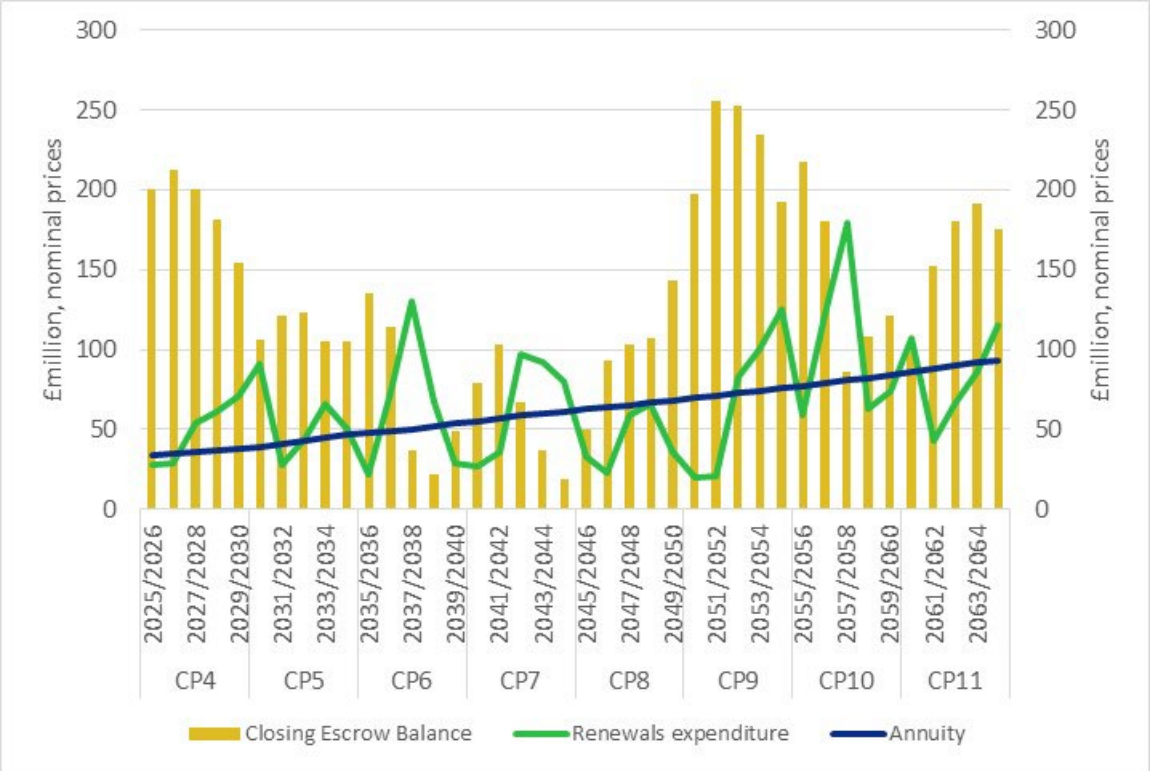
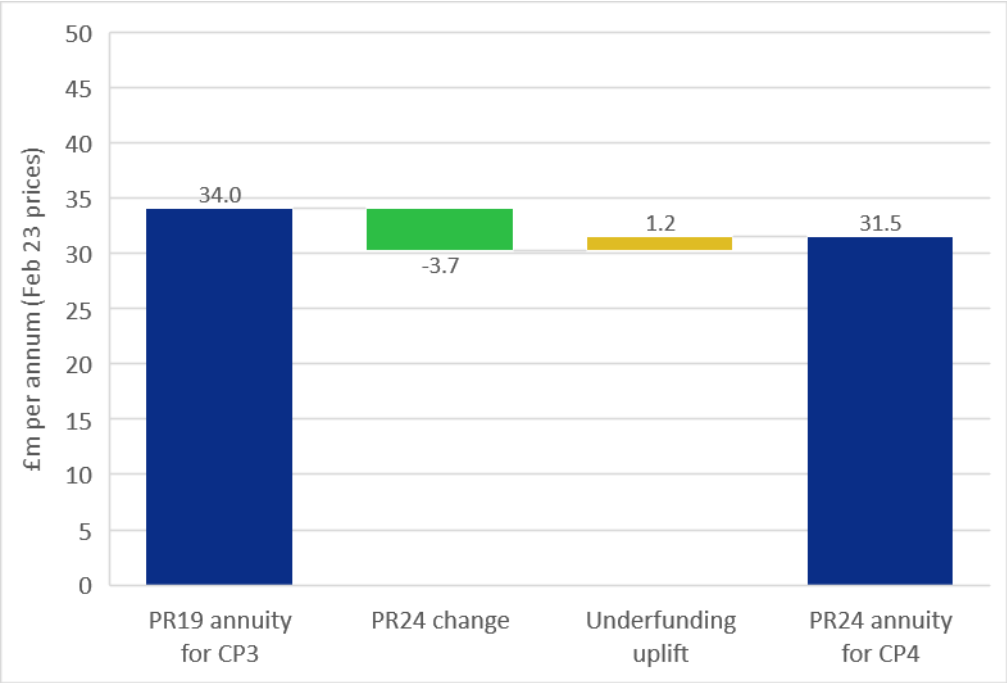


Figure 43 shows the change in the proposed CP4 renewals annuity from the CP3 annuity determined in PR19.

**Figure 43: Change in annuity charge CP3 to CP4 (£m, February 2023 prices)**



# 14 Route upgrades

## 14.1 Specified Upgrades

ERTMS implementation is a large signalling project that must be completed to avoid obsolescence and non-interoperability and for HS1 to meet our asset stewardship obligations under the Concession Agreement. The early planning and design works we will undertake in 2024 – known as ERTMS Early Works – will provide the necessary information we need to take an informed view about the timing and approach to ERTMS implementation (see Section 3.7.1). However, currently we anticipate implementation to be in CP5 and we expect to make a Specified Upgrade application for the implementation project early in CP4 once we have assessed the Early Works findings.

## 14.2 Other upgrades

No other upgrades are planned for CP4.

# 15 Route CP4 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 50 sets out the cost headings from the previous sections and summarises how each is treated in calculating charges.

**Table 50: Converting costs to charges**

| Costs | Calculation of charges |
|---|---|
| NR(HS) O&M costs | Forms part of OMRC charge to operators |
| HS1 costs<br>Pass through costs<br>Freight-specific costs | CP4 costs are apportioned between operators on the basis of forecast train services and network usage |
| Renewals | Forms part of OMRC charge to operators<br><br>40-year renewals costs are converted to an annuity which is apportioned between operators on the basis of forecast train services and network usage |
| Traction electricity | Not part of OMRC<br><br>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 do not currently have any works in CP4 that would be funded through Additional IRC. |

## 15.1 Structure of charges

In Section 19, 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 (2016 Regulations). 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 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:** long term common costs. OMRCB includes, for example, head office costs, and common 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.

## 15.2 Route charging model

The HS1 Route Charging Model calculates the cost components related to each of the four headings above and allocates them between train operators to produce charges for passenger and freight operators for their access to the HS1 railway infrastructure.

Appendix A6 summarises how the route charging model converts costs into charges and allocates them between train operators; this includes a detailed breakdown of the cost category allocation that is consistent with the 2016 Regulations.

### 15.2.1. Volume reopener functionality

The Review Event provisions in the HS1 Access Terms – known as the volume reopener – are triggered when train volumes are materially different to those used to set the fixed OMRC charges, i.e. OMRCA2 and OMRCB (see Section 21). As a consequence of the Covid-19 pandemic, actual volumes fell significantly below this threshold. For the December 2020 timetable change, additional functionality was added to the PR19 route charging model to implement annual volume reopener (VRO) amendments to charges for the remainder of CP3.

The additional functionality allowed HS1 to amend OMRCA2 and OMRCB charging rates at each timetable change date in order to ensure full recovery of fixed OMRCA2 and OMRCB costs over the remainder of CP3. There were no changes to the underlying costs or assumptions except train path volume forecasts.

This functionality is not intended to be routinely used during CP4 but remains in place as it may be needed in the event of entry by a new operator or other material changes in volumes, in line with the provisions of the Access Terms.

### 15.2.2. Model rebuild

As part of PR19, HS1 committed to undertaking a Structure of Charges review during CP3 (see Section 19.3). This included a rebuild of the HS1 route charging model to achieve the following outcomes:

- To make the model more transparent, easier to use and ensure it met current modelling best practice;
- To incorporate functionality and input changes identified in the Structure of Charges review (see Section 19.3);
- To incorporate other functionality and input changes to improve the model such as bespoke user dashboards and scenario analysis; and
- To incorporate functionality to provide an option to weight the renewals annuity element of charge in line with future 40-year train path forecasts.

The rebuild did not change the fundamental functionality or structure of the charging model, in line with the findings of the Structure of Charges review; nor did it change the VRO functionality.

Initial consultation was held with stakeholders in April 2022 with a rebuilt draft model issued to stakeholders in September 2022. Feedback was generally positive with stakeholders welcoming the transparency of the new model and finding it easier to use and understand. The final version of the model, taking into account the feedback, was issued in January 2023; this recognised that several changes for minor functionality and inputs would need to be resolved through the usual PR24 process.

The model initially used the same input data as the PR19 charging model and returned the same output charging rates. The 'new' charging model was operated in parallel with the PR19 charging model for subsequent VROs in December 2022 and December 2023 to ensure consistency between the two models. The new charging model has been used to calculate charges for PR24.

The HS1 Route Charging Model for PR24 has been audited and endorsed by CPCS, the parent company of First Class Partnerships who audited the PR19 route charging model and have expertise in transport infrastructure modelling. More detail on the audit and compliance with the 2016 Regulations is in Section 19.2.2.

### 15.2.3. Model inputs

The main inputs required by the route charging model are:

- CP4 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 CP4;
- High level traffic forecasts by operator for each control period from CP5 to CP11;
- Train specifications for calculation of relative levels of wear and tear (unchanged from PR19);
- Financial assumptions: discount rate, interest rates, inflation rate and escrow account opening balance at the start of CP4.

## 15.3 Charges for passenger train operators

The charges for OMR 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 the present value or annuity for each cost apportionment category
- Stage 3: Allocate total costs to be recovered between passenger train operators based on forecast network usage
- Stage 4: Calculate charges by operator and on a per train basis

Pass through costs (OMRCC) are allocated between passenger train operators in proportion to their total train minutes on HS1. The OMRCC charge is an indicative charge only; train operators are charged an estimate of pass through costs for each financial year with an annual wash up to actual, rather than estimated, pass through costs (see Section 18.4 for more detail).

### 15.3.1. Outcomes for CP4

Table 51 shows the breakdown of CP4 OMRC per train 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, taking into account the different characteristics of the two Eurostar train fleets and the mix of these trains expected to be used to operate the forecast timetable; different vehicle types may give rise to a different OMRC.

**Table 51: OMRC per train-km / per minute (February 2023 prices)**

| | International passenger services | Domestic passenger services |
|---|---|---|
| Vehicles | Class 373<br>Class 374 | Class 395 |
| **Charge per train per train-km** | | |
| OMRCA1 | £5.92 | £2.39 |
| **Charge per train per minute** | | |
| OMRCA2 | £12.39 | £2.78 |
| OMRCB | £36.61 | £39.35 |
| OMRCC | £13.69 | £13.69 |

Table 52 shows the chargeable journey time and train-km 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 52: OMRC per train (February 2023 prices)**

| Service Group | Chargeable journey time (minutes) | Train-km | OMRC per train |
|---|---|---|---|
| **International (all services)** | 31.0 | 109.9* | £2,594 |
| **Domestic** | | | |
| Ashford – St Pancras (and vice versa) | 31.0 | 91.5 | £1,948 |
| Springhead Jn – St Pancras (and vice versa) | 16.5 | 39.5 | £1,015 |
| Ebbsfleet – St Pancras | 14.0 | 39.5 | £876 |
| St Pancras – Ebbsfleet | 15.0 | 39.5 | £931 |

* This has been amended from 111.3km in PR19 to be consistent with the HS1 Sectional Appendix. There is a small impact on the allocation of charges between operators.

This represents a reduction for passenger operators of c. 13% to 18% relative to current charges, which account for the VRO reapportionment of fixed costs during CP3. Relative to PR19 determined charges, there is a small reduction for international services and a small increase for domestic services. We consider this a good outcome given the challenges and circumstances faced by the system and the lower overall volumes forecast to operate relative to PR19.

**Table 53: OMRC per train variance to current and PR19 charges (February 2023 prices)**

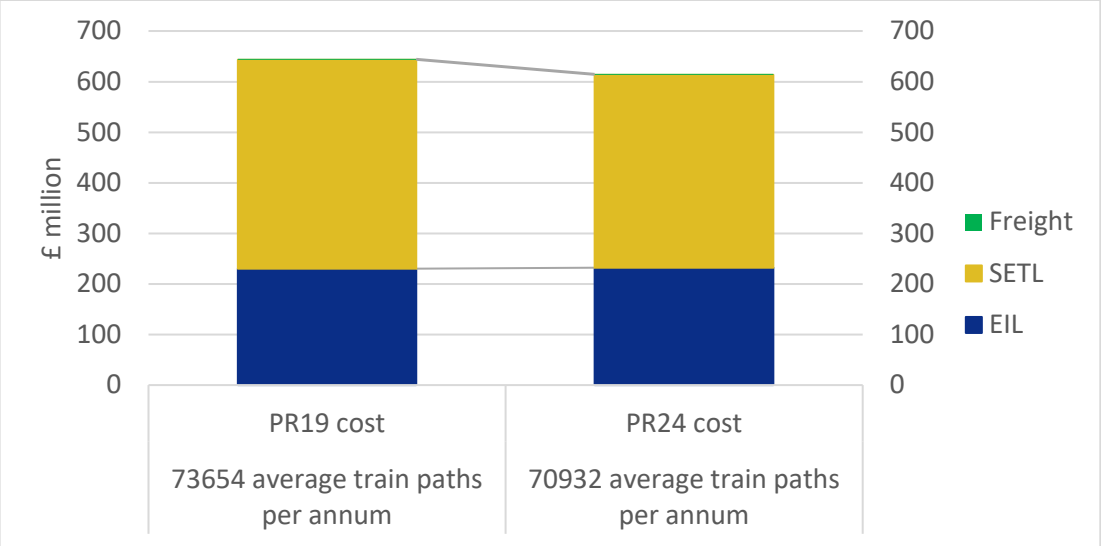
| Service Group | PR24 | Current* | % change | PR19 | % change |
|---|---|---|---|---|---|
| **International (all services)** | £2,594 | £3,168 | (18.1) | £2,605 | (0.4%) |
| **Domestic** | | | | | |
| Ashford – St Pancras (and vice versa) | £1,948 | £2,234 | (12.8) | £1,935 | 0.7% |
| Springhead Jn – St Pancras (and vice versa) | £1,015 | £1,170 | (13.2) | £1,011 | 0.4% |
| St Pancras – Ebbsfleet (Up) | £876 | £1,005 | (12.9) | £870 | 0.6% |
| St Pancras – Ebbsfleet (Down) | £931 | £1,071 | (13.0) | £926 | 0.6% |

* These are the 2023 VRO charges issued in February 2024 and OMRCC as at January 2024.

The key drivers of this variance are:

- The broad reduction across O&M costs. This is a result of the efficiencies achieved by (i) NR(HS) in its Annual Fixed Price and (ii) HS1 in our internal costs and both the subcontracted and pass through costs we manage on behalf of the operators.
- The reduction in the renewals annuity. Higher costs of certain renewals and volumes have placed significant upward pressure on the 40-year renewals costs. HS1 however has applied structured and transparent engineering judgement and sensible economic assumptions that results in a renewals annuity that is lower than PR19. We believe our approach appropriately balances meeting our asset stewardship purpose and ensuring the necessary works are funded in a sustainable economic way, while supporting affordability for operators.
- The lower overall train volumes forecast to operate compared with PR19. As the per train charges are subject to volume effects, this offsets the reduction in the overall OMRC cost stack in value terms (5%) as shown in Figure 44.

**Figure 44: Change in OMRC cost stack PR19 to PR24 (February 2023 prices)**




## 15.4 Charges for freight operators

Freight costs comprise:

- Freight variable costs (OMRCA1); and
- Freight long term 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 the Ripple Lane exchange sidings. Ripple Lane is accessed by freight trains travelling from the HS1 network to the NRIL network (and vice versa) as well as freight operators that only access it from the NRIL network to stop and/or turn around and do not access the HS1 network. The cost of Ripple Lane is split between these two types of freight in proportion to the forecast number of trains for each type.

The calculation of freight charges is summarised in Appendix A6262.

### 15.4.1. OMRC charges for freight operators on HS1

Table 54 shows the CP4 charges for freight services on the HS1 network, broken down into variable and long term avoidable elements.

**Table 54: CP4 OMRC freight charges (February 2023 prices)**

| | Charge per train-km | Charge per train (Dollands Moor to Ripple Lane) |
|---|---|---|
| OMRCA1 (variable) | £7.07 | £623.9 |
| OMRCA2 (avoidable) | £7.82 | £689.5 |
| Total OMRC | £14.89 | £1,303.2 |

Compared with the PR19 determined costs and charges, we are delivering a significant reduction (34%) in the total OMRC costs for freight in value terms. However, due to a large reduction in the freight volumes forecast to operate in CP4, there is an increase in the OMRC per train charge for the operator. This is shown in Table 55.

**Table 55: Changes in freight costs and charges (February 2023 prices)**

| | PR24 | PR19* | % change |
|---|---|---|---|
| Total OMRC to be recovered (5 years) | £1.31m | £1.97m | (34%) |
| OMRC per train | £1,313 | £981 | 34% |
| Train volume forecast (per annum) | 200 | 454 | (56%) |

* These are the current charges for freight as it has not been subject to the VROs for passenger operators.

### 15.4.2. Ripple Lane (Domestic Sidings) charge

The Ripple Lane (Domestic Sidings) charge applies to the freight operators accessing Ripple Lane from the NRIL network but not entering the HS1 network. This charge is levied on a per train basis.

Table 56 shows the total cost for Ripple Lane and how these costs are apportioned between freight operating on HS1 and freight that uses the sidings to access only the NRIL network.

**Table 56: Ripple Lane costs for CP4 (February 2023 prices)**

| | Total cost | HS1 freight | Domestic freight |
|---|---|---|---|
| Total cost (over control period) | £779k | £89k | £690k |
| Train volumes forecast (over control period) | 8,800 | 1,000 | 7,800 |
| Proportion of total cost | n/a | 11.4% | 88.6% |

The cost of Ripple Lane for HS1 freight is recovered through OMRCA2 as noted above. The cost for domestic freight is recovered through the Ripple Lane (Domestic Sidings) charge. This is shown in Table 57; the charges will increase compared to PR19.

**Table 57: Changes in Ripple Lane (Domestic Sidings) charges (February 2023 prices)**

| | PR24 | PR19 | % change |
|---|---|---|---|
| Total cost (over control period) | £690k | £980k | (29.6%) |
| Train volumes forecast (over control period) | 7,800 | 13,725 | (43.2%) |
| Per train charge | £88.52 | £71.42 | 23.9% |

The key drivers of the variance from PR19 are:

- The total cost of operating and maintaining Ripple Lane is lower compared to PR19, driving a 30% reduction in the cost attributed to domestic freight.
- The lower forecast volumes compared with PR19 for domestic freight. This volume effect results in a higher per train charge for the domestic freight for PR24.

## 15.5 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 CP4, based on our forecast of electricity costs in Section 12.5.1, are an average over CP4 of £1,028 per train for EIL and £322 per train for SETL.

# 16 Stations CP4 proposals

Similar to route assets, the HS1 stations assets are maturing and renewals volumes are increasing as the 40-year outlook period rolls forward. We have developed specific plans for the volumes of renewal interventions required and the associated costs of such works. These have been developed to meet our asset stewardship obligations, known as the Life Cycle Purpose for stations, and to ensure that the station assets meet operators' and passengers' needs.

During CP3, there has been significant change in the approach to delivering asset management and this has improved line of sight for station assets since PR19 (as discussed in Section 10). The new approach supports a risk-based approach and totex models have supported the optimisation of life cycle costs across renewals and maintenance. This is discussed in Section 16.1.

Section 16.1 also describes how NR(HS) has developed the CP4 and 40-year renewals cost estimates, including the direct and indirect costs. It also summarises the HS1 stations benchmarking study we commissioned that was a qualitative assessment of HS1's asset management approach and planning assumptions compared with domestic and international organisations with comparable asset portfolios.

Section 16.2 sets out the CP4 renewals works. With the exception of Ashford International, there will be a larger volume of work delivered at a lower cost in CP4 relative to PR19 forecasts. This is driven by the change in LET renewals strategy and efficiencies achieved in Station Communication System Renewal (SCSR) works. Section 16.3 sets out the 40-year renewals profile where there have been large increases in the costs of civils and MEP renewals relative to PR19 forecasts for comparable periods.

Station enhancements expected in CP4 and the treatment of long lived assets are set out in Section 16.4.

We use a renewals annuity to calculate the Long Term Charge (LTC) for each station based on the renewals profile. The structure of the LTC and its allocation across the operators using the station are discussed in Section 16.5. This section also sets out the proposed LTC for each station and for each operator for CP4.

Section 16.6 provides the total station charges showing the stations operations and maintenance costs (which are not part of the PR24 scope) alongside the LTC.

More detail on the renewals plans for the stations is set out in the stations LCRs, totex models and LTC model provided as supporting documents to this Draft 5YAMS.

## 16.1 Development of the 40 year workbank

### 16.1.1. Approach

As noted in Section 10 and the stations LCRs, NR(HS) has used totex modelling to evaluate four investment scenarios to determine the most appropriate renewals and maintenance approach for the three stations it manages. This is a risk-based approach which optimises the life cycle costs of operations, maintenance and renewals of the assets. HS1 welcomes the significant change in approach to delivering asset management and improved line of sight for station assets since PR19. HS1 has adopted a similar approach for Ashford International.

The renewals volumes proposed by NR(HS) were subject to assurance by HS1, as discussed in Section 10.7. This included an iterative process of document reviews, meetings with NR(HS) Heads of Asset and an extensive programme of site visits.

HS1 agrees with NR(HS)'s recommendations for the renewal and maintenance approach based on the scenario that achieves the AMOs and ensures that we meet the Life Cycle Purpose and expected performance service levels. The changes in CP4 and 40-year renewals works relative to the PR19 LCRs are based on refined asset condition and performance information gained over CP3.

The CP4 and 40-year station renewals works are developed from the SASs which are grouped by asset discipline. The four station SASs are Station Civils; Data and Communications (D&C); Lifts, Escalators and Travelators (LETs); and Mechanical, Electrical and Plumbing (MEP).

### 16.1.2. Renewals pricing

The costs for CP4 and 40-year renewals have been developed using totex models for each of the four asset disciplines. The totex models identify the base cost (direct and indirect costs) for the renewals.

For all stations, the direct costs have been developed as follows:

- Where similar renewal work to that proposed in the model has been undertaken in CP2 or CP3, the actual costs of the CP2 or CP3 renewal have been used to calculate the direct cost. These post-efficient rates are used for the major assets such as LETs and Uninterruptible Power Supply.
- Where there are plans for a renewal type that has not been undertaken before, we have used costs from the PR19 LCC models. These were developed by external cost consultants (Pell Frischman) using Building Cost Information Service breakdown of main assets and sub-components. This used a combination of published pricing books (e.g. SPONS), sub-contract prices, quotations from suitable suppliers and other published price sources. This approach was audited by an independent consultant (as agreed with DfT) and reviewed by the DfT and its technical advisers (GHD) in 2019 to establish that the estimating approach was robust. The Pell Frischman reports are provided as supporting documents.
- These costs have been adjusted to 2023 prices using the RPI inflation rate.

Indirect costs (also known as 'on-costs') were applied as a percentage of the direct cost for each asset discipline.

In PR19, we assessed indirect costs for each type of asset with regard to a range of factors. Indirect costs included preliminaries, design, builders' work in connection, access, strip out, safety, heritage, specialist contractors, out of hours working, scrap disposal, possessions costs and risk. The percentages applied for each factor were set in line with guidelines developed by HS1 and reviewed by HS1's external cost consultants. The review benchmarked the indirect costs against a range of external organisations and concluded HS1's approach was in line with the benchmark comparators. As with the direct costs, these were audited by independent consultants and DfT and GHD as part of PR19. The PR19 indirect costs are set out in the PR19 LCC models and the Pell Frischman reports are provided as supporting documents.

The same categories and application as PR19 have been used for PR24 for both CP4 and the 40-year renewals. For each type of project, NR(HS) assessed the indirect cost percentage to be applied to each type of asset discipline at each station and was assured by HS1. HS1 followed a similar approach for Ashford.

The NR(HS) mark up of 10% on the base cost has then been applied.

The exact indirect cost percentages that have been applied to each type of renewal are shown in the totex models. These are summarised, along with the 10% mark up, for the three stations managed by NR(HS) in Table 58.

**Table 58: Proposed indirect costs and mark up for St Pancras, Ebbsfleet and Stratford**

| | Civils | D&C | LETs | MEP |
|---|---|---|---|---|
| Design | 15% | 15% | 15% | 15% |
| PMO | 12% | 12% | 12% | 12% |
| Other | 21% | 7% | - | 7% |
| **Subtotal** | **48%** | **34%** | **27%** | **34%** |
| Risk | 15% | 15% | 8% | 15% |
| Total Indirect Cost | 63% | 49% | 35% | 49% |
| Total Base Cost | 163% | 149% | 135% | 149% |
| NR(HS) mark up (10%) on Base Cost | 16.3% | 14.9% | 13.5% | 14.9% |
| **Gross uplift applied to Base Cost** | **79.3%** | **63.9%** | **48.5%** | **63.9%** |

The indirect cost percentages are the same for St Pancras, Stratford and Ebbsfleet stations as the delivery of projects will be similar at each location. These fall within the same range as CP3 (i.e.

25-50% excluding risk) as highlighted in the HS1 stations benchmarking study which found that our planning assumptions are in line with similar organisations (see Section 16.1.3).

Civils projects attract the highest level of indirect costs primarily because of the more complex access and protection arrangements. For example, working on an item such as the St Pancras roof is complex and requires the operations in the station to be fully protected. It also reflects the greater costs of disposal. LETs attract the lowest level of indirect costs, reflecting greater understanding of these costs; costs for CP4 are based on recent CP3 renewals contract pricing. No specific allowance has been made for indirect costs due to heritage issues in PR24.

At Ashford, indirect costs have been set at a lower level; we have applied only a design cost of 5%, as shown in Table 59. There is also a 10% management mark up that applies only to the direct costs. Due to the small volume of work, we have assumed that the contracting approach will be for contractor-managed turn-key type projects where the contractor will take on aspects of the project and project management. This means there will not be overheads associated with a dedicated project management resource. In addition, the station currently has no international passengers, providing only domestic passenger thoroughfare, so is a far simpler environment in which to undertake project work.

**Table 59: Proposed indirect costs and mark up for Ashford station**

| | Civils | D&C | LETs | MEP |
|---|---|---|---|---|
| Design | 5% | 5% | 5% | 5% |
| Management mark up | 10% | 10% | 10% | 10% |
| **Gross uplift applied to direct costs** | **15%** | **15%** | **15%** | **15%** |

At this stage in the project life, the indirect cost percentages applied are estimates. The actual costs will be developed with greater certainty as the renewals pass through the design and procurement stages of project governance. Each project will be delivered using the HS1 Project Process which will ensure that work is properly controlled and competitively procured to deliver value for money.

The indirect cost estimates are based on delivering an efficient price for the train operators while ensuring that there are sufficient funds in the escrow account to allow HS1 to undertake renewal works that fulfil its asset stewardship obligations. We believe the approach proposed is proportionate and balances the need for a sufficient portfolio level of funding taking account of risk and uncertainty, while ensuring efficient pricing of stations renewals.

For PR24, HS1 has developed a Cost Policy which provides a structured and transparent approach to long term (CP5 to CP11) route renewals pricing that considers the inherent uncertainty of forecasting so far into the future. The Cost Policy has been applied to route renewals (see Section 13.5.1). We are exploring whether a similar approach can be applied to stations long term renewals pricing and will incorporate any outcomes on this into our Final 5YAMS submission.

### 16.1.3. HS1 stations benchmarking study

We commissioned Rebel to undertake an HS1 stations benchmarking study, similar to the OMR Effectiveness Study for route. The study compared key elements of major asset renewals and the Long Term Charge in line with the scope of PR24. HS1 was benchmarked against five organisations with broadly similar asset portfolios and performance requirements. This included two domestic stations (NRIL Southern, NRIL Scotland), one international station (Netherlands) and two airports (Gatwick and London Luton). The stations benchmarking study is provided as a supporting document to this Draft 5YAMS.

This was the first time such a study has been undertaken. Difficulties with sample sizes and reporting of data (i.e. the use of single planning assumptions rather than outturn costs for projects) meant that it was difficult to clearly identify efficiency opportunities in the same way as in the OMR Effectiveness Study for route. The study focused on qualitative insights on comparisons of the asset management and procurement approaches, renewal frequencies and planning assumption.

The key findings of the study were:

- Overall HS1 has a logical and robust process for developing its planning assumptions. Asset life assumptions are consistent with other organisations, noting that HS1 could benefit from discussions with comparators on whether underlying activities to achieve longer asset lives could drive value for money.
- Proposals for renewal unit costs of LET assets are in line with comparators and represent sensible planning assumptions.
- Renewal unit cost assumptions for information system assets (particularly CCTV and Customer Information Screens) are at the lower end of the comparators.
- HS1 indirect cost assumptions are reasonable when compared on a like-for-like basis and are derived from a logical set of assumptions, noting that HS1 assumptions tend to be at the higher end of the range (between 25-50% excluding risk). It was recommended that HS1 should continue to track outturn against indirect cost assumptions, acknowledging this is difficult to do in practice.

HS1 welcomes the findings that our asset management approach is robust and in line with comparators. The organisational changes within NR(HS) under the Target Operating Model have driven improvements in the asset management approach. HS1 has challenged and assured the indirect costs to be applied as part of PR24; these fall within the same range as CP3 (i.e. 27-48%) for St Pancras, Ebbsfleet and Stratford. While we already track overall outturn on indirect costs, we will explore with NR(HS) how we might monitor the main components in a proportionate way.

HS1 will review the approach to the stations benchmarking study as part of the planning for PR29; we will consider the balance between taking a proportionate approach to the scope and achieving robust quantitative findings.

## 16.2 CP4 renewals

The renewals works that need to be delivered across the HS1 stations are broadly similar, with the exception of works related to the strategic roof interventions at St Pancras. Table 60 sets out the types of works to be undertaken for each asset discipline.

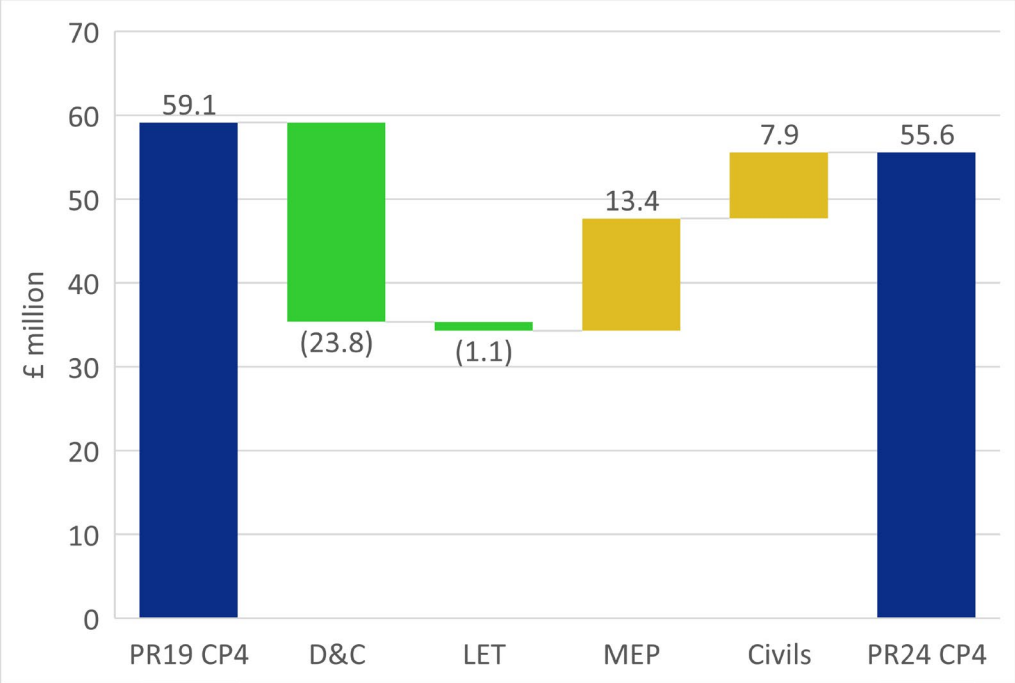
**Table 60: CP4 works across all stations**

| Discipline | Description of Works |
|---|---|
| Civils | Roof strategic intervention at St Pancras; Roof coverings at the other stations; Fittings, furniture and equipment; Condition surveys |
| D&C | Survey and design of CP5 cabling works (excluding Ashford) |
| LETs | Mid-life refurbishment/operational renewal of assets |
| MEP | UPS renewal, Sanitary installations/toilet refurbishment, Space heating; the strategic intervention to remove powered roof gantries at St Pancras |

For LET assets, the improved asset condition data and understanding of necessary interventions has driven a revision in planning compared to PR19. Based on the asset information and totex modelling, there has been a change in the renewals strategy away from full scale asset renewals to more frequent smaller scale (and typically less costly) operational renewals. The timing of the renewals was also amended based on the condition of the assets at each station.

The cost of delivering CP4 works across the four stations is £55.6 million as shown in Figure 45. This has decreased by £3.5 million compared with the PR19 forecast for CP4. There is a larger volume of work being delivered for a lower cost in CP4 relative to PR19, due to the outcomes at St Pancras and Stratford stations. At Ashford a large volume of CP3 renewals was able to be deferred into CP4.

**Figure 45: CP4 renewals comparison PR19 to PR24 (£million, February 2023 prices)**




The main drivers of the variance in the CP4 renewals workbank relative to PR19 estimates are as follows:

- Significant savings across all stations due to the delivery of the station communication system renewal (SCSR) in CP3 which extended the asset life so the renewal cycle could be deferred without impact on asset performance.
- The increase in MEP expenditure at St Pancras, Ebbsfleet and Stratford due to higher costs for uninterruptible power supply replacement and space heating renewal costs (to move from chillers and gas boilers to air source heat pumps), and the acceleration of toilet refurbishments to ensure performance and availability targets are maintained. The deferral of MEP renewals from CP3 to CP4 at Ashford also contributed.
- The increase in civils renewals expenditure at St Pancras to deliver strategic roof interventions efficiently by bringing CP5 works forward to deliver these as one package to lower access costs; also higher cost estimates for the works.
- Planned expenditure on LET renewals is broadly similar to PR19. The change in the LET renewals approach to more frequent smaller scale (and typically less costly) operational renewals and the revised timing of renewals leads to minimal variance overall.

The proposed CP4 renewals works will follow the HS1 Project Process which is a stage and gate process in line with Association for Project Management (APM) best practice. This allows for controlled progression of projects through a process allowing maturity of scope, cost, and timescales to develop in a controlled way.

As set out in the CP4 Renewals Strategy, NR(HS) intends to move to a portfolio packaging approach rather than a project-based approach to procuring and delivering renewals works. HS1 will also adopt this approach for Ashford. This reflects the learning and recommendations

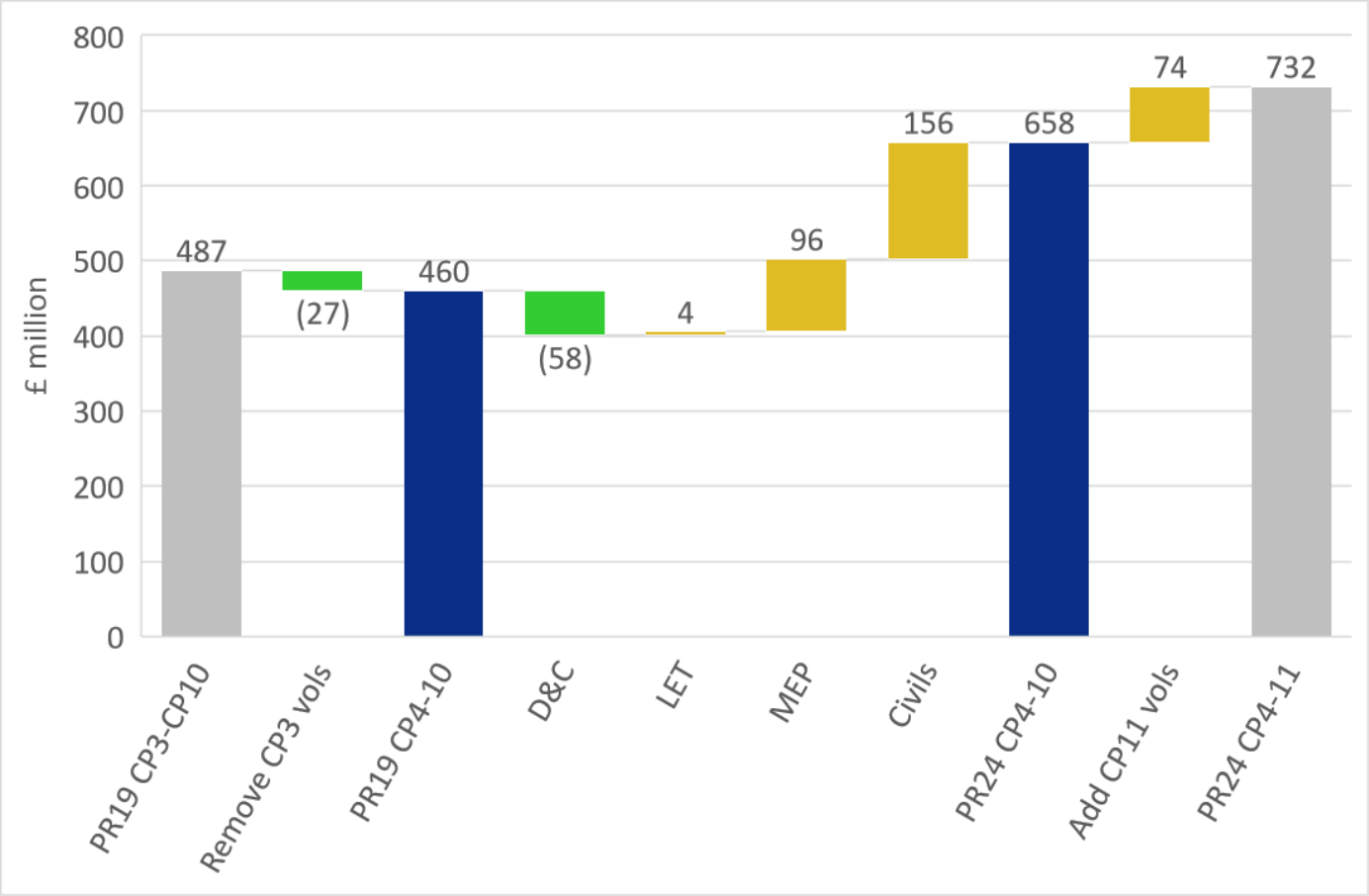
from the Capability Development Partner works conducted in CP3. HS1 and NR(HS) will have detailed information on the approaches planned for CP4 renewal delivery by January 2025 and this will be reported in HS1's 2024/25 AMAS.

## 16.3 40-year renewals

The works to be undertaken over the 40-year period are similar across all four HS1 stations. These include the same works as CP4 along with other major renewals such as the delivery of cabling works, CIS, CCTV, station communication/security systems and building management systems.

The cost of the 40-year renewals workbank across all four stations is £732 million. For comparable periods (CP4 to CP10), this is a 43% increase relative to PR19 estimates as shown in Figure 46.

**Figure 46: 40 year renewals comparison PR19 to PR24 (£million, February 2023 prices)**




The significant variance in the 40-year profile relative to PR19 estimates for comparable periods is driven by large increases in the civils and mechanical, electrical and plumbing renewals expenditure. This is mainly due to increases in the cost of work relative to PR19 across a range of assets in these disciplines. More frequent interventions in civils (including a small number of

high cost civils renewals at St Pancras, such as steel and glass wall cladding) and MEP assets (such as toilet refurbishments) is also a factor.

There is minimal overall variance in LET expenditure; there are more frequent interventions occurring over the long term, but these are smaller scale operational renewals that typically incur a lower cost than the full scale asset renewals forecast in PR19.

The reduction in D&C expenditure is driven the by cost savings delivered on the SCSR across all stations.

As HS1 was completing final validations, we identified that further investigation of the drivers of large variances is warranted. HS1 and NR(HS) will undertake further work in March 2024 to more fully understand the factors driving the differences from PR19 estimates to ensure the proposals are appropriate, in line with our asset stewardship obligations. HS1 is also continuing to explore if a similar approach to the Cost Policy applied to route renewals could be applied to stations long term renewals pricing, as noted in Section 16.1.2. We will incorporate any findings into our proposal in the Final 5YAMS.

## 16.4 Other works

### 16.4.1. Station enhancements

HS1 introduced a Station Enhancements Policy in CP3 (see Section 4.6). We are currently considering a number of potential enhancements at St Pancras International, including:

- Capacity optimisation: we are preparing to bring forward options for increasing station capacity for international services.
- Gateline improvements for SETL and EMR and a new lift for SETL.

For each of these, we will work through the options with the operators which would benefit from the enhancement.

The Station Enhancements Policy may need to reviewed in light of the potential introduction of new operators on HS1. Should any amendments be required, we will consult on such amendments and publish the updated policy on the HS1 website.

### 16.4.2. Treatment of long lived assets

In PR19, in response to an issue raised by DfT, we considered whether we should be collecting contributions now for 'long-lived' assets. This involved reviewing renewals that fall beyond the 40-year horizon used in the calculation of the LTC (100 years out). An example is the renewal of the St Pancras International roof.

Not including such assets effectively underfunds the escrow account and may lead to cost shocks for operators in the future when the renewals fall within the scope of the review.

However, the renewals are so far into the future that it is hard to generate a meaningful estimate of the costs, and it could present a challenge to train operator affordability.

The decision between DfT and HS1 was not to include such long-lived assets in the calculation for CP3 but to keep this under review. Given the current challenges to affordability, we do not propose to include such long-lived assets in the calculation of the station LTC for CP4.

## 16.5 Long term charge (LTC)

The final step of the PR24 process for stations is to convert the efficient station renewals costs into the LTC for each station. The LTC for each station is then allocated across the train operators. These calculations are set out in the LTC model.

### 16.5.1. Structure of station charges

The LTC is a fixed annuity charge using the same methodology and assumptions as the OMRC renewals annuity calculation and as outlined in the ORR's PR24 Approach and Process document. This is to:

- Fully fund renewals over a 40-year period;
- Ensure we renew assets in accordance with the Life Cycle Purpose; and
- Ensure the escrow account reaches zero balance at the end of the 40-year period while remaining fully funded (i.e. no negative balances) during this period.

We apply the same financial assumptions for inflation, discount rates and escrow account assumptions to the LTC annuity as for the route renewals annuity calculation (see Section 7.2). We do not apply any weighting of the annuity by train path volumes.

The structure for allocating the LTC annuity (and the O&M (Qx) costs) for each station between operators is set by the contractual framework for HS1 stations: the Concession Agreement, Station Leases and the Station Access Agreements in place for station access.

The LTC for each station is apportioned between operators based on:

- A fixed percentage defined in the Station Access Conditions (SAC) reflecting the dedicated area (i.e. zone) used by each operator at each station. For PR24, we are proposing to use updated floor plans for certain stations that more accurately reflect current floor space usage to allocate LTC across the zones.
- A share of the costs for the common usage area defined in the Station Access Agreement (SAA) (except where the change threshold is triggered) reflecting each operator's share of vehicle departures.

This allocation across operators is currently only needed for St Pancras and Ebbsfleet stations. Stratford and Ashford stations have one operator using the station (SETL and EIL respectively) and these operators pay the full LTC.

HS1 does not allocate LTC to retailers at the stations. We do not consider this would be appropriate nor consistent with the Concession Agreement because:

- The concession was sold on the basis that HS1 operates a 'dual till' model where retail income is unregulated and that regulated charges (OMRC and LTC) are not established using the 'single till' model adopted for NRIL. This is reflected in the ORR's regulatory statements on HS1 (2009 and 2022).
- The primary purpose of the station is to provide passenger access to trains. Renewals plans are developed on this basis so it is appropriate that operators pay for renewals.
- Consistent with this approach, retailers pay all directly incurred costs associated with the retail units. These are paid by retailers but not included as part of LTC or Qx calculations. These include costs such as:
  - Business rates;
  - Utility bills;
  - Cleaning costs, waste disposal;
  - Retail unit fit-outs and unit maintenance;
  - Share of BTP costs;
  - Cost of HS1 and NR(HS) staff dedicated to retail and commercial activity; and
  - Share of wi-fi costs.

### 16.5.2. LTC model inputs

The main inputs required by the stations LTC charging model are:

- 40-year renewals costs by year (the Life Cycle Costs);
- Financial assumptions: discount rate, interest rates, inflation rate and escrow account opening balance at the start of CP4.

### 16.5.3. LTC outcomes for CP4

Table 61 below shows the LTC for each station based on our proposed renewals cost profile compared with PR19.

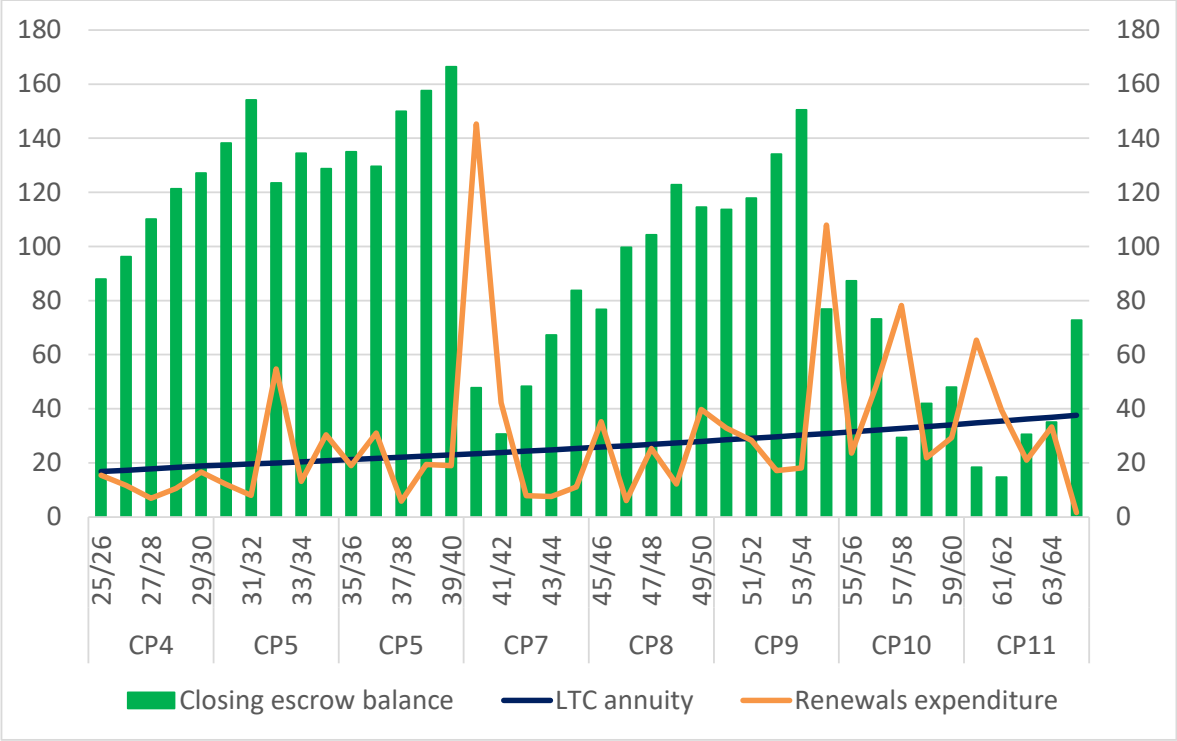
There is a material increase in the LTC across all stations, reflecting the increase in the 40-year renewals cost profiles across all the stations (see Section 16.3). We recognise the affordability impact this has on the operators. HS1 and NR(HS) will undertake further work to fully understand the factors driving the large variance. HS1 is also exploring if the Cost Policy approach used for route can be applied to the pricing of long term stations renewals. We will incorporate any findings into our Final 5YAMS submission.

**Table 61: Stations Long Term Charge (£m pa, February 2023 prices)**

| Station | PR24 | PR19 | £ change | % change |
|---|---|---|---|---|
| St Pancras | 10.36 | 7.55 | 2.81 | 37% |
| Ebbsfleet | 2.23 | 1.62 | 0.61 | 38% |
| Stratford | 1.93 | 1.54 | 0.39 | 26% |
| Ashford | 1.04 | 0.87 | 0.17 | 19% |
| **Total** | **15.56** | **11.58** | **3.98** | **34%** |

Figure 47shows the renewals costs, annuity payments and resulting escrow balance (in nominal terms) over the 40 years from CP4 to CP11 for all four stations combined. We present the renewals costs and annuity *in nominal terms* for consistency with the escrow balance figures – these will not align with the figures reported in real prices above.

**Figure 47: Stations renewals costs, annuity payments and escrow balance (£m nominal terms)**




### 16.5.4. LTC allocation across operators

This section focuses on St Pancras and Ebbsfleet stations as the LTC for Stratford and Ashford are fully paid for by the operator at that station (SETL and EIL, respectively).

For PR24, we propose to use updated floor plans for St Pancras and Ebbsfleet stations to derive the percentages used to allocate the LTC into the dedicated zones. Table 62 sets out the proposed allocations relative to the allocations used in PR19 and defined in the SAC.

**Table 62: Stations LTC zone allocation, St Pancras and Ebbsfleet**

| Zone | St Pancras | | | Ebbsfleet | | |
|---|---|---|---|---|---|---|
| | PR24 | PR19 | SAC | PR24 | PR19 | SAC |
| International | 41.59% | 43.53% | 43.53% | 42.02% | 56.42% | 52.00% |
| Domestic Northbound | 8.62% | 8.34% | 9.42% | N/A | N/A | N/A |
| Domestic Southbound | 9.86% | 6.43% | 7.55% | 30.37% | 19.81% | 29.00% |
| Common | 39.93% | 41.70% | 39.50% | 27.61% | 23.77% | 19.00% |
| Total | 100% | 100% | 100% | 100% | 100% | 100% |

HS1 will need agreement from operators to amend the SAC to incorporate these updated zone allocations for consistency. We plan to update the St Pancras station floorplan with the implementation of the EU Entry Exit System in autumn this year. We would use this as the final allocation of the LTC at St Pancras; although this is expected to have limited impact on the overall allocations. However, if no agreement is reached on the SAC updates, HS1 will revert to the allocations defined in the SAC.

To allocate the common zone LTC:

- For St Pancras International, we use the proportions given by the SAAs. This is no change from those used in PR19.
- For Ebbsfleet International, when EIL ceased stopping at the station, the common zone LTC costs were reallocated 100% to SETL. In accordance with the SAC, we retain this allocation for PR24. If EIL resumes stopping at the station, this would trigger another reallocation.

The allocation of the common zone LTC for both stations are shown in Table 63.

For **Stratford International** station, SETL pays 100% of the LTC. For **Ashford International** station, EIL pays 100% of the LTC.

**Table 63: Common zone LTC allocation, St Pancras and Ebbsfleet**

| Zone | St Pancras | | Ebbsfleet | |
|---|---|---|---|---|
| | PR24 | PR19/SAA | PR24* | PR19/SAA |
| EIL | 35.30% | 35.30% | 0.00% | 32.70% |
| EMR | 29.10% | 29.10% | N/A% | N/A% |
| SETL | 35.60% | 35.60% | 100.00% | 67.30% |
| Total | 100% | 100% | 100% | 100% |

* This represents no change from the allocation of Common Zone LTC since 2021.

The resulting LTC for each operator is shown in Table 64. The relatively higher increase for SETL reflects the changes in the allocations at Ebbsfleet, where SETL has both an increase in the relative size of the Domestic Zone and pays 100% of the full Common Zone LTC compared with PR19. More detail on the revised allocations at St Pancras and Ebbsfleet is in the relevant station LCR.

**Table 64: Stations LTC by operator (£m pa, February 2023 prices)**

| | PR24 | PR19* | £ change | % change |
|---|---|---|---|---|
| EIL | 7.74 | 6.31 | 1.43 | 23% |
| EMR | 2.10 | 1.55 | 0.56 | 36% |
| SETL | 5.72 | 3.72 | 1.99 | 54% |
| **Total** | **15.56** | **11.58** | **3.98** | **34%** |

## 16.6 Total station charges

Stations operations and maintenance costs (Qx) is a significant cost for operators, larger than the LTC costs. It is an important consideration in overall affordability for the operators. Table 65 sets out the combined stations charges for CP4 based on the proposed CP4 LTC and latest estimate of Qx, the 2024/25 best estimates recently published.

**Table 65: Total stations charges for CP4 (£m pa, February 2023 prices)**

| | LTC | Qx* | Total | | LTC | Qx* | Total |
|---|---|---|---|---|---|---|---|
| St Pancras | 10.36 | 28.38 | 38.74 | EIL | 7.74 | 14.66 | 22.40 |
| Stratford | 2.23 | 4.47 | 6.70 | EMR | 2.10 | 8.43 | 10.53 |
| Ebbsfleet | 1.93 | 4.90 | 6.83 | SETL | 5.72 | 16.93 | 22.65 |
| Ashford | 1.04 | 2.28 | 3.31 | | | | |
| **Combined** | **15.56** | **40.03** | **55.59** | **Combined** | **15.56** | **40.03** | **55.59** |

* These are the latest Qx estimates available deflated to February 2023 prices to be consistent with the LTC. Allocation of St Pancras Qx among operators may be amended.

# Part 4:

# REGULATORY AND INCENTIVE FRAMEWORK

# 17 Regulatory framework 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 previous periodic reviews and is working well. We therefore propose largely rolling over this framework to CP4.

**Section 18: Access provisions**

As part of a periodic review, the Concession Agreement requires us to provide details of any proposed changes to the HS1 Passenger Access Terms and HS1 Freight Access Terms (together, the "Access Terms") for:

- The track access performance regime (other than the cap on liability); and
- The possessions regime (other than the cap on liability).

In addition, the Access Terms specify that the periodic review may cover any proposed changes to the following items:

- Volume reopener (defined as a Review Event in the Access Terms)
- Wash up provisions;
- Carbon costs;
- Capacity Reservation Charge; and
- Pass through cost categories.

Overall, we are proposing changes to the Access Terms in several areas, due to the Access Terms being stress tested during Covid-19 and other developments. We set out in this section how we are approaching this, as well as the proposed changes to the Framework Track Access Agreements.

**Section 19: Structure of charges**

The structure of charges determines how we apportion the costs of running the railway between the operators using the railway. We undertook a comprehensive Structure of Charges Review during CP3 in line with our commitment in PR19.

**Section 20: Escrow investment strategy**

Our current proposal for CP4 is to continue to follow the CP3 investment strategy and Escrow Cash Management Policy (ECMP) which is based on maintaining the current Concession Agreement provisions. DfT is proposing amendments to the Concession Agreement to improve

escrow returns. Some of this work will require further exploration by DfT, with HS1's assistance; this would incur legal costs that need to be recovered from the operators if the amendments are taken forward.

# 18 Access provisions

This section covers our review of, and proposed amendments to, important areas of the Access Terms and Track Access Agreements to be implemented for CP4. The proposed changes have been identified through:

- Issues identified with provisions when these were tested during the period of high volatility and uncertainty in train services due to the Covid-19 pandemic;
- Review of charges and terms as part of the PR24 process; and
- Wider developments such as the possible entry of new operators on the HS1 system.

## 18.1 Performance regime

The 2016 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 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 in accordance with the HS1 Network Code using NRIL's TRUST system, as on the national rail network.

The periodic review process does not require the performance regime to be recalibrated. However, as it affects the risk exposures of the parties, it has previously been expedient to do so. The performance regime was recalibrated as part of PR14 and PR19; thresholds and payment rates were recalculated using recent performance, demand and revenue data.

A fundamental principle of performance regime recalibration is that the regime should be recalibrated on data which is considered representative of operations going forward. Extraordinary events throughout CP3 (Covid-19, Brexit, significant industrial action) mean that demand, revenue and large parts of performance data from CP3 is unlikely to be representative for CP4. Because of this, HS1 held iterative consultations with stakeholders to discuss options for the approach to recalibration for PR24.

In a minded to proposal, HS1 sought views on delaying recalibration to a time during CP4 when data more representative of future operations was available. Stakeholders supported a delay until CP4 when sufficient data was available, but expressed a preference that recalibration be

done early in the control period. We currently expect sufficient data for a recalibration would likely be available around mid to late 2025. Following the recalibration, NR(HS) will need to update its Annual Fixed Price with the revised pricing of performance risk. Therefore, we propose that provisions be expressly provided in the ORR's PR24 determination to (i) support an in-control period recalibration; and (ii) allow HS1 to adjust the operators' OMRC charges to reflect any savings or increases to performance risk cost resulting from the recalibration.

HS1 or a train operator will retain the option under the Access Terms to request a recalibration of the performance regime at any point during CP4 if there is a material change. Given the more uncertain traffic outlook, it is more likely that performance regime recalibrations can be requested under the Access Terms. We propose that provisions be expressly provided in the ORR's PR24 Final Determination that allows (i) that the external cost of additional recalibration exercises (i.e. the consultancy costs) be borne by party that requests the recalibration; and (ii) HS1 to adjust the operators' OMRC charges to reflect any savings or increases in performance risk cost.

The backward looking nature of previous recalibrations is not only too simple a view of future performance, it also presents a potential challenge when setting parameters for potential additional operators. During CP4 we propose to also explore whether changes to the wider methodology, such as learnings from the new methodology introduced for NRIL in PR23, or setting the parameters based on forward looking modelling of asset performance are appropriate. Such an exercise will be undertaken so that any changes to the structure of the performance regime and its incentives can be considered in preparing the asset management plans for PR29.

The Access Terms do not have provisions to compensate for reactionary delays incurred by stakeholders on our network. Following a request from a user, we are working with NR(HS) to develop an approach to reactionary delays, and associated recovery plans. We will be consulting all affected stakeholders on the potential implementation and whether such a change aligns to the objectives of the performance regime[21]; this will require changes to the Access Terms. While this has the potential to affect NR(HS)'s performance risk pricing, it does not require a recalibration.

## 18.2 Possessions regime

The 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

[21] The objectives of the performance regime are to: (i) incentivise HS1 Limited and operators to deliver improved levels of performance; (ii) take account of and minimise TOC on TOC delay; (iii) ensure financial risk on each party is manageable and proportionate; (iv) be as simple as possible to understand and operate; and (v) be based on efficient and accurate monitoring and recording. See ORR Criteria and Procedures for the approval of framework agreements on the HS1 network. 23 November 2021.

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.

### 18.2.1. Efficient possessions for CP4

As explained in Section 11.2, there is a greater need for engineering access in CP4 relative to previous control periods due to the increasing age of the infrastructure and the renewals and maintenance interventions needed to keep the assets in the required condition. The Possessions Allowance in the Access Terms needs to be amended to allow for these increased engineering access requirements.

NR(HS) has undertaken an extensive exercise to determine the CP4 possession requirements, combining historical possession requirements for steady state interventions with predictions for new and/or future renewals and 'renewals to maintenance' based on more data-led modelling and stakeholder engagement. NR(HS) has taken steps to optimise efficient delivery to provide possessions requirements for inclusion in the Access Terms ahead of detailed scheme and plan development. These steps include:

- Multi work item possessions: assumptions on delivery of multiple work items in any given possession, aligned to the ORR Possessions Efficiency Independent Report 2021[22];
- Routing strategy and access modelling: more sophisticated access modelling with direct input from system stakeholders (particularly operators) to collaboratively identify acceptable access options, balancing disruption with cost;
- Optimisation of delivery: work to combine simple or non-disruptive works in possessions assigned to heavy works to maximise the efficiency of possessions; and
- Additional possessions efficiency: by assuming an estimated average delivery of six work items (increased from four previously) in standard possessions.

The resulting CP4 possessions requirements are shown in Table 66.

[22] www.orr.gov.uk/sites/default/files/2021-10/ghd-possessions-efficiency-review-independent-report-april-2021.pdf

**Table 66: CP4 possessions**

| Possession Type | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 |
|---|---|---|---|---|---|
| 12 hours | 12 | 10 | 16 | 8 | 8 |
| 10.5 hours | 0 | 0 | 0 | 67 | 84 |
| 8 hours | 36 | 38 | 38 | 34 | 34 |
| Midweek overnights | 42 weeks | 42 weeks | 42 weeks | 42 weeks | 42 weeks |
| Double line up to 30 mins | 3 per day | 3 per day | 3 per day | 3 per day | 3 per day |

### 18.2.2. Possessions allowance amendments

There are a large number of heavy renewals scheduled in CP4 that have additional planning challenges (such as ballast cleaning) and occur at different times over the control period. Given this, we have structured the Possessions Allowance into two categories.

**Standard Possessions Allowance:** The profile of access requirements necessary to deliver maintenance activities, including renewals to maintenance work items, and low-complexity renewals where they can be scheduled into the integrated plan. This largely mirrors the allowance currently in the Access Terms, adjusted for the increased number and type of works to be delivered. This includes some 12-hour possessions for renewals to maintenance works.

**Extended Possessions Allowance:** Additional access requirements for significant and complex renewals schemes, such as ballast cleaning, location cases, and switches and crossings refurbishment, with additional work scheduled into the possession where possible. This means including the allowance for the 8-hour, 10.5-hour and 12-hour possessions as agreed with stakeholders in the access modelling work. The scale varies year to year in line with the planned timing of the works, with phasing subject to finalisation through the Engineering Access Statement process. We will therefore include an indicative annual amount while providing a total five-year allowance for each type of possession.

We propose to define in the Access Terms these two categories of Possessions Allowance and the number of each type of possession. More detail on the Possessions Allowance amendments, including the breakdown into Standard and Extended Possessions Allowances, is provided in the supporting document NR(HS) Possession Allowance CP4.

HS1 will consult on the full range of proposed amendments to the Access Terms alongside the PR24 process (see Section 18.9 for more detail).

## 18.3 Volume reopener

OMRC is set on a per km and per minute basis using forecast traffic levels expected for the control period. As the intent of the HS1 regulatory framework is that we neither over- nor under-recover our costs, HS1 needs to be able to reapportion the fixed costs (OMRCA2 and OMRCB) between train operators if there are material changes in train numbers that materialise relative to the forecast used in the periodic review process. The Access Terms have Review Event provisions to allow for this, but it is more commonly known as a Volume Reopener (VRO).

For passenger services:

- The first volume reopener in a Control Period is triggered when the anticipated number of total timetabled train services in a given year differs by at least +/-4% from the forecast in the ORR's Final Determination; or
- When the anticipated number of timetabled train services for an individual passenger service operator in a given year differs by at least +/-4% from the forecast in the ORR's Final Determination.
- For any subsequent volume reopener, the baseline for triggering the reopener is the volume of trains that triggered the previous reopener.

For freight services:

- The first volume reopener in a Control Period is triggered when the forecast number of timetabled train services in a given year differs by at least +/-12.5% from the forecast in the ORR's PR19 Final Determination, if different.
- For any subsequent volume reopener, the baseline for triggering the reopener is the volume of trains that triggered the previous reopener.
- Freight charges are also reopened when the passenger reopener is triggered (but not vice versa).

These provisions were triggered during Covid-19 when train volumes reduced significantly from those expected in the PR19 Final Determination. The first VRO was executed for the December 2020 Principal Change Date to reapportion charges for the December 2020-21 Timetable Year. Due to the uncertainty around recovery in train volumes, HS1 agreed with the passenger operators and the ORR to hold annual VROs for the remainder of CP3.

In applying the VRO provisions through this period, HS1 identified a number of issues with the wording of the provisions in the Access Terms. The current provisions were not intended for circumstances with large reductions in train volumes and high uncertainty in future volumes, could drive perverse incentives and outcomes, and need further clarification for consistency. These are in the areas of:

- Clarification of the definition of a VRO event to make it simpler to understand. Also to amend the definition of the trigger for a subsequent VRO to refer to the forecast for that year, not the previous actuals (as these could differ significantly in situations with high uncertainty).

- Clarification of the evidence that HS1 can rely upon to form a reasonable view on expected train volumes.
- Clarifications that ensure the reapportionment and recovery of fixed costs are done on a fair allocation basis across operators.

HS1 is proposing to make amendments to the VRO provisions to address these issues. The operators also have proposals for amendments to the VRO provisions. These will be incorporated into HS1's separate consultation on the Access Terms amendments.

## 18.4 Wash up provisions

Under the HS1 Passenger Access Terms (PAT) 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 timetable and an estimate of the Pass Through Costs for the year.

The PAT provides 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 (FAT), freight operators are invoiced in arrears on the basis of actual trains operated and there is therefore no wash up for freight.

The large and uncertain changes in train volumes during Covid-19 highlighted issues with the wash up provisions in the PAT. HS1 is proposing changes to the following provisions:

- Pass through costs wash up: Application of the PAT provisions during Covid-19 highlighted that the strict interpretation limits the wash up to only the amount of under (over) recovery, not the total OMRCC amount. This could result in unfair allocation of OMRCC when actual volumes differ significantly from the FWT used to apportion OMRCC at start of the year, and could drive perverse incentives. We propose to address this by amending the provisions to apply the wash up to the total OMRCC costs in the year.
- OMRC charges wash up. To implement our proposed changes related to the Volume Reopener (VRO) provisions (Section 18.3) we propose to amend these wash up provisions to ensure fair allocation and recovery of fixed costs across operators.

We understand that operators are also proposing changes to the wash up provisions. HS1 will consult on the suite of proposed amendments to the Access Terms in a separate consultation process which will run alongside PR24 (see Section 18.9).

## 18.5 Carbon costs

The Access Terms contain a provision for us to recover costs incurred in relation to the Government's Carbon Reduction Commitment (CRC) Energy Efficiency Scheme. The scheme was closed in 2019; we are therefore proposing to remove this provision as it is no longer required.

## 18.6 Capacity reservation charge

### 18.6.1. Current provisions

The 2016 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 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 long term 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.

### 18.6.2. CP4 proposal

In PR19, we noted that there was spare capacity on the HS1 route and in recognition of this we suspended the Capacity Reservation Charge. We did, however, signal that we would keep this 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.

We now observe that while no party has yet committed to starting operation on HS1, significant interest exists from several prospective operators. Furthermore, one of these has made an application for access with the intention of starting international train services during CP4.

While we do not currently believe that any existing operator is holding inappropriate capacity, we nevertheless consider it appropriate to reactivate the Capacity Reservation Charge to ensure that operators hold only the capacity they intend to operate. We propose to reactivate the Capacity Reservation Charge at the start of CP4; this does not require any changes to the Access Terms. This Draft 5YAMS will serve as a consultation to gather views on the reactivation of this charge.

## 18.7 Pass through cost categories

### 18.7.1. 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 the ORR to determine in the periodic review which elements of cost are suitable for inclusion as pass through costs.

For CP3, the relevant cost categories defined in the PAT are:

- Rates;
- Insurance;
- Non-traction energy costs;
- Any sums payable by HS1 Ltd in connection with the provision of dispute resolution services;
- Operations, maintenance, renewal and replacement costs of the UKPNS assets; and
- Any costs incurred by HS1 Ltd in connection with the market testing of some or all of the services provided under the Operator Agreement

Other than costs in connection with dispute resolution services and market testing, these cost categories are identical to the initial list of pass through costs defined in the Concession Agreement.

In PR19, HS1 proposed that small scale energy saving schemes (the REACT schemes) should be included in pass through costs and this was agreed with the operators. We have been recovering these costs under OMRCC during CP3, however the amendment to the PAT was

inadvertently missed in light of our focus on Covid-19 management. We intend to remedy this as part of the Access Terms changes for CP4 (see Section 18.).

There is no pass through cost element of OMRC for current freight traffic.

### 18.7.2. CP4 proposals

There have been no issues in relation to the provisions which have been in place from CP1 through to CP3. We believe that the cost categories currently identified as pass through costs should continue into CP4. We do however propose to amend the pass through costs defined in the PAT to:

- Add costs related to the REACT schemes and the N-1 scheme; and
- Clarify some of the existing pass through cost items to support the most efficient approach to cost recovery from the TOCs.

Section 3.4.4 discusses the work we have undertaken to minimise pass through costs in CP3 and we will continue to pursue any further opportunities to reduce the level of pass through costs in CP4.

**REACT schemes**

We propose to include the cost of the REACT schemes as a defined pass-through cost in the PAT. This will allow HS1 to recover the proposed CP4 budget of £250k for these schemes as costs are incurred (see Section 9.2.2). Recovering the costs through this mechanism will provide HS1 with the flexibility to implement a rolling programme of these schemes and deliver positive benefits in the most timely and efficient way.

**N-1 Scheme**

The N-1 scheme commenced in January 2024 and is described in Section 9.2.1. The scheme provides savings to TOCs through reduced traction electricity charges, but involves ongoing costs incurred by UKPNS (as well as one-off costs to HS1) that operators agreed would be recovered by HS1. In the implementation process for the N-1 scheme, we outlined our intention to include ongoing N-1 cost recovery as a pass through cost for CP4 onwards. This will reduce the administrative burden of billing separately for N-1 costs which is being done in CP3.

**Cost clarification**

HS1 has identified certain costs that could be incurred in relation to the efficient management of pass through costs on behalf of the TOCs. These are variable or 'difficult to predict' elements that relate to existing categories of pass through costs which are not clearly defined. We do not consider these costs should be included under HS1's costs (which are fixed) given they are difficult to predict, meaning HS1 could have material under or over spend. They would also be incurred by HS1 in order to derive cost savings that would be passed through to the TOCs (i.e. a reduction in the pass through cost from the service we have procured on their behalf).

Therefore, including these items in pass through cost is the efficient and fairest approach to cost recovery.

We propose to clarify these costs in the PAT to ensure HS1 is able to recover them. The list below shows the existing pass through cost category, the associated costs and proposed clarifications.

- **Rates: Success fees paid to ratings advisers**

The costs of engaging ratings consultants as part of normal negotiations with the Valuation Office Agency are currently included in HS1 costs. HS1 proposes no change to this but recognises that there may be additional one-off unbudgeted costs incurred as part of appeals to live ratings lists. Although such costs have never been incurred to date, they would most likely comprise an hourly rate plus a "percentage of savings" incentive arrangement; any such costs are unpredictable. Furthermore, these costs would be incurred to achieve a reduction in business rates, which would flow through to the TOCs. HS1 proposes that the costs associated with obtaining a reduction in a live list should be recovered from the TOCs under OMRCC.

- **Insurance: Broking fees and professional costs**

In addition to the fees payable at the renewal of insurance, HS1 incurs fees associated with ensuring such renewals deliver the best possible outcome. This includes, in particular, asset revaluations, risk assessments and other activities designed to ensure up to date and efficient insurance coverage. These costs are required as part of the insurance placement but are variable in nature as they follow rolling programmes across a number of years and evolving best practice. They may also include one-off studies that lead to insurance premia reductions, such as the blast modelling work at St Pancras that reduced our Estimated Maximum Loss at the time of the November 2022 renewal by £160m. HS1 proposes that the insurance pass through definition is amended to include all such costs.

- **Non-traction energy: Management and bill checking**

Energy Risk Management (ERM) is a service provided to HS1 in gathering electricity market intelligence, advising HS1 on purchasing strategy and executing electricity trades on HS1's behalf. The Energy Supply Contract (ESC) is the service to actually provide and invoice for the purchased electricity and is many orders of magnitude larger than the ERM. Historically, the cost of ERM has been included in the management charges levied through the main ESC. HS1 is now separating the ERM and ESC elements. It is expected that an independent ERM will enable HS1 to hold the main supplier to account, provide an expert review of information provided under the ESC and will ultimately lead to lower overall costs. In addition, HS1 is investigating the option of conducting checks on historical bills received from the ESC with these checks potentially being remunerated on a share of savings basis. HS1 will need to incur costs for these services in order to provide savings for the TOCs. As these costs are unpredictable and hence difficult to quantify, it is most efficient to include them in pass through costs. HS1 proposes the clarification that all electricity related costs, including ERM and bill checking services, are included in OMRCC.

We are not proposing any other charges to OMRCC for CP4. As part of our Structure of Charges Review (see Section 19.3) we had proposed to expand the scope of OMRCC charges to include regulatory fees set by the ORR and RSSB and the cost of the BTP. These are costs that HS1 Ltd has little opportunity to control and we consider that categorising these costs as pass through would give operators more transparency and allow for more direct engagement on how these costs are set. While we maintain this view, the operators have not supported this change. We are therefore not pursuing this for CP4.

## 18.8 Outperformance regime

The PAT has provisions that reflect the Outperformance Regime in place between HS1 and NR(HS) under the Operator Agreement. The purpose of this regime is to incentivise NR(HS) to deliver outperformance beyond its efficient AFP for the control period.

The regime applies in years 3, 4 and 5 of the control period. If NR(HS)'s actual costs are lower than the AFP for that year, these savings are split between NR(HS), HS1 and passenger operators on a 50% / 20% / 30% basis, respectively. If actual costs are higher than the AFP for that year, NR(HS) bears all the additional cost as underperformance. Since March 2022, NR(HS) has also had an Outperformance Plan in place against which we monitor NR(HS).

The effectiveness of the Outperformance Regime as an incentive mechanism has been raised as part of PR24. It has both been suggested that it does not create sufficient incentives to outperform, and that more outperformance should be shared. As no clear objective or reason why the Outperformance Regime needs changing has been articulated, we do not consider that making changes to the Outperformance Regime would deliver material benefits to the system at this stage; e.g. sharing outperformance across the full five years would reduce incentives on NR(HS) to outperform. HS1 is, however, open to further views on this.

## 18.9 Approach to Access Terms changes

In addition to the proposed changes outlined above, HS1 is proposing changes to the Access Terms to:

- Clarify the billing of Additional IRC on spot bids;
- Clarify that traction electricity charges include the costs associated with Renewable Energy Guarantees of Origin (REGOs)[23] which are being used more; and
- Make amendments to reflect legislative changes since PR19.

The operators also have proposals for amendments to the certain provisions in the Access Terms such as the VRO provisions, billing and disputes processes.

As agreed with stakeholders, HS1 will be consulting on the proposed changes in a separate Access Terms Consultation which will run in parallel with the PR24 process. The outcome of the

[23] This includes, but is not limited to, REGOs which are required as part of a Corporate PPA

consultation will be provided to the ORR in time for its Determination to enable any approved changes to be incorporated in the Access Terms for the start of CP4.

## 18.10 Framework Track Access Agreements

Framework Track Access Agreements (FTAAs) are important contracts that contain, amongst other requirements, indemnity clauses that protect HS1 and the operators in the event of accidents on the network. EIL and SETL FTAAs with HS1 are due to expire in 2024. We have started discussions on renewing these with the operators.

The process of agreeing and signing new FTAAs presents an opportunity to review the existing agreements. We are engaging with stakeholders on how we can ensure all FTTAs are fit for purpose in a multi-operator environment and guarantee fair and non-discriminatory access to the network for all existing and future users.

# 19 Structure of charges

The structure of charges determines how we apportion the costs of the HS1 railway between the operators using the infrastructure. It is important in terms of establishing a fair allocation, and to incentivise efficient use of the network.

For the route OMRC, 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 Railways (Access, Management and Licensing of Railway Undertakings) Regulations 2016 (2016 Regulations) and the relevant European directives that still apply.

For stations LTC, the structure of charges is set by a framework of contractual agreements, including the Concession Agreement, Station Leases and Station Access Agreements. We set out the detail on this in Section 16.5.1 so that the information on the LTC and its allocation to operators is provided together.

This section focuses on the route structure of charges. It:

- Sets out the charging principles in the 2016 Regulations and how HS1's charges are compliant with these principles; and
- Summarises the process undertaken in the Structure of Charges Review during CP3, the areas covered, conclusions and the latest update on next steps.

The structure of charges framework set out in this section underpins the calculation the charges for CP4 shown in Section 15.

## 19.1 Route regulatory requirements

The 2016 Regulations set out the charging principles for 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 2016 Regulations require charges to be set at "the cost that is directly incurred as a result of operating the train service". Despite Brexit, the 2016 Regulations require this is done by reference to the Commission Implementing Regulations (CIRs) '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 modalities 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, and replacement costs related to obsolescence;

- 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 forecast or actually operated;
- 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.

The recovery of directly incurred costs will be substantially lower than the total costs of providing the HS1 infrastructure services. In order to allow for the recovery of total costs incurred, HS1 Ltd uses the second exception to the charging principles allowed for under the 2016 Regulations. The two exceptions to the charging principles are:

**Exception 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

**Exception 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.

HS1 applies the second exception as set out immediately below.

## 19.2 Statement of compliance with the 2016 Regulations

### 19.2.1. Full cost recovery

HS1 Ltd satisfies the requirements for the second exception to the charging principles under the 2016 Regulations 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 established 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.

### 19.2.2. Structure of charges

The structure of our charges is based on the considerable work (including industry consultation) done in the lead up to the sale of HS1 and is set out in our Network Statement. As per the 2016 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) long term 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 PR19, changes to the HS1 structure of charges were required to ensure consistency with the 2016 Regulations following the recast of the Directives during CP2. The ORR, in its PR19 Final Determination, approved that our structure of charges and charging model were consistent with the 2016 Regulations. During CP3 we ran an extensive iterative consultation on HS1's structure of charges with stakeholders and found that the fundamental structure and approach was appropriate (see Section 19.3). We rebuilt the HS1 Route Charging Model in 2022/23 to improve the transparency and usability of the model – this incorporated some minor functionality and input changes but did not change the fundamental structure of HS1's charges (see Section 15.2.2).

As part of PR24 we commissioned CPCS to audit the rebuilt route charging model to assess whether the model operates in a manner consistent with HS1's structure of charges. CPCS endorses the view that the HS1 Route Charging Model for PR24 operates as expected and in a manner consistent with the PR19 route charging model which was determined by the ORR as consistent with the regulations. HS1 is therefore confident that the HS1 Route Charging Model for PR24 is consistent with the 2016 Regulations.

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.
- Long term avoidable and long term common costs
  - OMRCA2: the avoidable costs on a long run incremental cost 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. These costs are allocated to that particular class of operator. An example is the section of infrastructure from Ashford International Station 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 long term common costs. OMRCB includes, for example, head office costs, and common 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 Directly Incurred and long term avoidable elements (OMRCA1 and OMRCA2).

## 19.3 Structure of Charges Review

As part of PR19, HS1 committed to undertaking an in-depth review of the structure of HS1's OMRC charges and other incentive elements during CP3. The review was conducted in four phases, commencing in May 2021. It involved iterative consultation with stakeholders (including train operators, the ORR and DfT), reviews of approaches adopted by other infrastructure managers, work with NR(HS) to understand in more detail the relationship between direct and non-direct costs and possible research into the impact of different trains on the network. The Conclusions and Next Steps were published in August 2022.[24]

Overall, the review concluded that the fundamental structure of charges and other incentive elements remained appropriate at this time. It identified several elements to be reviewed as part of the PR24 process; minor functionality changes and input data would be incorporated into the rebuilt HS1 Route Charging Model (see Section 15.2.2) for consultation as part of the PR24 process.

The specific areas we said we would consider in our review were:

- **Modifying charges based on vehicle characteristics, i.e. different types of rolling stock:** Through the R&D fund, HS1 initiated PhD research that could provide insight into the appropriateness of the Equivalent Million Gross Tonne-km Per Annum (EMGTPA) calculations currently used to allocate direct costs between operators for wear and tear. Unfortunately, due to Covid-19 and PhD recruitment and retention issues, the research has been delayed. We are therefore not proposing any changes at this time. We will use any emerging evidence from the research to make changes to this methodology (if appropriate) in the future.
- **Treatment of non-direct costs:** We do not consider that the type of train has a principal correlation to long term (non-direct) costs. The impact of heavier, faster trains is dealt with under the treatment of directly incurred costs (OMRCA1). To ensure our charging structure is cost reflective, we and NR(HS) undertook a detailed cost causation review to understand how each NR(HS) activity relates to direct costs. This has been incorporated into the direct/non-direct split of costs in the route charging model.

[24] The three publications related to our Structure of Charges Review are published on HS1's website: https://highspeed1.co.uk/regulatory/periodic-reviews

- **Treatment of freight costs:** The PhD research and the cost-causation work to update the direct/non-direct split of costs noted above also applies to the treatment of freight and its impact.
- Any other issues raised by stakeholders.

The areas we covered, the conclusions and the latest update on the next steps are summarised in Table 67.

**Table 67: Structure of Charges review - conclusions and next steps**

| Item | Conclusions and Next Steps |
|---|---|
| IRC | HS1 discount policy remains appropriate.<br><br>HS1 will consider any discount proposals for new and underutilised routes in line with the current policy. |
| Renewals costs | ORR intends that the long-term renewals annuity methodology used in PR19 is used for PR24. It is willing to explore profiling of the annuity within CP4 to support operators' affordability if needed.<br><br>DfT, with HS1's assistance, will be exploring amendments to the escrow investment requirements in the Concession Agreement to increase returns. |
| Direct/non-direct cost split | HS1 will maintain the existing EMGTPA methodology. We will review the emerging evidence from the R&D activities in consultation with stakeholders to consider if a different approach should be used in future.<br><br>The direct/non-direct cost splits used in CP3 has been updated as part of the PR24 process based on a more granular assessment of the cost drivers and the most current evidence at this time. |
| Split between operators | HS1 has reviewed the split between operators and updated these to reflect expected traffic patterns – these are set out in Section 7.1. |
| Other operators | HS1 cannot pursue the allocation of stations costs to Govia Thameslink Railway for use of St Pancras without DfT agreement. We have asked ORR to consider this in its review of stations cost allocation. |

| Item | Conclusions and Next Steps |
|---|---|
| Other incentives | HS1 plans to reactivate the Capacity Reservation Charge given the prospect of new entrants.<br><br>We may review the introduction of new incentive-based charges if there is a material change to capacity usage, e.g. a new operator with significant volumes.<br><br>We are proposing contractual amendments to the Access Terms to incentivise the booking of realistic train volumes and fair allocation of costs across operators (see Section 18). |
| New market segments | HS1 will continue to consider new market segments to bring forward in future Network Statement consultation. |
| Station enhancements policy | HS1 has finalised and published the Station Enhancements Policy on the HS1 website. There may be future amendments in light of potential new operators (see Section 16.4.1). |
| Freight charges and Ripple Lane | HS1 will maintain the existing EMGTPA methodology for PR24. We will review the emerging evidence from R&D activities in consultation with stakeholders to consider whether a different approach should be used in future.<br><br>DfT has concluded not to transfer Ripple Lane to Network Rail so HS1 will not pursue this further. We maintain that the transfer of Ripple Lane to NRIL would be a much more cost efficient way to manage the infrastructure. |
| R&D fund | The CP4 R&D strategy (see Section 10.3.2) proposes that R&D costs in CP4 are treated as an O&M cost (as in CP3) and that NR(HS) will hold the funding for CP4 R&D. Funds will be ring-fenced and will not form part of NR(HS)'s Annual Fixed Price. |
| Charging model | HS1 ran an iterative consultation with stakeholders on the rebuild of the route charging model to improve transparency, useability and implement minor functionality and input changes based on the outcomes of the Structure of Charges Review (see Section 15.2.2). The new model is used for PR24. |

The review also covered Specified Upgrades and pass through costs; these are covered in detail in the relevant sections of this Draft 5YAMS.

# 20 Escrow investment strategy

## 20.1 Improving escrow returns

The current escrow investment requirements set out in the Concession Agreement and Stations Leases mean that additional banks are unwilling to accept deposits and the investment instruments currently allowed are not maximising returns or diversification. This means that currently escrow investments earn a return lower than operators could potentially earn on investments, and in some cases less than inflation.

The two possible enhancements to help narrow the gap between interest earned and inflation are:

- Amending Appendix 4 of Schedule 10 of the Concession Agreement and Annex 4 of Schedule 10 of the HS1 Lease to improve the ability and willingness of banks to take deposits since the current terms are too prescriptive and lack flexibility to meet the latest banking norms. Currently we are unable to maximise returns and increase diversification, which could lead to an even larger interest gap if changes are not made, especially as we have reached investment capacity.
- Expanding the scope of Authorised Investments (as defined in the Concession Agreement) to include money market funds and reverse repurchase agreements so that we are able to diversify and increase returns while maintaining security over the balances.

DfT is proposing amendments the Concession Agreement (and equivalent changes to the Station Leases) to implement the first of the enhancements detailed above that could be implemented during CP3 with limited cost to any party.

The second enhancement requires further exploration and analysis by DfT, with HS1's assistance, to make sure any changes made are appropriate. If the changes are taken forward, DfT and HS1 will need to recover the legal fees incurred from the operators which are the sole beneficiaries of this enhancement. This cost is estimated to be £200k in total for DfT and HS1 external legal advice and drafting as well as the ORR's regulatory fees for work on this (which HS1 will incur). The pay off period is estimated to be eight months, given the benefit of the changes to the Authorised Investments and returns current forecast.

We could recover the costs of this project to amend the escrow Authorised Investments in two ways:

- As a project specific cost incorporated into the HS1 cost budget in the Final 5YAMS; it would be ring-fenced (similar to the treatment of the R&D budget in CP3) and would be credited back to operators if the project cannot be taken forward or if there is any underspend; or
- Included as a pass through cost in the Final 5YAMS, where these costs are incorporated into the pass through cost wash up in the year they are incurred.

We are seeking operators views on whether they support DfT, with HS1's assistance, exploring amendments to the types of Authorised Investments permitted in the escrow investment strategy and that this would be funded as a CP4 project.

## 20.2 CP4 escrow investment strategy

Our current proposal for CP4 is to continue to follow the CP3 investment strategy and Escrow Cash Management Policy (ECMP) during CP4 which is based on maintaining the current Concession Agreement provisions.

We will propose enhancements to the strategy to optimise interest received, if and when DfT makes any changes to Concession Agreement.

Table 68 shows the estimated escrow account movements forecast for CP4, compared with CP3 for route and stations. Actual outcomes will depend on market rates at the time, the level of CP4 renewals spend and the renewals track access income actually received. These escrow movements are calculated on the basis of the assumptions set out in Section 7, in particular, the assumption that 80% of funds are placed in Authorised Investments with the remaining 20% in a current account. However, the Concession Agreement allows for up to 90% of funds to be placed in Authorised Investments and in practice we will aim to ensure that cash in low interest instant access current accounts is limited to close to the 10% covenant limit consistent with our ECMP and investment strategy.

**Table 68: Escrow account movements (£m, nominal)**

| | Route | | Stations | |
|---|---|---|---|---|
| | CP3 outturn | CP4 forecast | CP3 outturn | CP4 forecast |
| Opening balance | 91.3 | 188.7 | 52.7 | 84.0 |
| Transfers in | 151.7 | 180.6 | 53.7 | 88.9 |
| Withdrawals | (64.8) | (243.3) | (29.1) | (61.1) |
| Interest | 10.6 | 28.1 | 6.7 | 15.2 |
| Closing balance | 188.7 | 154.2 | 84.0 | 127.1 |

# Part 5:

# CONCLUSIONS AND NEXT STEPS

# 21 Conclusions

This Draft 5YAMS sets out our plans for CP4 and beyond. In developing these plans, our focus has been on what we need to do to deliver our asset stewardship obligations, continue to operate a safe, sustainable and high-performing railway and manage our concession at the most efficient cost.

Events over CP3 have introduced more uncertainty, particularly around traffic volumes, and complexity into the HS1 system; the potential entry of a new international operator adds to this. This has presented additional challenges in preparing our proposals compared to previous periodic reviews. We have based on our proposals on the analysis of a range of traffic scenarios and a number of assumptions that aim to balance the range of risks and opportunities the system faces, based on evidence and good judgement, while delivering on our asset stewardship obligations. We consider it is appropriate that our proposals assume that a new operator does not start operation until CP5.

**Asset management**

During CP3 we have continued to improve our asset management capability through the delivery of our PR19 asset management commitments, working collaboratively with NR(HS) and taking a consistent approach across route and stations to share good practice. Continued improvements in asset information have strengthened our asset management decision making. For track assets, we have developed an industry-leading deterioration model that uses actual wear data which has resulted in significant reductions in 40-year track renewals. For other route and station assets we have developed risk-based models that build a totex output. R&D initiatives in CP3 have improved data collection and quality across asset types and contributed to deterioration modelling; CP3 findings and lessons learned have informed the development of our R&D Strategy for CP4 and the proposals for route R&D initiatives in the SASs.

To navigate the uncertainty around the rate of recovery from the pandemic we developed a set of recovery scenarios against which NR(HS) evaluated different life cycle costs by varying the time to renewals interventions and maintenance requirements. Evaluation of the different scenarios allowed us to fully explore the asset management options and better understand the optimum lifecycle costs for each asset.

Joint assurance of the SASs and renewals workbanks has been extensive, with an iterative process of document reviews, meetings with NR(HS) Heads of Asset and a programme of site visits. In addition, Arcadis provided an independent review of the track SAS and track deterioration model. Reductions in track, OCS and signals renewals volumes have been achieved, partially offset by increases in some civils and plant renewals. For stations renewals, condition information and totex modelling drives a change in the LET renewals strategy to more frequent smaller scale operational interventions across the 40-year period, away from larger full scale asset renewals in PR19 plans.

Through our assurance and continuous improvement processes, we have identified a number of areas in which we intend to make further asset management improvements in CP4 and have documented these as CP4 commitments.

**Cost efficiency**

In developing its Annual Fixed Price (AFP) for CP4, NR(HS) made an initial top-down strategic evaluation of efficiency opportunities for the recovery scenarios. These initiatives were further developed during the detailed PR24 planning to validate the efficiencies bottom-up and identify the requirements to invest in innovation and new ways of working to unlock efficiencies. The resulting CP4 AFP represents a 7% net efficiency when comparing CP4 exit with CP3 exit.

For HS1 costs, we have built costs bottom up, undertaking a comprehensive review of our organisational structure and other HS1 costs. This has enabled us to start CP4 in an efficient, steady state position and deliver an 8% reduction in HS1 costs compared with the CP3 efficient budget. This is delivered despite more complex processes that will continue through CP4. HS1's scrutiny and challenge of the subcontract and pass through costs we manage on behalf of the TOCs had a positive impact. Pass through costs for CP3 are forecast to be 2% lower than budget, with all savings passed on to operators.

Both NR(HS) and HS1 O&M costs have been subject to a robust process of assurance, internal review and challenge and, where appropriate, costs have been benchmarked. Elements of NR(HS) O&M costs have been assured by HS1; we do not yet have sufficient evidence to support the NR(HS) submission in some areas. We forecast an overall reduction of 4% in O&M costs for CP4 compared with the CP3 efficient budget. We will continue to pursue improved efficiency throughout CP4, challenging NR(HS) to outperform its AFP, identifying opportunities to reduce HS1 costs and working to minimise costs which are passed through to train operators.

For CP4 route and station renewals, NR(HS) is moving from a project level workbank to a portfolio-based packaging approach to ensure the efficient management and delivery of renewals. NR(HS) developed the CP4 route renewals cost estimate in accordance with NRIL's Rail Method of Measurement (RMM1). HS1 has assured these CP4 costs, working with NR(HS) to update the approach to project management costs and the calculation of risk allowance. For long term route renewals costs (CP5 to CP11), HS1 has funded and developed the Cost Policy which provides a structured and transparent approach to pricing long term renewals, recognising the inherent uncertainty of forecasting so far into the future.

In the calculation of the route renewals annuity we have maintained the 40-year fully funded approach from PR19. Renewals costs have been inflated by the CPI long term forecast and the annuity is weighted by train volume forecasts over 40 years for consistency with the renewals profile. The resulting route renewals annuity is £31.5 million per annum, a reduction from £34.0 million per annum in PR19. We believe this strikes an appropriate balance between meeting our asset stewardship purpose and ensuring the necessary works are funded in a sustainable economic way, supporting affordability for operators.

The stations renewals plans are based on the totex modelling undertaken by NR(HS) (for the three stations it manages) and by HS1 (for Ashford International) on an aligned basis. Over the 40-year period, there is increase in the costs of a range of civils and mechanical, electrical and

plumbing renewals and additional interventions for some of these assets which is the main driver for the increase in LTC across the stations. The overall 40-year renewals cost is £732 million across the four stations, a 43% increase from PR19 for comparable periods (CP4 to CP10).

Overall, our proposals deliver a net reduction of 1.5% in the HS1 system costs that are the focus of PR24.

**Charges**

Reductions in the route O&M costs and renewals annuity have driven a reduction in OMRC for passenger operators of 13% to 18% compared to current charges, which reflect the VRO reapportionment of fixed costs during CP3. Relative to the PR19 determined charges, there is a small reduction for international services and a small increase for domestic services (less than 1% variance in each case). We consider this a good outcome given the challenges faced by the HS1 system and the lower overall train volume forecasts compared with PR19. The proposed charges for CP4 and comparisons with PR19 and current charges are shown in Table 69.

**Table 69: CP4 OMRC per train variance to current and PR19 charges (February 2023 prices)**

| Service Group | PR24 | Current* | % change | PR19 | % change |
|---|---|---|---|---|---|
| **International (all services)** | £2,594 | £3,168 | (18.1%) | 2,605 | (0.4%) |
| **Domestic** | | | | | |
| Ashford - St Pancras (and vice versa) | £1,949 | £2,234 | (12.8%) | 1,935 | 0.7% |
| Springhead Jn - St Pancras (and vice versa) | £1,015 | £1,170 | (13.2%) | 1,011 | 0.4% |
| St Pancras – Ebbsfleet (Up) | £876 | £1,005 | (12.9%) | 870 | 0.6% |
| St Pancras – Ebbsfleet (Down) | £932 | £1,071 | (13.0%) | 926 | 0.6% |

* These are the 2023 VRO charges issued in February 2024 and OMRCC as at January 2024.

HS1 has delivered a reduction in OMRC costs for freight on the HS1 network compared with CP3. However, the freight OMRC charge per train has increased compared with the CP3 charges determined in PR19 due to a reduction in the freight volumes forecast for CP4. Table 70 shows the charge per train for freight trains operating on HS1; and the Ripple Lane (Domestic Sidings) charge for trains accessing Ripple Lane only from the NRIL network.

**Table 70: CP4 freight charges per train (February 2023 prices)**

| | PR24 | PR19* | % change |
|---|---|---|---|
| Freight OMRC | £1,314 | £981 | 34% |
| Ripple Lane (Domestic Sidings) charge | £88.52 | £71.42 | 24.6% |

* These are the current charges for freight as it has not been subject to the VROs for passenger operators.

The increase in stations 40-year renewals plans results in an increase in the combined HS1 stations LTC of 34%, with increases for individual stations ranging from 19% for Ashford to 38% for Ebbsfleet, as shown in Table 71. We recognise the impact this will have on operators' affordability. HS1 and NR(HS) will be undertaking further work to fully understand the factors driving the large variance. HS1 is also exploring if the Cost Policy approach used for route can be applied to stations long term renewals pricing. We will incorporate any outcomes into our Final 5YAMS submission.

**Table 71: Stations Long Term Charge CP4 (£m pa, February 2023 prices)**

| Station | PR24 | PR19 | £ change | % change |
|---|---|---|---|---|
| St Pancras | 10.36 | 7.55 | 2.81 | 37% |
| Ebbsfleet | 2.23 | 1.62 | 0.61 | 38% |
| Stratford | 1.93 | 1.54 | 0.39 | 26% |
| Ashford | 1.04 | 0.87 | 0.17 | 19% |
| **Total** | **15.56** | **11.58** | **3.98** | **34%** |

**Regulatory and incentive framework**

During CP3 we ran a consultation on HS1's **Structure of Charges** which found that the fundamental structure and approach was appropriate. We rebuilt the HS1 Route Charging Model to improve the transparency and usability of the model; this incorporated minor functionality and input changes but did not change the fundamental structure. The model was audited by CPCS who confirmed that the model operates in a manner consistent with the PR19 model and therefore the 2016 Regulations.

We are proposing changes to the Access Terms in several areas. Some of these changes will address issues identified with provisions which were stress tested during the Covid-19 pandemic. Other proposed changes have arisen from our review of charges and terms during the PR24 process and the greater uncertainty in the system.

Stakeholders supported delaying the recalibration of the **performance regime** until CP4. We are proposing to recalibrate when sufficient data is available, which is likely to be mid to late 2025. For this, the ORR's PR24 determination will need to expressly provide provisions which allow HS1 to adjust OMRC charges for any change in the performance risk cost resulting from the recalibration. We will also be consulting on an approach to compensate for reactionary delays; this may also affect the performance risk cost and require an adjustment to OMRC charges. We will explore over CP4 whether changes to wider recalibration methodology are appropriate.

As the HS1 asset ages, there is a greater need for engineering access for renewals and maintenance interventions. The Engineering Access Strategy, developed in consultation with stakeholders, used a more sophisticated data-led approach, modelling the impact of engineering access on train operators and providing access options. We propose to amend the **possessions allowance** in the access terms to reflect the requirements identified in the Engineering Access Study.

The **volume reopener** (VRO) provisions were triggered during Covid-19. The current provisions were not intended for circumstances with large reductions in train volumes and high uncertainty in future volumes and could drive perverse incentives and outcomes. We propose to clarify the VRO to address the issues identified and to consider additional operator proposals for amendments.

We propose to amend the **pass through costs** definition to add costs related to schemes which reduce electricity consumption and costs for operators (the N-1 and REACT schemes) and to clarify some of the existing pass through cost items to ensure HS1 can deliver further potential cost savings to the operators.

We also propose the following changes to the Access Terms:

- Given interest from several prospective new operators, we propose to reactivate the **Capacity Reservation Charge**;
- Changes to the pass through costs and OMRC **wash ups** to address issues with the application of the provisions identified during Covid-19; and
- Removal of **carbon costs**, which relate to a scheme which is now closed.

We do not consider making changes to the **outperformance regime** would deliver material benefits to the system, but we remain open to further views on this.

Our current proposal for the CP4 **escrow investment strategy** is to continue to follow the CP3 strategy and Escrow Cash Management Policy which are based on the current Concession Agreement provisions. DfT is proposing amendments to the Concession Agreement which would allow us to improve escrow returns. For some of this work to proceed, HS1 and DfT will need to recover associated legal costs from the operators; we are seeking views from stakeholders on how we do this. We will propose enhancements to the strategy to optimise interest received, if and when DfT amends the Concession Agreement.

The allocation of **stations LTC** across the operators is governed by the Station Access Conditions (SAC). We are proposing to use proportions based on up-to-date floor plans to allocate the LTC

into the designated zones for St Pancras and Ebbsfleet stations; these are the stations used by multiple operators. We will need agreement from the operators to reflect this in the SAC. In accordance with the Concession Agreement and the basis of the concession sale, HS1 does not allocate LTC to retailers; retailers pay all directly incurred costs associated with the retail units.

Our proposals assume a new international operator does not start operation until CP5. We consider a change to this assumption to be a material and significant change under the Concession Agreement that would need to be addressed by means of reopening the PR24 determination through an Interim Review. An application for an Interim Review by HS1 would consider the updated system costs and outline what charges would be required from all operators to allow HS1 to continue to comply with its General Duty. Furthermore, our proposals do not include any asset management impact from the flooding event in HS1's Thames tunnels. Investigations are ongoing and we aim to incorporate any findings into our plans in time for the ORR's Final Determination.

The submission of our Draft 5YAMS is a significant milestone in the PR24 process. We are confident that our plans meet the asset stewardship obligations in our Concession Agreement and Station Leases, while delivering a good service at an efficient cost to operators. We invite your views on our proposals and look forward to engaging with you over the coming months.

# 22 Next steps

This Draft 5YAMS has been submitted to the ORR, along with the four stations Life Cycle Reports and other supporting documentation listed in Appendix A4. It launches our formal public consultation with stakeholders on HS1's proposed plans and access charges for CP4. We are seeking responses to this consultation by **18 April 2024**.

Stakeholders are welcome to provide views on any of our proposals. There are some questions on which we are seeking specific feedback as set out in Table 72. We do not include specific questions on our proposed amendments to the Access Terms as we are consulting on these separately (see Section 18).

**Table 72: Questions for consultees**

| No | Question | 5YAMS reference |
|---|---|---|
| 1 | Please explain whether you support the train path forecasts for CP4 and over 40 years that we propose to use, and your reasons for this. Please provide evidence where possible. | Section 7.1.4 |
| 2 | Please give your views on our proposal to address the cost implications arising from an additional international operator through an Interim Review, if there is such an entry in CP4, and correspondingly adjust the OMRC (and LTC if appropriate). | Section 5, 7.1 and 7.3 |
| 3 | Please explain your views on whether you support our proposal that the HS1 annually audited WACC is the rate used for small scale CP4 projects, and that the ORR endorses this in the Final Determination. | Section 7.2.3 |
| 4 | Please give your reasons for whether you support the proposed REACT budget of £250k for CP4 and to remove the annual limit. | Section 9.2.2 and 18.7.2 |
| 5 | HS1's cost base for CP4 is built assuming a steady-state HS1 asset. Please give your views on whether we should consider accounting for any shock events or allowance for new operators (currently assumed to be addressed as part of an Interim Review). | Section 12.4.1 |
| 6 | Please give you view on our proposed approach to Renewals to Maintenance, specifically:<br>(i) To streamline the governance of light renewals that will deliver cost savings.<br>(ii) To evaluate the Renewals to Maintenance approach as part of PR29 planning to explore whether it is to shift some of the future works from renewals funding into O&M. | Section 13.3.2 |

| No | Question | 5YAMS reference |
|---|---|---|
| 7 | Please give you views on the Cost Policy approach to pricing the long term route renewals workbank. | Section 13.5.1 |
| 8 | Please explain your views on whether you support our approach to weight the route renewals annuity by long term train path forecasts. | Section 13.6.1 |
| 9 | Please explain your views on whether you support the use of the updated station floor plans at St Pancras and Ebbsfleet to allocate the LTC into the zones. | Section 16.5.4 and Section 5.2 of the relevant LCRs |
| 10 | Please explain your views on our proposal to reactivate the Capacity Reservation Charge at the start of CP4 to ensure that operators hold only the capacity they intend to operate. | Section 18.6.2 |
| 11 | Please explain your views on whether you support HS1 and DfT exploring amendments to the Concession Agreement to expand the scope of Authorised Investments allowed under escrow investment, and that this would be funded as a CP4 project through the PR24 Determination. | Section 20.1 |

Stakeholders should note that in our Final 5YAMS, which will be published on the HS1 website, we intend to include summarises of the responses to this Draft 5YAMS. If your response includes any confidential and commercially sensitive information which you do not wish to be published, please clearly indicate the specific text which is confidential (e.g. with yellow highlighting).

Please send your responses to:

HS1 Regulation Team: Regulation@highspeed1.co.uk

Following receipt of consultation responses, we will update the Draft 5YAMS and follow the process set out below:

**Table 73: Remaining PR24 milestones**

| Milestone | Date |
|---|---|
| HS1 Ltd submits the Final 5YAMS and Life Cycle Reports to ORR | 31 May 2024 |
| ORR issues Draft Determination and commences consultation | 30 September 2024 |
| 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 | 30 November 2024 |

| Milestone | Date |
|---|---|
| ORR issues Final Determination | 6 January 2025 |
| HS1 Ltd submits revised stations asset management strategy (including life cycle budget) | 27 January 2025 |
| HS1 Ltd submits revised 5YAMS and Life Cycle Reports | 3 February 2025 |
| Start of PR24 | 1 April 2025 |

We will also reflect ORR's final determination in changes to any associated regulatory documents and contracts that are necessary.

The new charges and changes to our regulatory framework will take effect from 1 April 2025.

# APPENDICES

# A1 Glossary

| | |
|---|---|
| 2016 Regulations | The Railways (Access, Management and Licensing of Railway Undertakings) Regulations 2016 |
| 5YAMS | Five Year Asset Management Statement |
| AFC | Anticipated Final Cost |
| AFP | Annual Fixed Price |
| AMAS | Asset Management Annual Statement |
| AMOs | Asset Management Objectives |
| BoE | Bank of England |
| BTP | British Transport Police |
| BTPA | British Transport Police Authority |
| CA | Concession Agreement |
| CDM Regulations | The Construction (Design and Management) Regulations 2015 |
| CIS | Customer Information Systems |
| CIRs | Commission Implementing Regulations |
| CP | Control Period |
| 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 |
| DfT | Department for Transport |
| DTN | Data Transmission Network |
| eAMs | Electronic Asset Management System |
| ECMP | Escrow Cash Management Policy |
| EES | EU Entry/Exit System |

| | |
|---|---|
| EIL | Eurostar International Limited |
| EIM | European (Rail) Infrastructure Managers association |
| EMGTPA | Equivalent Million Gross Tonne-km Per Annum |
| EMMIS | Electrical Mechanical Management and Information System |
| EMR | East Midlands Railway |
| ERTMS | European Rail Traffic Management System |
| ESC | Electricity Supply Contract |
| ESN | Emergency Services Network |
| FAT | HS1 Freight Access Terms |
| FOC | Freight Operating Company |
| FTAA | Framework Track Access Agreement |
| FWI | Fatalities and Weighted Injuries |
| GBRf | GB Railfreight |
| Getlink | formerly Group Eurotunnel |
| GSM-R | Global System for Mobile Communications – Railway |
| 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 |
| LCC | Life Cycle Cost |
| LCR | Life Cycle Report |
| LTC | Long Term Charge |
| M&E | Mechanical and Electrical |
| MAA | Moving Annual Average |

| | |
|---|---|
| MEP | Mechanical. Electrical and Plumbing |
| MPV | Multi-Purpose Vehicle |
| NGC | National Grid Connections |
| NR(HS) | Network Rail (High Speed) Limited |
| NRIL | Network Rail Infrastructure Limited |
| 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 |
| PPA | Power Purchase Agreement |
| PR14 | 2014 Periodic Review of HS1 |
| PR19 | 2019 Periodic Review of HS1 |
| PR24 | 2024 Periodic Review of HS1 |
| PR29 | 2029 Periodic Review of HS1 |
| Qx | Qualifying expenditure |
| RCCS | Route Control Centre System |
| RCM | Remote condition monitoring |
| REGO | Renewable Energy Guarantees of Origin |
| RIDDOR | Reporting of Injuries, Diseases and Dangerous Occurrences Regulations |
| RM3 | Risk Management Maturity Model |
| RMM1 | 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 |
| SAA | Station Access Agreement |
| SAC | Station Access Conditions |
| SAMP | Strategic Asset Management Plan |
| SAS | Specific Asset Strategy |
| SCSR | Station Communications Systems Renewal |
| SETL | SE Trains Limited |
| SNCF Réseau | Infrastructure manager for the French rail network |
| SoS | Secretary of State for Transport |
| SVC | Static VAR Compensator |
| TAA | Track Access Agreement |
| TOC | Train Operating Company |
| TOM | Target operating model |
| TPS | Traction Power Supply |
| UKPNS | UK Power Networks Services |
| UPS | Uninterruptible Power Supply |
| VCS | Ventilation Control System |
| VHME | Vehicle Health Monitoring Equipment |
| VRO | Volume reopener |

# A2 Concession Agreement 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 CP4 | 10 |
| 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 | 18.2 |
| 8.1.3 | Details of forecast demand and traffic levels (with supporting evidence) for CP4 | 7.1 |
| 8.1.4 | A proposal with respect to the level of OMRC for CP4 | 15 |
| 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 | 17, 18 |
| 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 CP4 | 10, 11, 13 |
| 8.1.7 | A detailed record of the cost of operations, maintenance, renewal and replacement for CP3 and plans for the remainder of CP3 | 3.4, 3.5 |
| 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 |

| CA Sch10 Section 2 paragraph | Requirement | 5YAMS section reference |
|---|---|---|
| 8.1.9 | Details of any Specified Upgrades or other upgrades that have been implemented in CP3 | 3.7 |
| 8.1.10 | Details of any Specified Upgrades or other upgrades which HS1 Ltd proposes to implement in CP4 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 | 4.4 |
| 8.1.12 | A cost efficiency plan for CP4 | 12 |
| 8.1.13 | Details of amounts withdrawn from the escrow account to fund any additional renewals and replacements | 4.4 |
| 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 | 18.1 |

# A3 Station Leases requirements for periodic review

This table sets out the requirements for the Life Cycle Reports for each station which are contained in Paragraph 5.4 of Schedule 10 of the HS1 Lease and Paragraph 5.4 of the Ashford Deed. A summary of this information for all stations is found in Section 4 and 16 of this Draft 5YAMS.

| Paragraph 5.4 | Requirement | LCRs section reference |
|---|---|---|
| *5.4.1* | *A summary of the following in respect of the current Control Period:* | - |
| 5.4.1 (A) | the Life Cycle Works carried out by the Tenant (or that it is anticipated will have been carried out by the end of the current Control Period); | 3.2 |
| 5.4.1 (B) | the Available Life Cycle Funds at the end of each Financial Year in the current Control Period and, in respect of the last Financial Year in the current Control Period, the anticipated Available Life Cycle Funds at the end of such Financial Year; | 3.3.4 |
| 5.4.1 (C) | the Life Cycle Works Cost (or anticipated Life Cycle Works Cost) by the end of the current Control Period; | 3.2 and 3.3.1 |
| 5.4.1 (D) | the Deferred Life Cycle Works Savings (if any) approved in previous Life Cycle Reports; | 3.3.2 and 3.3.3 |
| 5.4.1 (E) | the Life Cycle Works Savings (if any) brought forward from previous Control Periods; | 3.3.2 and 3.3.3 |
| 5.4.1 (F) | the effect of any Relevant Changes of Law that have occurred during the Control Period; | 3.3.2 |

| Paragraph 5.4 | Requirement | LCRs section reference |
|---|---|---|
| 5.4.1 (G) | an analysis of breakdown frequencies and the performance of Asset Types which were identified in the Asset Management Strategy as being monitored by the Tenant; | 3.1.2 to 3.1.4 |
| 5.4.1 (H) | the renewals and replacements (if any) undertaken by the Station Operator in order that it discharged its Safety Obligations in respect of the Station but which were not identified in the current Life Cycle Report ("Station Safety Works"); | 3.3.2 |
| *5.4.2* | *In respect of the current Control Period a progress report, comparison and reconciliation by reference to the Life Cycle Report approved for the current Control Period of:* | - |
| 5.4.2 (A) | the Life Cycle Works actually completed to date against those anticipated giving the reasons for any differences | 3.2 and 3.3.2 |
| 5.4.2 (B) | the Life Cycle Works Cost incurred to date against those anticipated giving the reasons for any differences; | 3.3.1 to 3.3.2 |
| 5.4.2 (C) | the Life Cycle Works Savings achieved to date against those anticipated; | 3.3.1 to 3.3.2 |
| 5.4.3 | A summary of the following up to the end of the previous Control Period for each Asset Type at the relevant Station of: | - |
| 5.4.3 (A) | the aggregate amount of the Life Cycle Works Cost; | 3.3.3 |
| 5.4.3 (B) | the aggregate amount of the Deferred Life Cycle Works Savings (if any); and | 3.3.3 |
| 5.4.3 (C) | the aggregate amount of the Life Cycle Works Savings (if any); | 3.3.3 |
| *5.4.4* | *In respect of the next Control Period:* | - |

| Paragraph 5.4 | Requirement | LCRs section reference |
|---|---|---|
| 5.4.4 (A) | the Tenant's proposals for the carrying out of the Forecast Life Cycle Works and, to the extent known (having made all reasonable enquiries), any notices consents and approvals required in order to carry out and complete them; | 4.2 |
| 5.4.4 (B) | the Forecast Life Cycle Works Cost; | 4.5.1 |
| 5.4.4 (C) | the effect of any Relevant Changes of Law, to the extent known (having made all reasonable enquiries), that will occur during the next Control Period; | 4.3 |
| 5.4.4 (D) | the forecast amount of Available Life Cycle Funds at the end of each Financial Year during the next Control Period; | 5.3 |
| *5.4.5* | *In respect of the remainder of the Life Cycle Period a summary of any changes to* | - |
| 5.4.5 (A) | the Forecast Life Cycle Works to be undertaken in each subsequent Control Period and Overhang Period in respect of each Asset Type at the relevant Station; | 4.1 |
| 5.4.5 (B) | the Forecast Life Cycle Works Cost in each subsequent Control Period and Overhang Period in respect of each Asset Type at the relevant Station; and | 4.5.2 |
| 5.4.5 (C) | a forecast of the amount of Available Life Cycle Funds for each subsequent Control Period and Overhang Period; | 5.3 |
| *5.4.6* | *The Tenant's proposals (if any) for:* | - |
| 5.4.6 (A) | the deferral to any later Control Period or Overhang Period or the permanent omission of any Life Cycle Works that are identified in the Asset Management Strategy as being required in future Control Periods and/or Overhang Periods; and/or | 4 and 4.1 |

| Paragraph 5.4 | Requirement | LCRs section reference |
|---|---|---|
| 5.4.6 (B) | the distribution of any Deferred Life Cycle Works Saving pursuant to paragraph 7.1; | None proposed |
| | *which shall include:* | - |
| *5.4.6 (C)* | *in respect of a proposal in relation to a proposed deferral or permanent omission* | - |
| 5.4.6 (C) i | confirmation by the Tenant that the proposed deferral or permanent omission will not result in the Tenant being unable to comply with its obligation under Clause 4.3.1 and 4.14 or the Life Cycle Purpose to be achieved; and | 4 |
| 5.4.6 (C) ii | a report setting out the likely effect on performance arising out of or in connection with the proposed deferral or permanent omission; | 4 |
| 5.4.6 (D) | the forecast Deferred Life Cycle Works Saving arising from paragraph 5.4.6(a); and/or | 4 and 4.5 |
| 5.4.6 (E) | the forecast reduction in the Long Term Charge, the LTC and the Tenant's Share arising from paragraph 5.4.6(b); | 5.2 |
| 5.4.7 | the Tenant's proposals for any distribution of any Life Cycle Works Saving pursuant to paragraph 7.2, identifying the amount of the Life Cycle Works Saving, the reduction in the Long Term Charge, the LTC and the Tenant's Share, setting out the reasons why the Tenant considers such distribution should be made and providing all relevant supporting information; | None proposed |
| 5.4.8 | details of any Adjustment to the Available Life Cycle Funds made pursuant to paragraphs 4.11 or 6.3.4 in the current Control Period (or anticipated to be made prior to the end of the current Control Period) and the arrangements (if any) which the Tenant has implemented and/or proposes to implement in order to mitigate the likelihood that any of the circumstances described in paragraph 5.11.9(a) to (c) will occur ("Adjustment Arrangements"); | 3.3.2 and 4.5 |

| Paragraph 5.4 | Requirement | LCRs section reference |
|---|---|---|
| 5.4.9 | a description of any arrangements the Tenant has reached with Users to modify the LTC; | n/a |
| *5.4.10* | *any proposals by the Tenant for a modification to the LTC to recover* | - |
| 5.4.10 (A) | any Increased Life Cycle Costs which it has funded in accordance with paragraph 6.3; and/or | 3.3.2 and 4.5 |
| 5.4.10 (B) | any costs which it has suffered or incurred in connection with the Station Operator carrying out Station Safety Works in the current Control Period; | 3.3.2 and 4.5 |
| *5.4.11* | *any proposal by the Tenant for a modification to the LTC (other than pursuant to a proposal in paragraphs 5.4.6(b), 5.4.7, 5.4.9 or 5.4.10) to take effect from the beginning of the next Control Period:* | - |
| 5.4.11 (A) | setting out the reasons why the Tenant considers that such modifications should be made and providing all relevant supporting information; and | 5.2 and 4.5 |
| 5.4.11 (B) | In the case of a modification resulting from a Relevant Change of Law, confirming that the Tenant has notified each User of the Relevant Change of Law and of its assessment of the amount of the modification, and provided Users with such information as they shall reasonably require, in a form and amount of detail which is sufficient to enable Users to make a proper assessment of the effect of the Relevant Change of Law and of the Tenant's assessment; and | 4.3 |
| 5.4.12 | the Tenant's proposals for any modifications to the Asset Management Strategy (including the Life Cycle Budget) that are required to reflect its proposals in respect of the matters set out in paragraphs 5.4.1 to 5.4.11 above and/or to ensure that the Asset Management Strategy continues to satisfy the requirements set out in Annex 1 to this schedule. | 4 (also the SASs and totex models) |

# A4 Supporting documents and models

This section lists documents that are shared as part of the 5YAMS submission or have been shared previously during the PR24 process. The documents marked with (*) are a summarised or redacted version of the full document. We also provide the slide pack presentations from the PR24 stakeholder bilateral meeting and workshops for easy reference. We have evidence of our progressive assurance process which we can provide the ORR on request.

## Route supporting documentation

| Supporting documentation | ORR/DfT | Operators |
|---|---|---|
| HS1 SAMP Strategic Asset Management Plan (publicly available on HS1's website) | ✓ | ✓ |
| NR(HS) Route 5YAMS for Control Period 4 (and Appendix 1), including: | ✓ | ✓ |
| *Appendix 2:* NR(HS) *Strategic Asset Management Plan* | ✓ | ✓ |
| *Appendix 3: Specific Asset Strategy: Track* | ✓ | ✓* |
| *Appendix 4: Specific Asset Strategy: Route Civils* | ✓ | ✓* |
| *Appendix 5: Specific Asset Strategy: Signalling & Control Systems* | ✓ | ✓* |
| *Appendix 6: Specific Asset Strategy: Mechanical & Electrical* | ✓ | ✓* |
| *Appendix 7: Specific Asset Strategy: Overhead Contact System* | ✓ | ✓* |
| *Appendix 8: Specific Asset Strategy: Traction Power Supply* | ✓ | ✓* |

| Supporting documentation | ORR/DfT | Operators |
|---|---|---|
| *Appendix 9: NR(HS) Operations Strategy* | ✓ | ✓ |
| *Appendix 10: NR(HS) Safety Strategy* | ✓ | ✓ |
| *Appendix 11: NR(HS) Sustainability Strategy* | ✓ | ✓ |
| *Appendix 12: NR(HS) Engineering Access Strategy* | ✓ | ✓ |
| *Appendix 13: NR(HS) Rail Plant Strategy* | ✓ | ✓ |
| *Appendix 14: NR(HS) and HS1 Joint R&D Strategy* | ✓ | ✓ |
| *Appendix 15: NR(HS) Renewals Strategy* | ✓ | ✓ |
| Route renewals 40-year workbank costing | ✓ | ✓* |
| Note on NRHS Asset Management approach PR24 | ✓ | ✓ |
| Determination of an appropriate management fee for NR(HS) (Oxera Report) | ✓* | - |
| Review of the Management Fee proposed by NR(HS) for CP4 (Frontier Economics) | ✓ | - |
| CP4 Contract Risk | ✓ | ✓ |
| NR(HS) Possession Allowance CP4 PATFAT Proposal | ✓ | ✓ |
| HS1 Security and Cyber Security Strategies | ✓ | - |
| HS1 Sustainability Strategy (publicly available on HS1's website) | ✓ | ✓ |
| The Cost Policy | ✓ | ✓ |

| Supporting documentation | ORR/DfT | Operators |
|---|---|---|
| The Cost Levers Scoring Report | ✓ | ✓ |
| OMR Effectiveness Study (Route benchmarking) | ✓ | ✓ |
| O&M Cost allocation | ✓ | ✓ |
| Renewals – Allocation to Structure of Charges | ✓ | ✓ |
| HS1 Route Charging Model PR24 v1.1 | ✓ | ✓ |
| HS1 PR24 Charging Model Audit Final Report | ✓ | ✓ |
| Long term train path forecasts | ✓ | ✓ |
| PR24 Route KM change note | ✓ | ✓ |

## Stations supporting documentation

| Supporting documentation | ORR/DfT | Operators |
|---|---|---|
| PR24 Life Cycle Reports (4 reports: St Pancras, Stratford, Ebbsfleet and Ashford) | ✓ | ✓ |
| HS1 SAMP Strategic Asset Management Plan (publicly available on HS1's website) | ✓ | ✓ |
| NR(HS) Stations 5YAMS for Control Period 4 (and Appendix 1), including: | ✓ | ✓ |
| *Appendix 2: Strategic Asset Management Plan* | ✓ | ✓ |
| *Appendix 3: Specific Asset Strategy: Stations Civils* | ✓ | ✓* |
| *Appendix 4: Specific Asset Strategy: Data & Communication* | ✓ | ✓* |
| *Appendix 5: Specific Asset Strategy: Lifts & Escalators* | ✓ | ✓* |
| *Appendix 6: Specific Asset Strategy: Mechanical, Electrical & Plumbing* | ✓ | ✓* |
| *Appendix 7: NR(HS) Operations Strategy* | ✓ | ✓ |
| *Appendix 8: NR(HS) Safety Strategy* | ✓ | ✓ |
| *Appendix 9: NR(HS) Sustainability Strategy* | ✓ | ✓ |
| *Appendix 10: NR(HS) Engineering Access Strategy* | ✓ | ✓ |
| *Appendix 12: NR(HS) Renewals Strategy^* | ✓ | ✓ |
| *Appendix 14 NR(HS) TOTEX Models (5 documents: All stations, Civils, D&C, L&E, MEP)* | ✓ | -^^ |
| Ashford TOTEX models (5 documents: All stations, Civils, D&C, L&E, MEP) | ✓ | -^^ |

| Supporting documentation | ORR/DfT | Operators |
|---|---|---|
| Note on NRHS Asset Management approach PR24 | ✓ | ✓ |
| CP3 Stations Asset Performance Data | ✓ | ✓ |
| HS1 stations benchmarking study | ✓ | ✓ |
| Pell Frischmann 2019 Reports on Asset Replacement Costs (5 reports; one per station and overview) | ✓ | ✓ |
| Pell Frischmann 2018 Review of On Costs | ✓ | ✓ |
| HS1 Sustainability Policy | ✓ | ✓ |
| HS1 LTC Charging model PR24 v1.1 | ✓ | ✓* |

^ There is no Appendix 11 or 13 to the NR(HS) Stations 5YAMS; Appendix 11 relates to the R&D Strategy which applies to route; Appendix 13 is the 40-year workbank which all of this content is provided in replaced totex models.
^^ A summary of the 40-year renewals profiles (based on the totex models) for each station is contained in the LTC model that the operators recieve.

# A5 CP4 commitments

## CP4 asset management commitments

| | Commitment | Milestone |
|---|---|---|
| 1. | NR(HS) to produce an asset maintenance data and information system strategy for the deployment and integration of EAMS, GIS, and BIM systems.<br><br>The strategy will outline the vision for how these systems will be integrated and key milestones for implementation. The creation of the strategy will ensure that new projects and renewals to the assets and asset data help build an integrated data system (as opposed to preventing). | The strategy to be produced by April 2026. |
| 2. | NR(HS) to deliver the maintenance efficiencies by the end of CP4 that are declared in the NR(HS) 5YAMS. The efficiencies will consider (and implement where cost effective) the following new ways of working:<br>• Trials of automated inspection and video analytics.<br>• Deploy Remote Condition Monitoring on points and switches, this may then be expanded to other assets whose failure significantly impact cost or performance.<br>• Adopt risk-based maintenance approaches to identified assets.<br>• Delivering the next phase of integrating NR(HS)'s O&M and renewals projects planning and delivery. | By end of CP4. |
| 3. | NR(HS) to maintain ISO55001 certification across Route and Stations and its other certifications: ISO9001 (Quality), ISO14001 (Environment) and ISO45001 (Occupational Health & Safety). | Throughout CP4. |

| Commitment | | Milestone |
|---|---|---|
| 4. | NR(HS) to continue to develop totex forecasting capability, including monetisation of risk and opportunities in accordance with NR(HS) SAMP timeframe. This information is used to inform where to apply risk-based maintenance resulting in a PR29 submission that considers better the financial impact of asset failure. | Incorporate into NR(HS)'s PR29 plans. |
| 5. | NR(HS) to introduce objective condition scoring methodology for major asset groups, which should reflect those assets that drive 80% of the O&M and Renewals 40-year costs, within CP4.<br><br>In CP4 NR(HS) will develop the scoring that is held in our maintenance management systems such that those working in the field on hand-held devices can select an objective condition score for each asset they are inspecting. We will use the condition scoring data to improve maturity of degradation analysis for PR29 and this will be evidenced and reflected in our PR29 submission. | Incorporate into NR(HS)'s PR29 plans. |
| 6. | NR(HS) to continue to develop the Obsolescence approach developed for PR24. To do this by developing and implementing an obsolescence strategy that considers the financial impact of asset failure, the cost to maintain an obsolete asset, the management of spares and the cost to renew. This will result in a common set of guidelines that will drive the strategy for S&T and E&P assets such that the approach is common to all assets. | The strategy to be in place by April 2026. |
| 7. | *[If approach approved by ORR]* HS1 and NR(HS) to trial the implementation of streamlined governance on minor renewals. Assessment and recommendation to be included in PR29 on whether these works should move to O&M categorisation for CP5. | Update on trial provided end of Year 2 of CP4.<br><br>Outcome of trial to be incorporated into PR29 plans. |

# A6 Calculation of route access charges

This Appendix summarises how the HS1 Route Charging Model converts costs into charges and allocates them between train operators.

## A6.1 Calculation of charges for passenger operators

### A6.1.1 O&M (excluding pass through costs) and renewals

The charges 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 engineering experience of HS1 Ltd and NR(HS) management and their knowledge of the drivers of costs in each category. The allocation has been reviewed and updated for CP4 and is set out in Table 74. The allocation has been done at a more granular cost item level for both O&M cost and Renewals costs than in previous Periodic Reviews. The allocation into cost categories is consistent with the 2016 Regulations (see Section 19.2).

**Table 74: Allocation of costs to cost apportionment categories**

| Cost apportionment category | O&M costs | Renewal costs |
|---|---|---|
| Track and traffic dependent costs | 12.5% of infrastructure staff cost<br><br>4% of recoveries<br><br>100% of tamping costs, grinding costs and infrastructure freight haulage costs<br><br>9.5% of contribution to national functions<br><br>13% of specialist contractors<br><br>19% of materials | 100% of wear-related Track renewals<br><br>75% of mostly wear-related Civils renewals<br><br>25% of mostly non wear-related Civils renewals<br><br>50% SC&C - equally wear and tear / non-wear and tear related<br><br>100% of the cost for the Overhead Catenary Contact Wire (within E&P assets) |
| Track dependent, traffic independent costs | 65% of infrastructure staff costs<br><br>100% of operations staff costs<br><br>23% of recoveries<br><br>100% of plant and vehicle costs, track recording costs and security of infrastructure costs<br><br>79% specialist contractors<br><br>81% materials | 100% of non wear-related Track renewals<br><br>100% of non wear-related Civils renewals<br><br>75% of mostly non wear-related Civils renewals<br><br>25% of mostly wear-related Civils renewals<br><br>50% SC&C - equally wear and tear / non-wear and tear related renewals<br><br>100% non wear and tear SC&C renewals<br><br>100% non wear and tear E&P renewals |
| Operator dependent costs | None | None |

| Cost apportionment category | O&M costs | Renewal costs |
|---|---|---|
| Fixed common costs | All remaining NR(HS) O&M costs<br><br>NR(HS) management fee and Contract Risk<br><br>HS1 costs<br><br>R&D costs | 100% of SC&C fixed cost renewals<br><br>100% of E&P fixed cost renewals<br><br>100% of Rail Plant renewals<br><br>NR(HS) management fee<br><br>Project partner cost |

**Stage 2: Calculate an annuity for each cost apportionment category**

For **O&M costs** a constant annual payment for CP4 is calculated such that the present value of the annual payment is equal to the present value of the CP4 O&M costs (excluding pass through costs).

A **route renewals annuity** is calculated taking into account payments into and withdrawals from the escrow account and interest received on the escrow account. The annuity calculation uplifts for underfunding of the escrow account in CP2, consistent with the approach taken in PR19. It is adjusted to ensure that the escrow account does not have a negative balance at any time during the 40 years. The annuity is weighted by train volume forecasts over 40 years.

**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 75.

**Table 75: 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:<br><br>No. of trains x EMGTPA weighting per train |
| Track dependent, traffic independent costs (net of mothballing costs)<br>• International track<br>• Domestic track<br>• Common track | • Train minutes on international track<br>• Train minutes on domestic track<br>• Train minutes on common track |
| Operator dependent costs | Each active operator would have an equal share. Currently no costs are allocated to this category. |
| 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 train-km for OMRCA1 and a price per minute for OMRCA2 and OMRCB for each operator and then into a price per train service for each operator and service group.

### A6.1.2 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 then into 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.

## A6.2 Calculation of charges for freight operators

Freight costs comprise:

- Freight variable costs (OMRCA1); and
- Freight long term 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 long term avoidable costs is the cost of operating and maintaining Ripple Lane exchange sidings (net of mothballing costs). This cost is split based on the number of trains forecast to be operated between the:

i) Freight trains accessing Ripple Lane to travel to/from the HS1 network from/to the NRIL network; and

ii) Freight trains accessing Ripple Lane from the NRIL network to stop/turnaround – i.e. they only use Ripple Lane Domestic Sidings without entering onto HS1.

The Ripple Lane cost for freight using the HS1 and domestic sidings is recovered under OMRC. The cost for freight using the domestic sidings is recovered under the Ripple Lane (Domestic Sidings) charge.

### A6.2.1 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 long-term 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 long term avoidable costs are calculated as total track dependent costs multiplied by the percentage of equivalent track-km that is freight only.

For freight long term avoidable costs a constant annual payment for CP4 is calculated such that the present value of the annual payment is equal to the present value of the freight long term avoidable costs.

Total freight charges are converted into a price per train-km for each operator and then into a price per train service for each operator.

### A6.2.2 Charges for freight trains accessing Ripple Lane (Domestic Sidings)

A charge per train is calculated by dividing the Ripple Lane (Domestic Sidings) costs by the forecast number of such trains; see Section 15.4.2.

# Five Year Asset Management Statement for Control Period 4