high speed one

FIVE YEAR ASSET MANAGEMENT STATEMENT FOR CONTROL PERIOD 4

Response to Final Determination

3 February 2025

Foreword

This submission sets out HS1's plans for the next control period (CP4) to encourage passengers to fall 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; and
- Potent competition faced by our international operators from a resurgent aviation industry.

We need 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 a more 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 and station 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 have updated our approach to modelling how our route and station 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. We welcome the ORR's recognition of the improvements we have made and general support for our plans.

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 plans that will deliver real-terms savings to operators. This Five Year Asset Management Statement sets out these plans. We look forward to working with customers, suppliers and stakeholders throughout CP4.

Robert Sinclair
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 net zero ambition. 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 of ensuring 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 three years. HS1 and NR(HS) took 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 improved performance to back around target by end 2023/24; similar issues have affected performance in 2024/25. NR(HS) has 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 has 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. Safety performance in 2023/24 was better than the threshold for both workforce and members of the public. 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; an improving trend was seen in the second half of 2023/24.

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 across the traction power system. 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. 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 in CP3 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 total expenditure (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 demonstrated the potential for 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, we forecast that HS1 costs (excluding R&D) will reduce to below the CP3 budget level in the final year of CP3. CP3 pass through costs are forecast to be 0.4% 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 plans for CP4

For CP4, we have carried forward our HS1 system thinking and learning from CP3 to develop plans 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 plans compared to previous periodic reviews. We have based our plans 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 ORR final determination (FD) concluded there were further efficiency opportunities of £11.5m in NR(HS) O&M costs which have been incorporated into our plans. As a result, the NR(HS) Annual Fixed Price delivers a 15% gross efficiency (11% net) from CP3 exit (2024/25) to CP4 exit (2029/30); this equates to a 7% 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 a 6% reduction in HS1 costs for CP4 relative to the CP3 efficient budget, delivering significant efficiencies in the face of cost headwinds and increasing complexity in managing the system; this budget was approved by the ORR. 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. The ORR reviewed the evidence provided by HS1 and NR(HS) in making its determination.

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 overhead contact system (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. In 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. We have explored with NR(HS) an approach to the delivery of routine renewals works with streamlined governance that would deliver efficiencies; we will trial this approach over CP4. The HS1 challenge to NR(HS) volumes and pricing has removed £109 million of costs but there is still an increase in CP4 route renewals costs of £65 million, more than offsetting the reduction in volumes. These costs were approved by the ORR.

Extending the CP4 renewals pricing to the 40-year workbank would give route 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 reduced the cost of the 40-year workbank to £1.7 billion. The ORR FD concluded there were efficiency opportunities that should reduce the costs of long term renewals further, which gives an efficient price for the 40-year workbank of £1.6 billion.

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.

We have applied a Cost Policy to stations renewals, similar to that applied to route renewals. We also applied a 0.5% efficiency (i.e. a 0.5% cost reduction) to station renewals from CP5 onwards in response to the ORR draft determination (DD). The ORR FD concluded there were similar efficiency opportunities in station long term renewals as for route. This gives an efficient cost for the 40-year stations renewals workbank of £475 million. This reflects increased costs for mechanical, electrical and plumbing renewals and civils renewals expenditure at St Pancras, with efficiencies achieved in data and communications renewals compared with PR19. 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 £52 million, 12% lower than PR19 estimates.

Overall, our plans for CP4 deliver a 10% reduction in route OMRC and stations LTC costs combined compared with the PR19 determination.

Charges for CP4

Our 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 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. The CP4 OMRC per train for passenger operators is 15% to 20% lower than current charges. Relative to PR19 determined charges, there is a decrease of 2 to 3%. We consider this a good outcome given the lower traffic volumes expected on the network compared to PR19.

Since our May 2024 5YAMS, in which we forecast 200 trains per year over CP4, there has been a change in the outlook for freight services. Freight ceased operating on HS1 in mid-2024 and, due to market conditions and uncertainty, the most appropriate freight forecast for CP4 is zero trains per year. We are required to propose an indicative freight charge and have used a shadow model with a forecast of 200 trains per year to calculate this charge. We have also reallocated certain freight-specific fixed costs in response to the ORR DD as these are better defined as common costs (which are allocated to passenger operators).

Following these adjustments, the freight charge is lower than the PR19 determined charge and current charges (as a result of the April 2024 volume reopener).

Table 2 sets out the CP4 stations Long Term Charge (LTC) per annum by operator compared with the CP3 charge determined at PR19. Our review of station renewal costs and application of the Cost Policy has resulted in lower LTC at all stations. This has resulted in a large decrease in overall LTC compared with CP3, with reductions for all operators.

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

	CP3 OMRC at PR19	Current OMRC	CP4 OMRC	CP4 vs PR19	CP4 v Current
International	2,605	3,168	2,537	(2.6%)	(19.9%)
Domestic (St Pancras - Ashford)	1,935	2,234	1,896	(2.0%)	(15.1%)
Freight (Dollands Moor)	981	1,424	684	(30%)	(52%)

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

	CP3 LTC at PR19	CP4	CP4 vs PR19
EIL	6.31	4.32	(32%)
EMR	1.55	1.11	(28%)
SETL	3.72	3.04	(18%)
Total	11.58	8.47	(27%)

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 plans meet our asset stewardship obligations while delivering affordability for operators with lower costs and charges.

About this submission

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) undertook a proactive, open and collaborative stakeholder engagement programme with one-to-one meetings with key stakeholders and industry-wide workshops culminating in a formal consultation through the Draft 5YAMS issued on 29 February 2024. We received responses to our consultation from the following organisations:

- DB Cargo;
- Department for Transport (DfT);
- East Midlands Railway (EMR);
- Eurostar International Limited (EIL); and
- SE Trains Limited (SETL).

Stakeholder responses were taken into account in the preparation of the Final 5YAMS in May 2024. A summary of stakeholder feedback and HS1 responses is included in the 'Summary of Draft 5YAMS consultation feedback' document and has been published on the HS1 website.

We continued to engage with the ORR after the submission of our May 2024 5YAMS to provide further evidence to support our submission and to support the ORR in the preparation of its DD. The ORR published its DD on 30 September 2024[1].

The ORR's DD was positive about HS1's 5YAMS and recognised the improvements we have made since PR19 and supported the majority of the proposals set out in our May 2024 5YAMS. The ORR found that our plans are of good quality and manage uncertainty more efficiently than in previous reviews. In particular, the ORR supported the Cost Policy we have developed for forecasting long term renewals costs and our setting charges to account for expected traffic growth which have led to a significant reduction in the renewals annuity.

The DD proposed a number of adjustments to reflect opportunities for further efficiency, noting that each of the adjustments is a relatively small percentage of the total costs, reflecting the overall good quality of our plans. We addressed these in full in our response to the ORR DD, providing further explanation and additional evidence. We amended our November 2024 5YAMS to apply most of the ORR DD proposals.

The ORR considered our November 2024 5YAMS along with stakeholder responses to its DD consultation and final consultation in December 2024, ahead of publishing its FD on 6 January 2025. The ORR made three key determinations on our route and station plans related to further efficiencies from: accelerating asset management maturity; addressing contractual inefficiencies in the Operator Agreement; and improved long term renewals base cost estimation. This 5YAMS implements the ORR FD. The ORR FD also made final decisions on amendments to our Access Terms, which we are in the process of implementing.

[1] Information about the ORR Draft and Final Determinations can be found on its website: https://www.orr.gov.uk/monitoring-regulation/rail/networks/hs1/periodic-reviews/pr24

Contents

Part 1: Context and Approach

1 HS1 16

1.1 Our vision and our journey 16
1.2 How HS1 works 17

2 PR24 approach and process 25

2.1 Scope of PR24 25
2.2 How we put this plan together 29

3 CP3 outturn: Route 36

3.1 Overview 36
3.2 Safety performance 37
3.3 Operational performance 40
3.4 CP3 outturn costs 44
3.5 CP3 renewals 58
3.6 Renewals escrow account 63
3.7 Upgrades 66
3.8 Innovation, R&D 67

4 CP3 outturn: Stations 71

4.1 Safety performance 71
4.2 Operational performance 73
4.3 CP3 renewals 76
4.4 Renewals escrow accounts 77
4.5 Operations and maintenance (Qx) costs 79
4.6 Other improvements 80

5 Overview of CP4 plans 83

6 Our outcomes for CP4 88

7 Key assumptions 90

7.1 Traffic forecasts 90
7.2 Financial assumptions 95

7.3	Asset management assumptions	99
8	**Safety and security**	**102**
8.1	Health, Assurance and Safety Strategy	102
8.2	Security and cyber security strategies	105
9	**Sustainability**	**107**
9.1	Sustainability Strategy	107
9.2	Energy Strategy	110
10	**Asset management approach**	**116**
10.1	Overview	116
10.2	Improving our asset management capability	118
10.3	Innovation, research and development	119
10.4	Asset Management System	123
10.5	Recovery scenarios	125
10.6	Asset data	128
10.7	Specific Asset Strategies	130
10.8	ORR conclusions	135
11	**Route Operations and Maintenance**	**137**
11.1	Operations Strategy	137
11.2	Engineering Access Strategy	139
11.3	Maintenance	141
12	**Route O&M costs**	**145**
12.1	Identifying efficient costs for CP4	145
12.2	OMR effectiveness study	148
12.3	NR(HS) O&M costs	150
12.4	Other O&M costs	158
12.5	Traction electricity costs	169
13	**Route renewals**	**172**
13.1	Overview	172
13.2	Renewals volumes	173
13.3	CP4 renewals	177
13.4	Renewals capability development programme	188
13.5	40-year renewals	190

13.6 Renewals annuity 196

14 Route upgrades 201

14.1 Specified Upgrades 201
14.2 Other upgrades 201

15 Route CP4 charges 202

15.1 Structure of charges 202
15.2 Route charging model 203
15.3 Charges for passenger train operators 205
15.4 Charges for freight operators 208
15.5 Traction electricity charge 211

16 Stations CP4 plans 212

16.1 Development of the 40 year workbank 213
16.2 CP4 renewals 220
16.3 40-year renewals 222
16.4 Other works 223
16.5 Long term charge (LTC) 224
16.6 Total station charges 230

17 Regulatory framework overview 232

18 Access provisions 234

18.1 Performance regime 234
18.2 Possessions regime 236
18.3 Volume reopener 238
18.4 Wash up provisions 241
18.5 OMRC indexation floor 244
18.6 Carbon costs 245
18.7 Capacity reservation charge 245
18.8 Pass through cost categories 246
18.9 Outperformance regime 250
18.10 St Pancras International station – contractual inconsistency 251
18.11 Other Access Terms changes 251
18.12 Framework Track Access Agreements 266

19 Structure of charges 267

19.1 Route regulatory requirements 267
19.2 Statement of compliance with the 2016 Regulations 268
19.3 Structure of Charges Review 270

20 Escrow investment strategy 273
20.1 Improving escrow returns 273
20.2 CP4 escrow investment strategy 274

21 Conclusions 277

22 Next steps 283

A1 Glossary 285

A2 Concession Agreement requirements for periodic review 289

A3 Station Leases requirements for periodic review 291

A4 Supporting documents and models 296

A5 CP4 commitments 302

A6 Calculation of route access charges 306
A6.1 Calculation of charges for passenger operators 306
A6.2 Calculation of charges for freight operators 310

A7 Combined costs 312

A8 Zero freight scenario 314
A8.1 Impact on asset management plans and costs section 314
A8.2 Cost reallocation 315

Part 1:

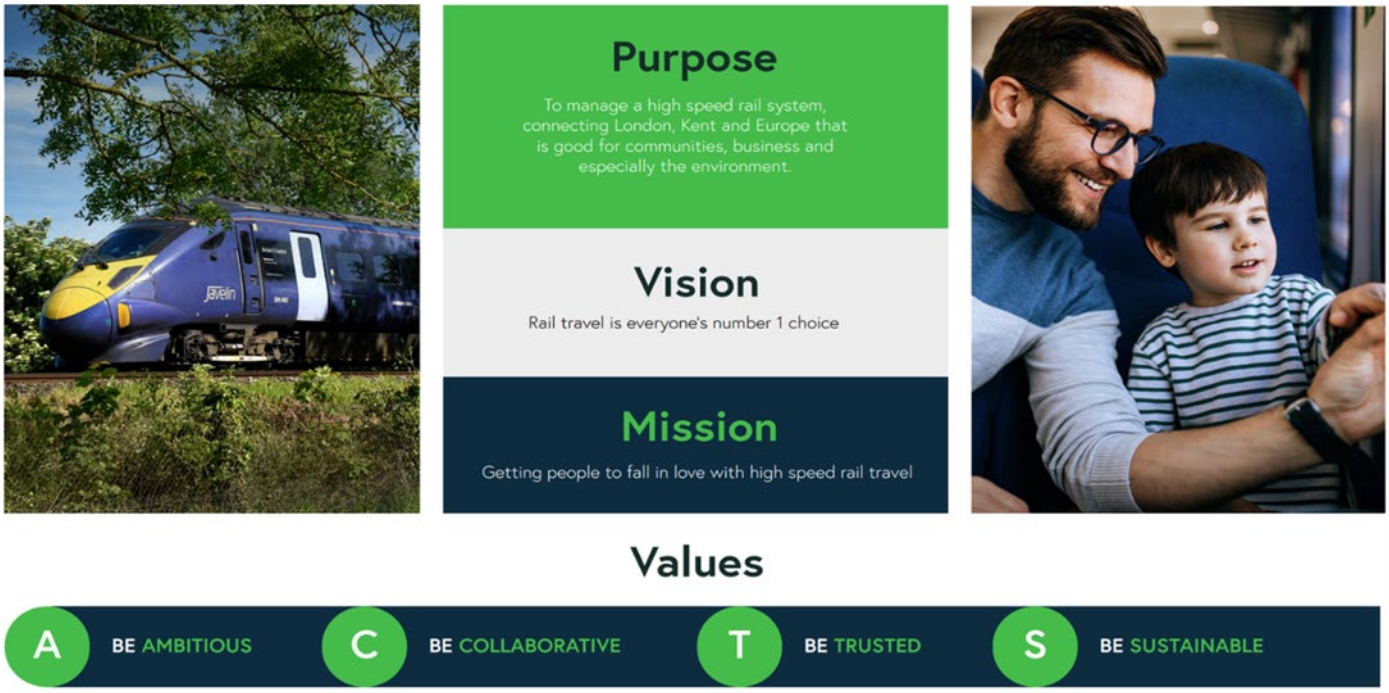
CONTEXT AND APPROACH

1 HS1

1.1 Our vision and our journey

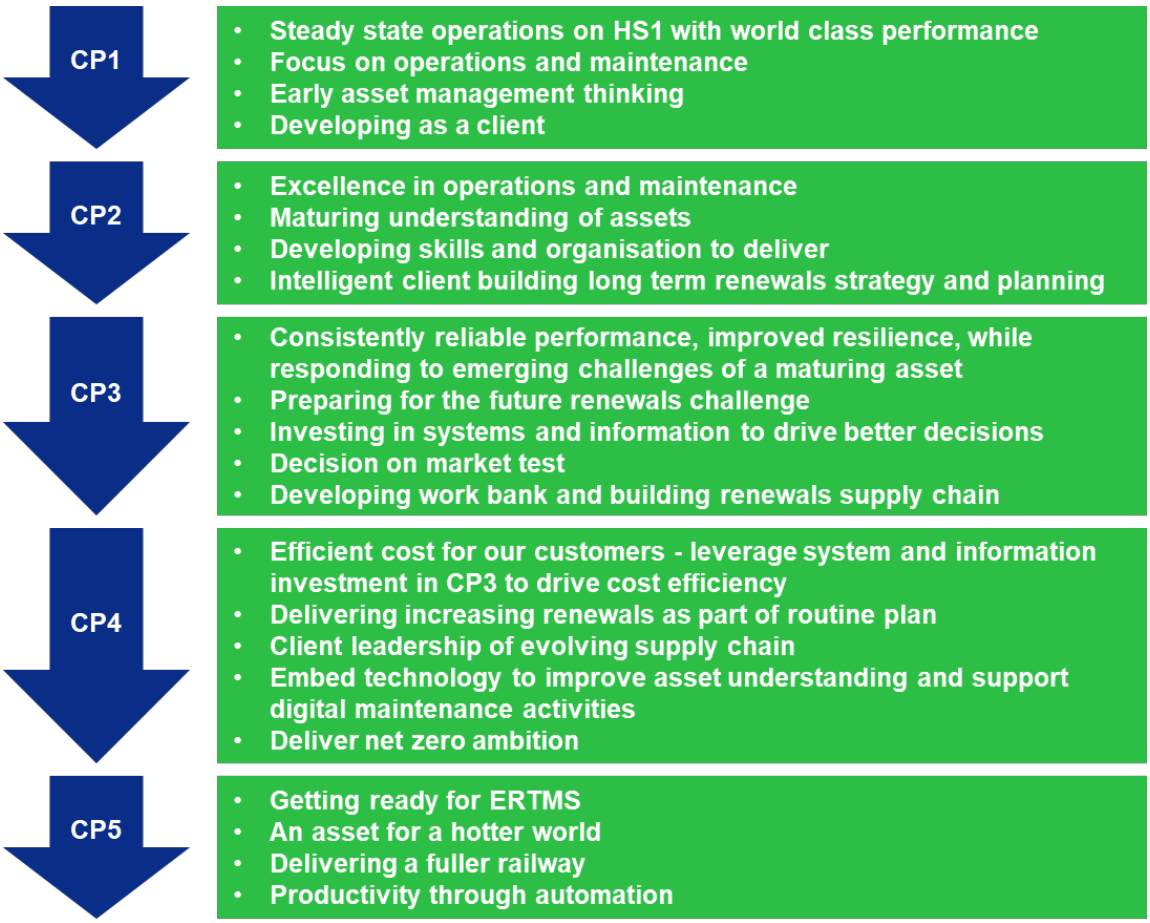
HS1 is operating in an uncertain macroeconomic, geopolitical and rail industry environment; we have updated our strategy to reflect this, to focus on our core operations and drive modal shift to rail, supporting our customers and future growth. More trains on the infrastructure drive a lower cost per 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[2] 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.[3]

[2] supplement-to-concession-agreement-july-2022.pdf (highspeed1.co.uk)
[3] 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[4]), we have a number of asset stewardship obligations, including keeping the stations in "good and substantial repair and condition" 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[5] 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

[4] 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.
[5] 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 2025;
- A Framework Track Access Agreement with SETL, which expires on 31 December 2029. 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[6]	✓	✓	✓
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;

[6] 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) and RailNetEurope (RNE).

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).

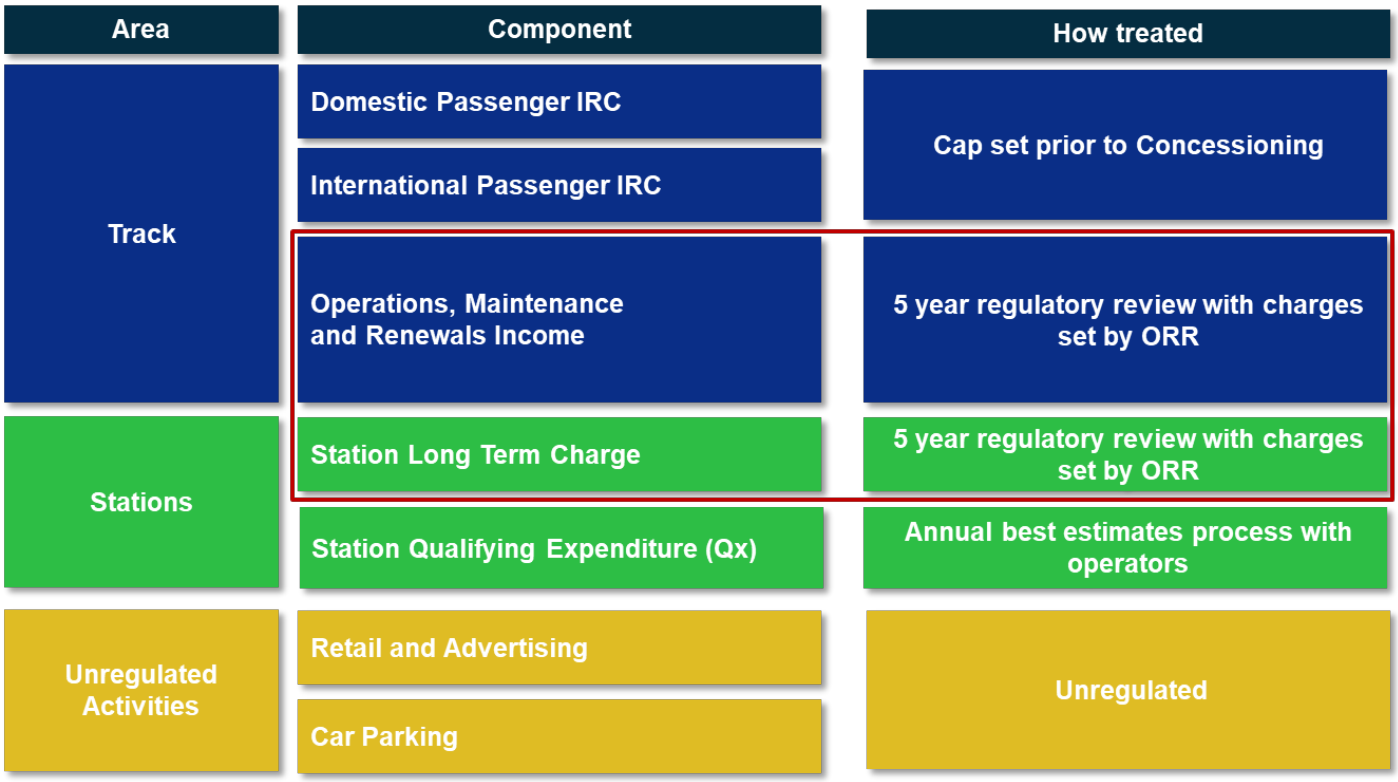
Under the terms of the Concession Agreement, the periodic review for the HS1 route covers the efficient costs for the operation, maintenance and renewal of the HS1 route infrastructure, and how these costs are recovered via charges to train operators. Under the Station Leases, the periodic review for 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 5YAMS; Appendix A3 shows the specific HS1

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

This 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 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. 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 was a significant reduction in route 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 route 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 requested NR(HS) to provide a separate strategy document including a costed worked example as a supporting document for ORR review.

Between the Draft 5YAMS and the Final 5YAMS submitted in May 2024, we undertook an additional detailed review of the station totex models with a focus on MEP and Civils which resulted in a significant reduction in renewals costs at all stations.

We have discussed our assurance plans and activities with stakeholders throughout PR24. We have shared details of our assurance activities with the ORR and sample documents cutting across all asset groups and a range of assurance activity types to evidence this work. We also shared graphs demonstrating the change in renewals volumes between the emerging draft workbank (in March 2023) and the final workbank, following our assurance activities.

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 reviewed selected items of NR(HS)'s O&M costs (costs of Operations and S&T maintenance teams and CP4 efficiency targets). As NR(HS)'s detailed O&M cost breakdowns are commercially sensitive information under the Operator Agreement, it is not possible for HS1 to provide full assurance of NR(HS) O&M costs; ORR had access to more detailed information for its review and assurance of NR(HS) costs.
- 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 the information contained within this version. HS1 commissioned Frontier Economics to undertake a critical review which suggested possible improvements to the Oxera analysis.
- Following the publication of the ORR DD, NR(HS) commissioned Oxera to review the proposals in the DD in the context of NR(HS)'s contractual and business risk profile; this review has been provided to the ORR.

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

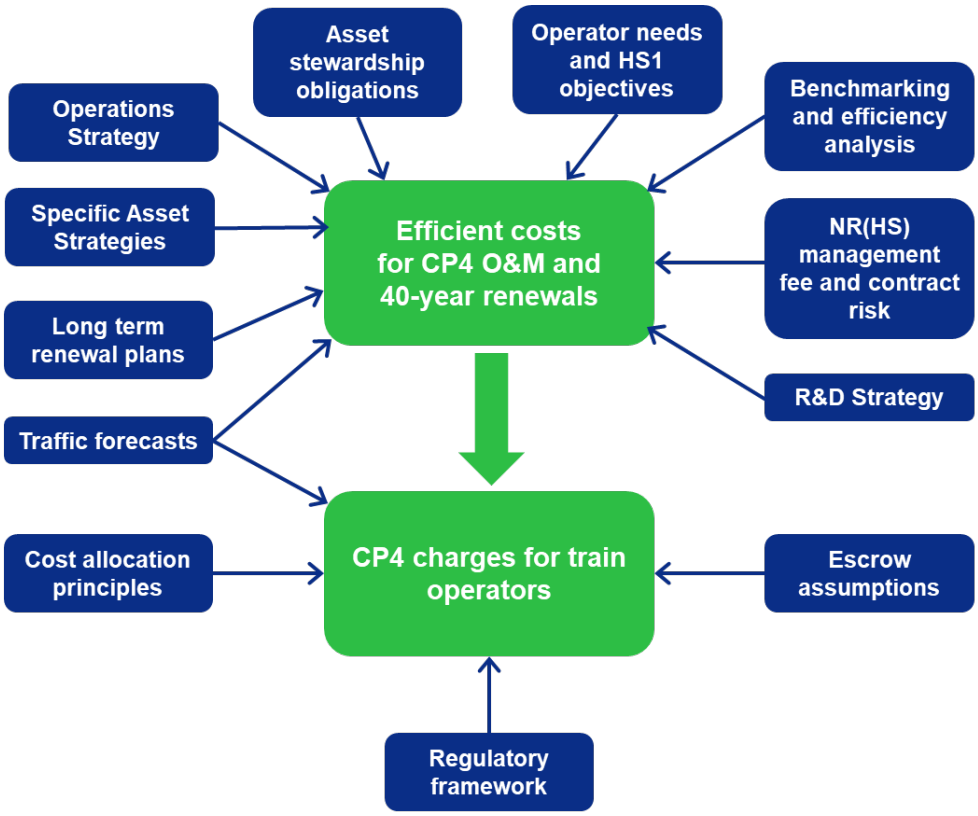
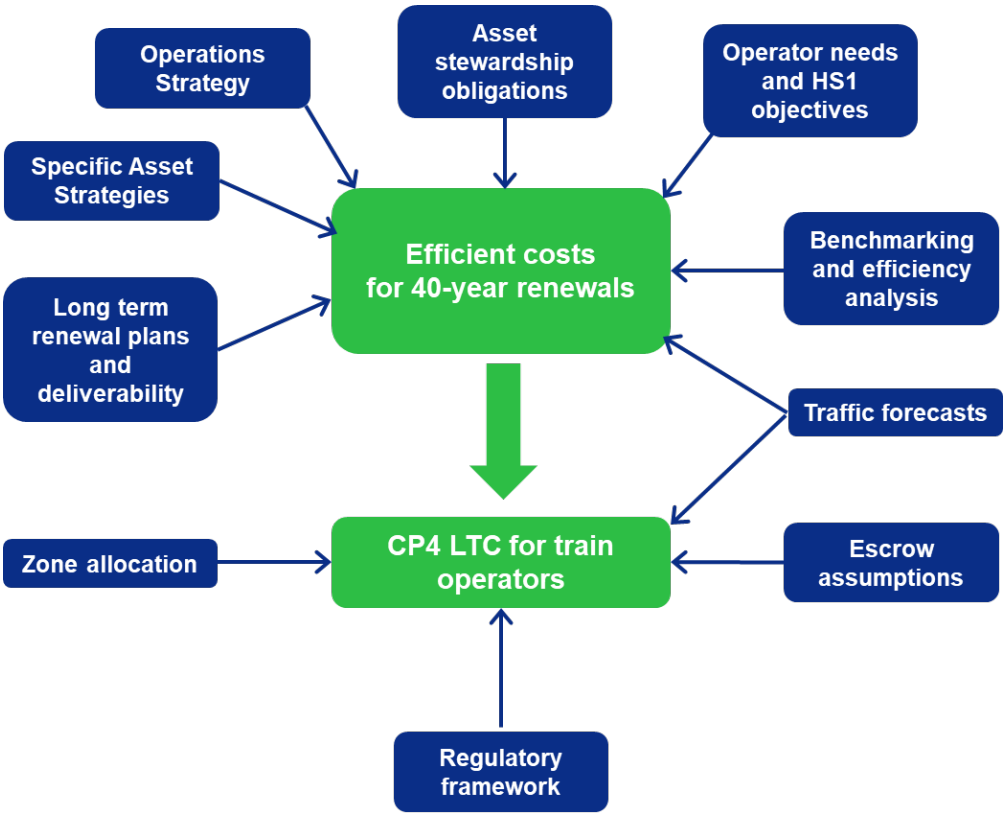


Figure 5: How we get to station charges

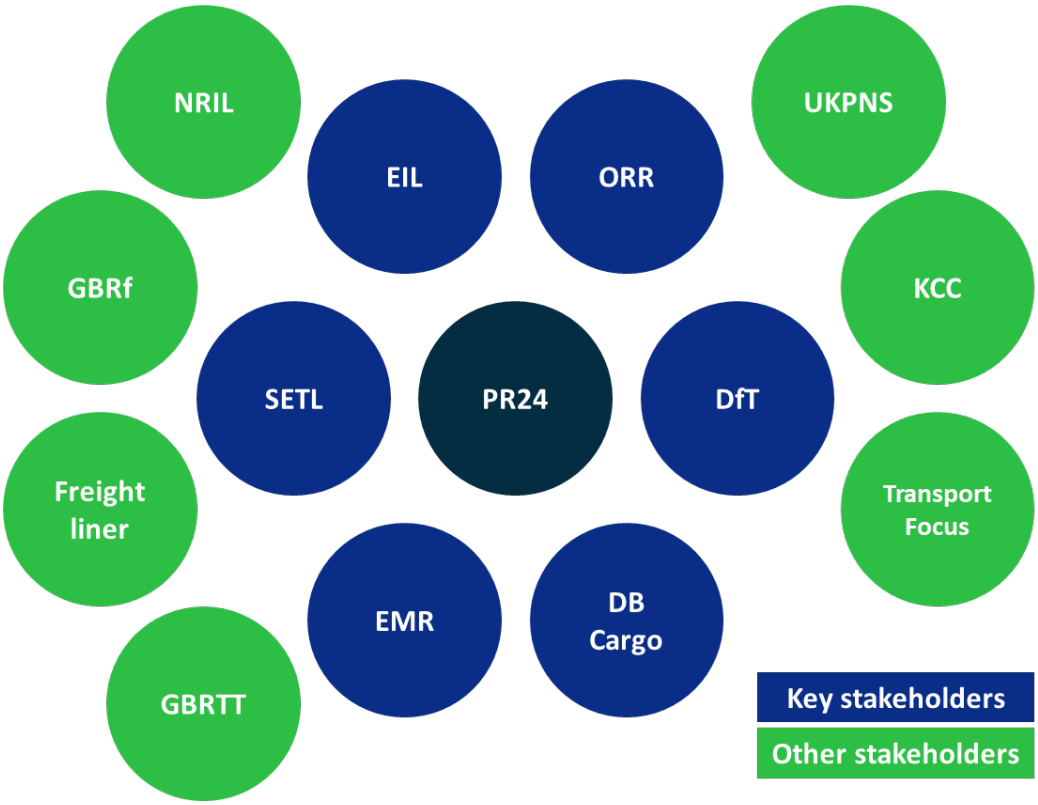


2.2.4. Stakeholder engagement

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



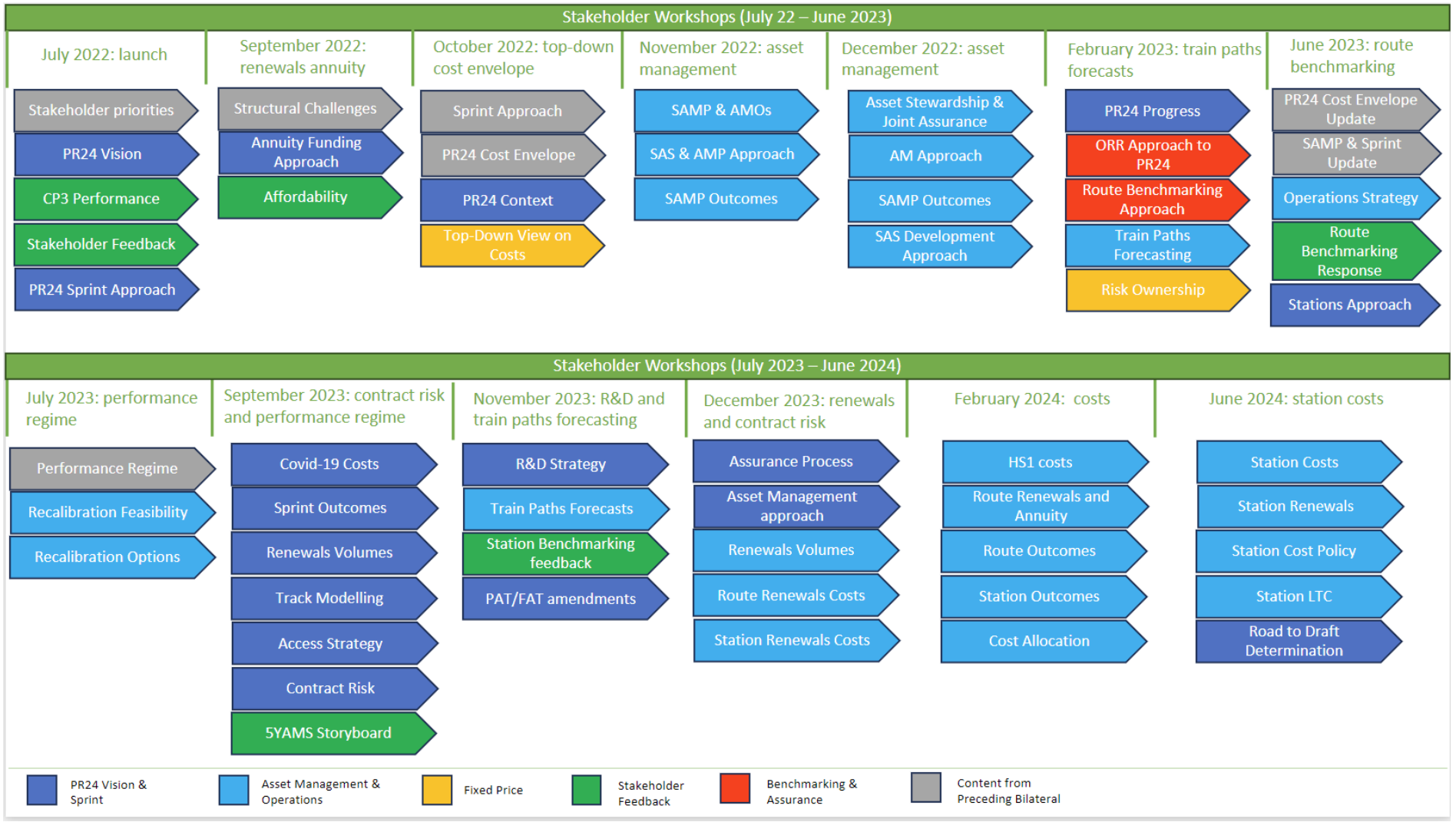
We started the programme in May 2022, with the official launch of PR24 in July 2022. The programme involved regular rounds of one-to-one meetings with key stakeholders followed by industry-wide workshops, held mostly on a quarterly basis. This approach allowed us to keep stakeholders regularly updated 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.

Our Draft 5YAMS was submitted to ORR in February 2024 and provided to stakeholders for formal consultation. Stakeholder responses were taken into account in the preparation of the Final 5YAMS issued in May 2024. A summary of stakeholder feedback and HS1 responses (public version) is available on the HS1 website alongside this 5YAMS.[7] The non-public version is included as supporting document 'Summary of Draft 5YAMS consultation feedback'; this does not include the DfT response, which can be provided to stakeholders on request.

Since the submission of our Final 5YAMS in May 2024, we have worked with ORR throughout its review and challenge of our plans, providing additional supporting data and evidence to assist ORR in making its DD. The ORR DD was published on 30 September 2024. We revised our 5YAMS in November 2024 to address the recommendations in the DD. The ORR then made its FD on 6 January 2025, having reviewed this alongside further consultation on the key areas on which it made determinations.

[7] https://highspeed1.co.uk/regulatory/periodic-reviews

Figure 7: PR24 stakeholder engagement timeline



Part 2:

CP3 OUTTURN

3 CP3 outturn: Route

3.1 Overview

This section of our 5YAMS discusses our performance in the first four years of CP3.

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 safety performance. 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; technical and operational investigations are complete and recommendations are being addressed.

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 (0.5%) higher than the budget. The HS1 costs over this period are forecast to be 4% 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 0.4% 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.

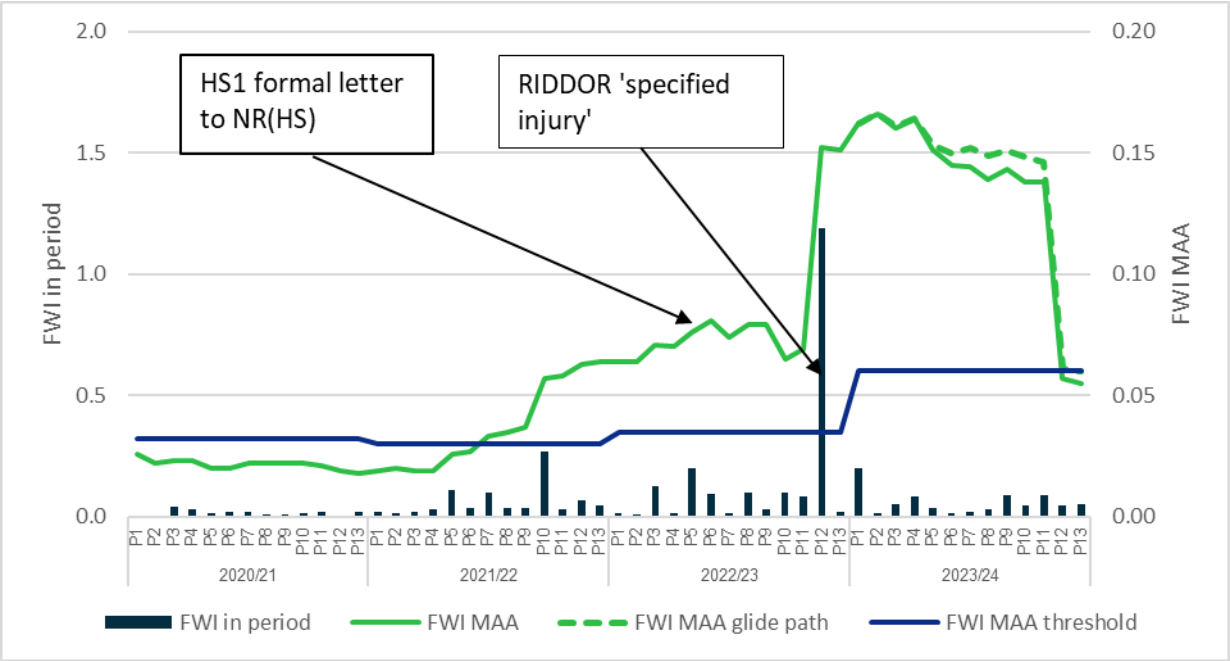
The PR19 Final Determination allocated R&D funding to HS1. Over the course of CP3, we implemented an R&D governance procedure to ensure responsible and targeted spending of funds, identified our highest priority areas (automated inspection, cross-domain integration and efficient possessions) to ensure 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 to P13 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 Committee 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 a significant proportion of workforce accidents (54% in 2023/24); 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.

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).

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 incident affected the FWI MAA calculation through most of 2023/24 but dropped out of the calculation in P12 2023/24. HS1 worked with NR(HS) to create an FWI MAA threshold of 0.060 for 2023/24, a realistic but challenging threshold based on analysis of recent safety performance, and a glide path to monitor progress towards achieving it by year end. FWI MAA remained below the glide path from P5 2023/24 onwards, ending the year at 0.055 compared with threshold of 0.060. This suggests that NR(HS)'s locally owned safety improvement plans are having a positive impact.

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. An improving trend was seen in the second half of 2023/24 with no staff assaults recorded in P12 and P13.

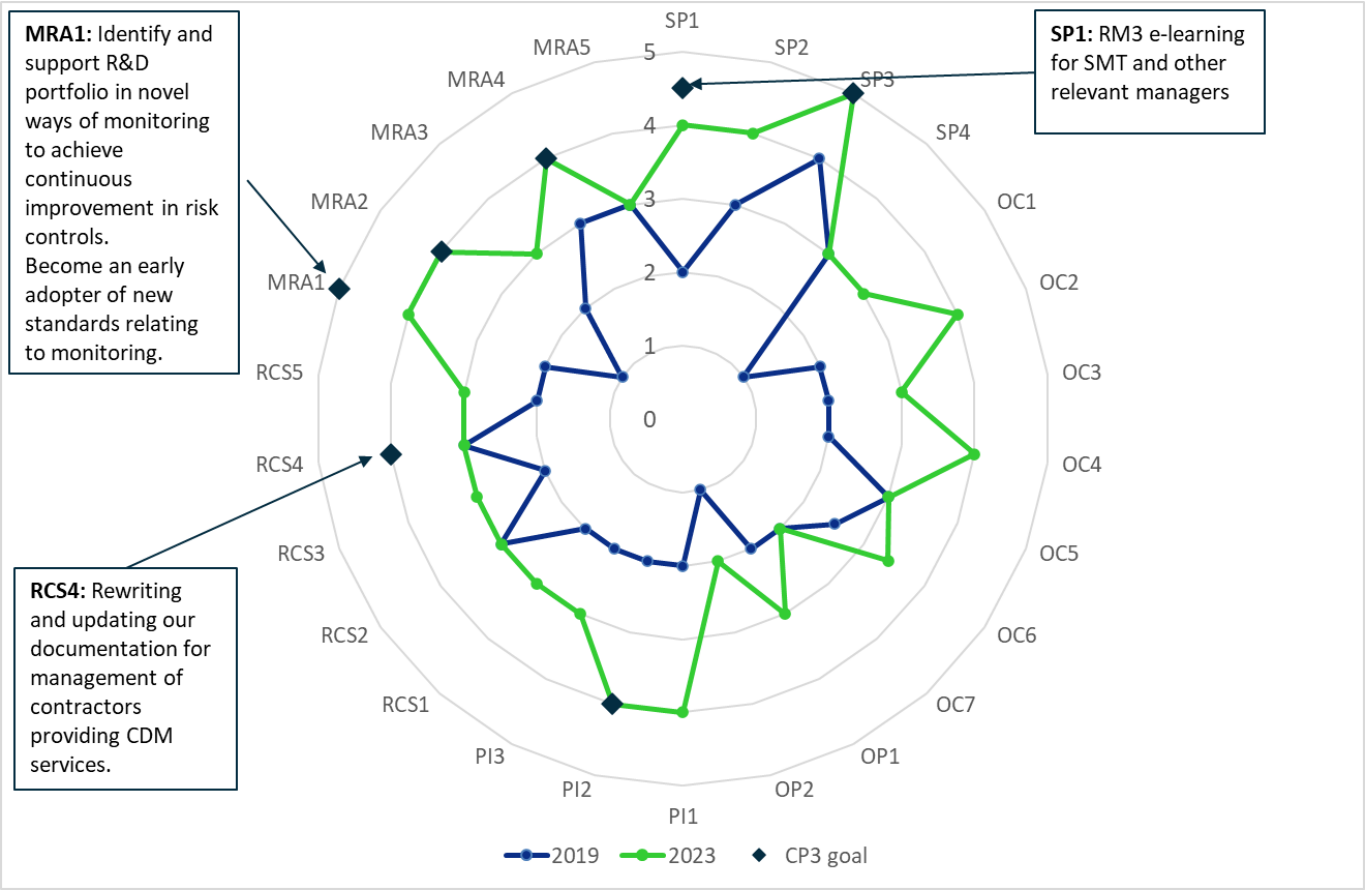
As part of PR19, ORR made seven recommendations related to safety. Actions to address these recommendations were completed in the first two years of CP3 and reported in the Asset Management Annual Statement (AMAS). A key recommendation was that HS1 should more fully embrace RM3.

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; we have since reviewed and updated our documentation and 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 Safety Strategy Improvement Plan. 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.

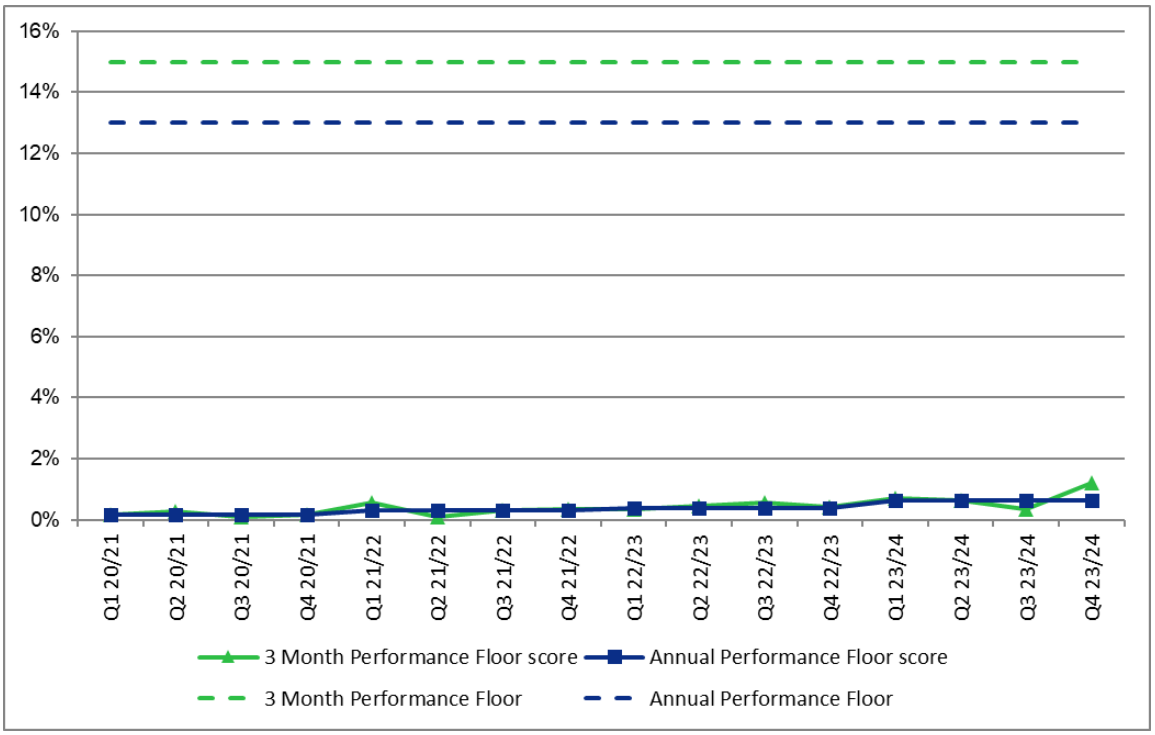
3.3 Operational performance

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 throughout CP3.

Figure 10: Actual performance against performance floors



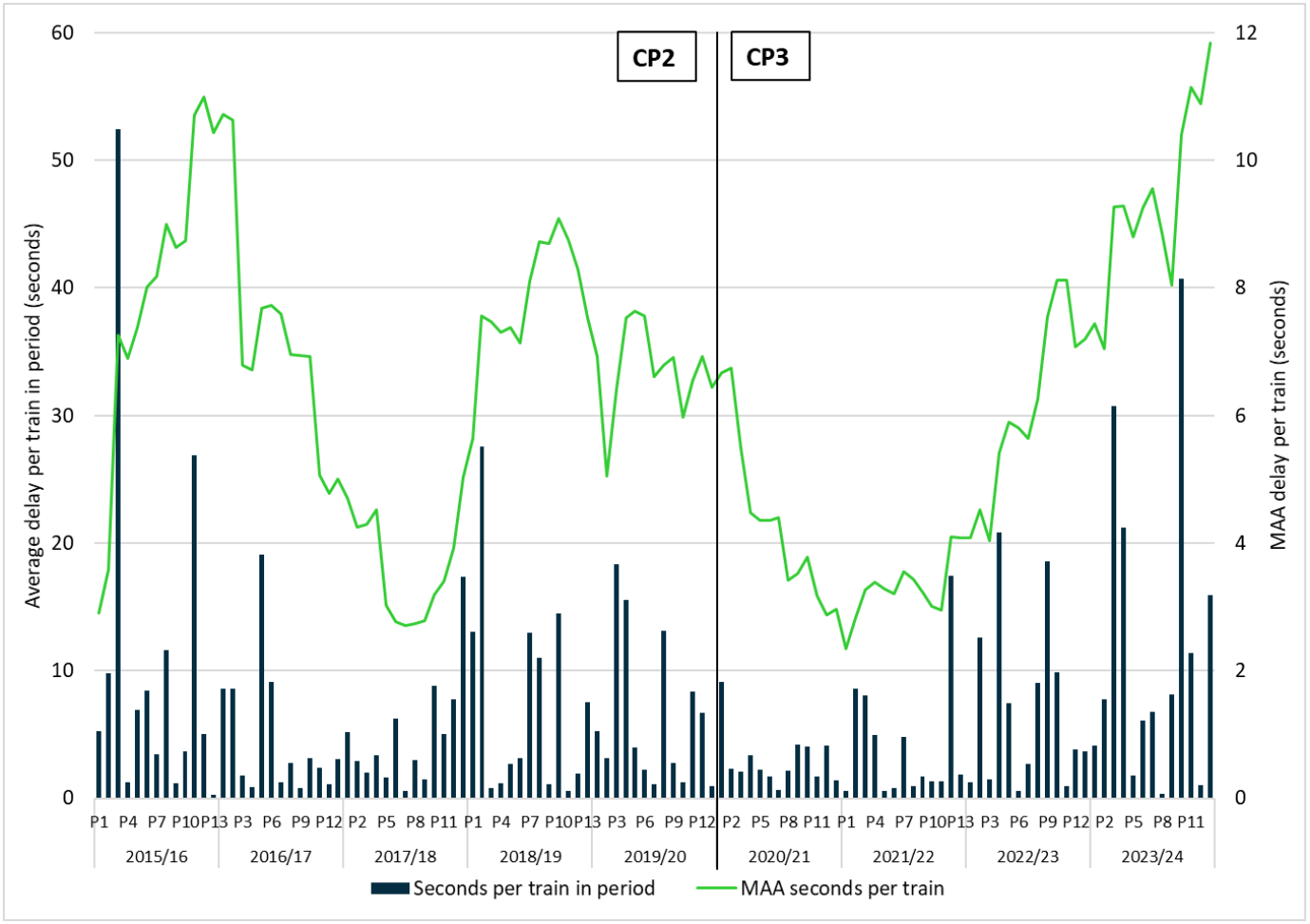
3.3.2. Delay minutes

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 the first four years of CP3.

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.

Performance was severely impacted by the Thames tunnels flooding in December 2023. This was the most significant incident in CP3, resulting in single line working on 29 December and full route closure on 30 December. Substantial resource and technical input were used to recover the situation, allowing services to recommence on 31 December. Independent technical and operational investigations have been completed and we will use their findings to work with NR(HS) to improve systems and processes to prevent a similar incident in the future. This incident is reported in more detail in the 2023/24 AMAS.

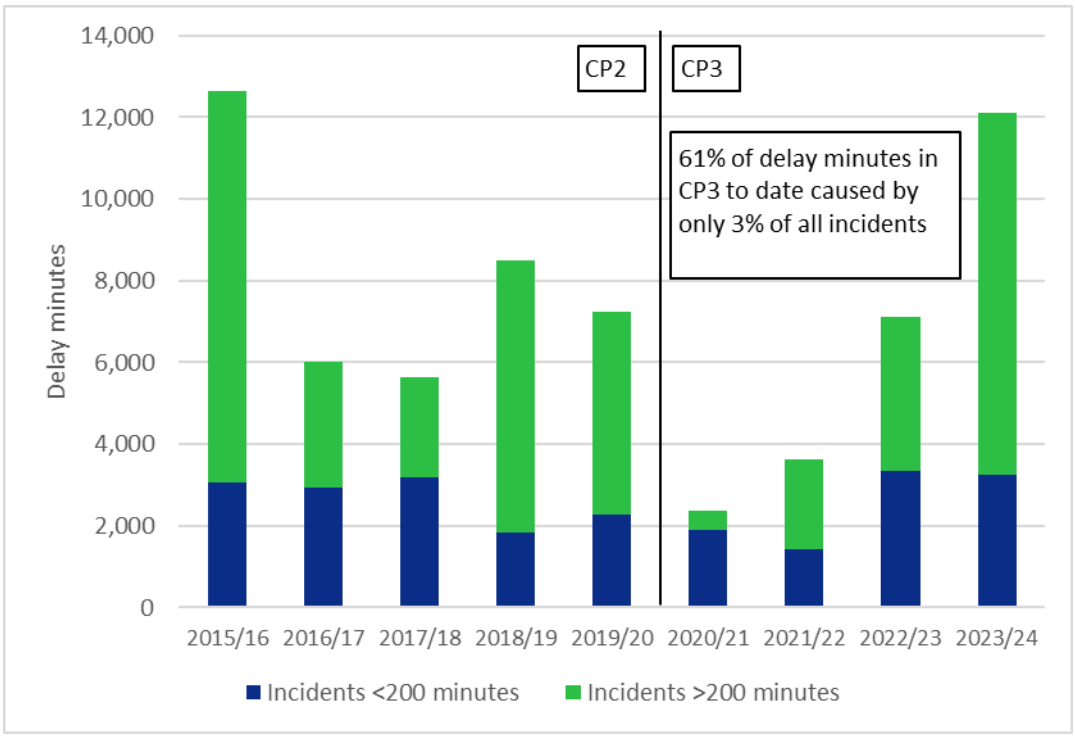
Figure 11: Average seconds delay per train attributed to HS1



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 date, 61% of total delay minutes were caused by only 3% of all incidents.

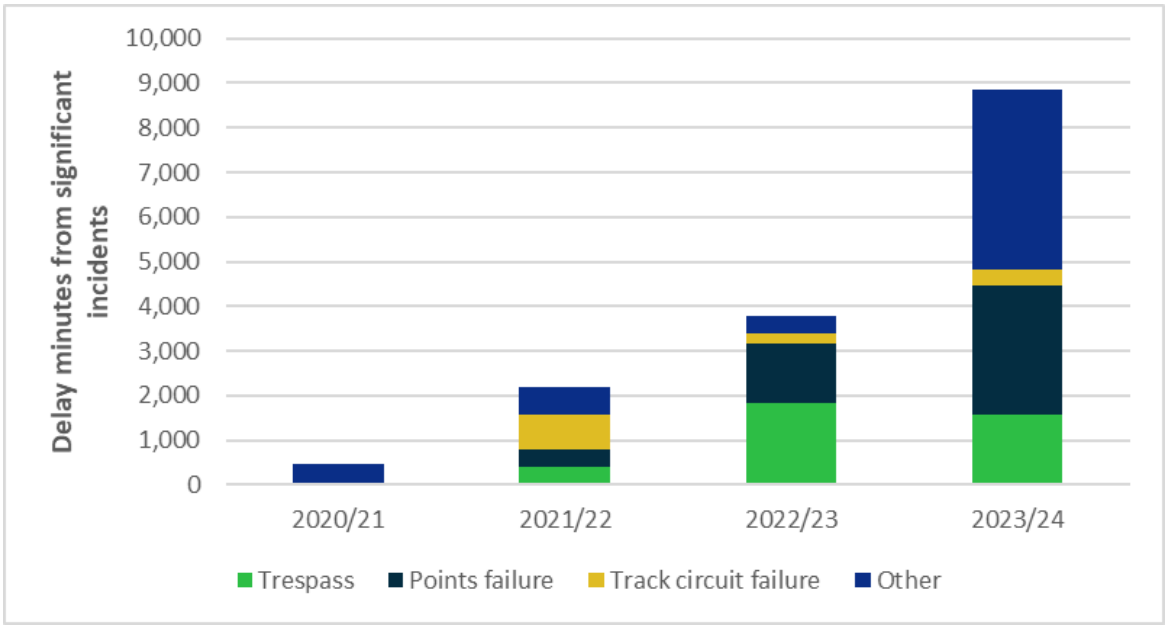
Each incident with a performance impact of over 200 minutes is reviewed with the HS1 system to learn and improve the operational response in order to minimise the impact of such events. These reviews are carried out for all incidents on HS1, not just those caused by HS1 assets.

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).

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.
- NR(HS) has reviewed the structure, communications and roles required to respond to major incidents on the railway and introduced training for operational staff.

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.

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 2023/24 and forecast costs for 2024/25. 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 2023/24 and cost forecasts for 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 (0.5%) higher than the budget. The HS1 costs over this period are forecast to be 4% 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 (excluding R&D) 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 0.4% 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 actual	Budget	Outturn forecast	Budget	Outturn forecast	Variance	Variance %
NR(HS)[8]	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[9]	15.8	16.7	15.9	16.8	16.5	18.2	16.9	16.6	16.1	16.2	81.1	84.5	+3.3	4.1%
Pass through	24.7	24.4	24.7	23.6	24.7	24.2	24.7	26.2	24.7	24.6	123.6	123.1	-0.5	-0.4%
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	-19.6%
Total O&M	**95.9**	**96.6**	**95.8**	**95.5**	**95.5**	**96.5**	**95.5**	**96.6**	**93.7**	**93.7**	**476.4**	**478.8**	**2.4**	**0.5%**

[8] 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. See Section 12.3.6 for more detail.

[9] 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 4.1% (£3.3m) higher than the CP3 efficient budget, driven largely by increased staff and consultancy costs incurred in managing our recovery from Covid-19, 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 actual	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	-0.5%
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	-1.5%
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	1.1	6.7	5.4	-1.3	-19.4%
ORR regulatory and safety	0.4	0.4	0.4	0.2	0.4	0.3	0.7	0.4	0.7	0.5	2.7	1.9	-0.8	-29.7%
Subtotal	4.8	4.8	4.8	4.2	4.8	4.1	5.1	4.1	5.1	4.3	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	6.0	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	1.7	1.0	1.1	7.3	10.6	3.3	45.4%
Office running	1.5	1.5	1.4	1.6	1.6	1.7	1.7	1.6	1.7	1.4	7.9	7.8	-0.1	-1.4%
Other: Concession	1.3	1.1	1.2	1.6	1.5	1.6	1.4	1.4	1.2	1.6	6.5	7.3	0.8	11.7%
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	-17.1%
Subtotal	10.5	12.0	10.6	12.0	11.2	13.9	11.2	12.1	10.4	10.5	54.0	60.4	6.4	11.8%
R&D	0.5	0.0	0.5	0.6	0.5	0.2	0.5	0.4	0.5	1.5	2.6	2.6	0.0	0.0%
Total	**15.8**	**16.7**	**15.9**	**16.8**	**16.5**	**18.2**	**16.9**	**16.6**	**16.1**	**16.2**	**81.1**	**84.5**	**3.3**	**4.1%**

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: • 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. • 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. • Safety audit: High level safety audit costs of £0.13m in total for CP3. 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. 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. 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. 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. This has led to a forecast reduction of £1.3m (19%) compared with the CP3 efficient budget.

Cost category	Comments
ORR regulatory and safety	The CP3 efficient budget included: • ORR regulatory fees: £310k p.a. • ORR safety levy: £160k p.a. • Access Disputes Committee: £50k p.a. Outturn costs are forecast to be 30% (£0.8m) 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 10% (£3.0m) higher than the CP3 efficient budget. 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: • Volume reopeners and ongoing underpin as a result of lower train volumes; • Increased use of spot bidding and resulting invoicing including strike billing and TOCs querying invoices; • Active cash and supplier management to maintain liquidity; • Stakeholder relationships requiring more regular dialogue; • Customer challenges around the regulatory framework; • Regular forecasting in the volatile market to ensure debt obligations were met; • Escrow management; and • Added audit complexities. In addition to increased headcount, staff costs have increased due to: • 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; • 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; • SMT changes in response to Covid-19, with an additional SMT, Finance Director, until July 2022. 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. 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 £1.1m reduction in staff costs by 2024/25 from their 2022/23 peak and reducing headcount by four. 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 £3.3m (45%) higher than the CP3 efficient budget. 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: • Interim consultants in the Finance team. This cost is expected to return to baseline in 2024/25; • Consultant CIO to support the IT efficiency review and cyber risk management requirements. This was a temporary resource; • Additional support for the COO on renewal projects and Procurement Portal License; • Specialist legal support. This is not an ongoing spend; • 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; • Unbudgeted recruitment spend as a result of staff churn. 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. 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: • Rent and service charge (55% of total) • IT/telecoms (30% of total) • Other running costs (15% of total). 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. CP3 outturn costs are forecast to be £0.8m (12%) 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: • £1.2m for the rescue locomotive; • £0.8m for Ashford Integrated Electronic Control Centre (IECC); and

Cost category	Comments
	• £1.2m for route-specific PR and marketing. 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 £0.5m lower than the CP3 efficient budget.

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 actual	Budget	Outturn forecast	Budget	Outturn forecast	Variance	Variance %
Non-traction electricity	2.4	2.4	2.4	1.6	2.3	2.9	2.3	4.3	2.3	2.7	11.7	14.0	2.2	18.9%
Insurance	3.9	3.7	3.9	4.0	3.9	4.0	3.9	3.7	3.9	3.7	19.6	19.2	-0.4	-2.2%
UKPNS O&M and renewals	7.4	7.4	7.4	7.3	7.4	7.3	7.4	7.2	7.4	7.3	36.9	36.6	-0.3	-0.9%
Rates	11.1	10.9	11.1	10.8	11.1	9.9	11.1	10.9	11.1	10.9	55.3	53.4	-2.0	-3.5%
Total	**24.7**	**24.4**	**24.7**	**23.6**	**24.7**	**24.2**	**24.7**	**26.2**	**24.7**	**24.6**	**123.6**	**123.1**	**-0.5**	**-0.4%**

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. CP3 outturn is forecast to be 19% higher than the CP3 efficient budget as a result of large increases in wholesale electricity prices. These were, however, 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. The CP3 cost outturn is forecast to be £0.4m (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. 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 £2.0m (3.5%) lower than budget. 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.25%.

3.4.5. Freight-specific costs

This section reports on the freight-specific costs as determined in PR19 for CP3. For PR24, the ORR DD concluded that certain freight-specific fixed costs should be reallocated to common costs and this is reflected in CP4 costs and charges (see Section 12.4.3).

In CP3, freight-specific O&M costs were 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.

Cost category	Comments
	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. The CP3 efficient budget included the following costs: • £358k p.a. for operations, inspections, regular proactive and reactive maintenance and vegetation clearance; and • A smoothed allowance of £92k p.a. for heavy maintenance works. 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. Mothballing costs of £220k p.a. are subtracted from total Ripple Lane costs, with the remaining cost charged to freight operators. In the freight charging calculations Ripple Lane costs are split between freight trains accessing Ripple Lane from HS1 and freight trains accessing Ripple Lane from the NRIL network in proportion to the number of trains operated.
HS1	This is an allocation from total HS1 costs of those costs which are specific to freight operations. 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	40.2	46.2	39.6	158.5
Variance	-7.6	-13.6	+13.9	+19.8	+13.4	+25.9

For CP3 as a whole, outturn costs are expected to be 20% 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 were 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 were 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. This has been achieved for crossing replacements with volumes being accelerated in 2023/24.

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

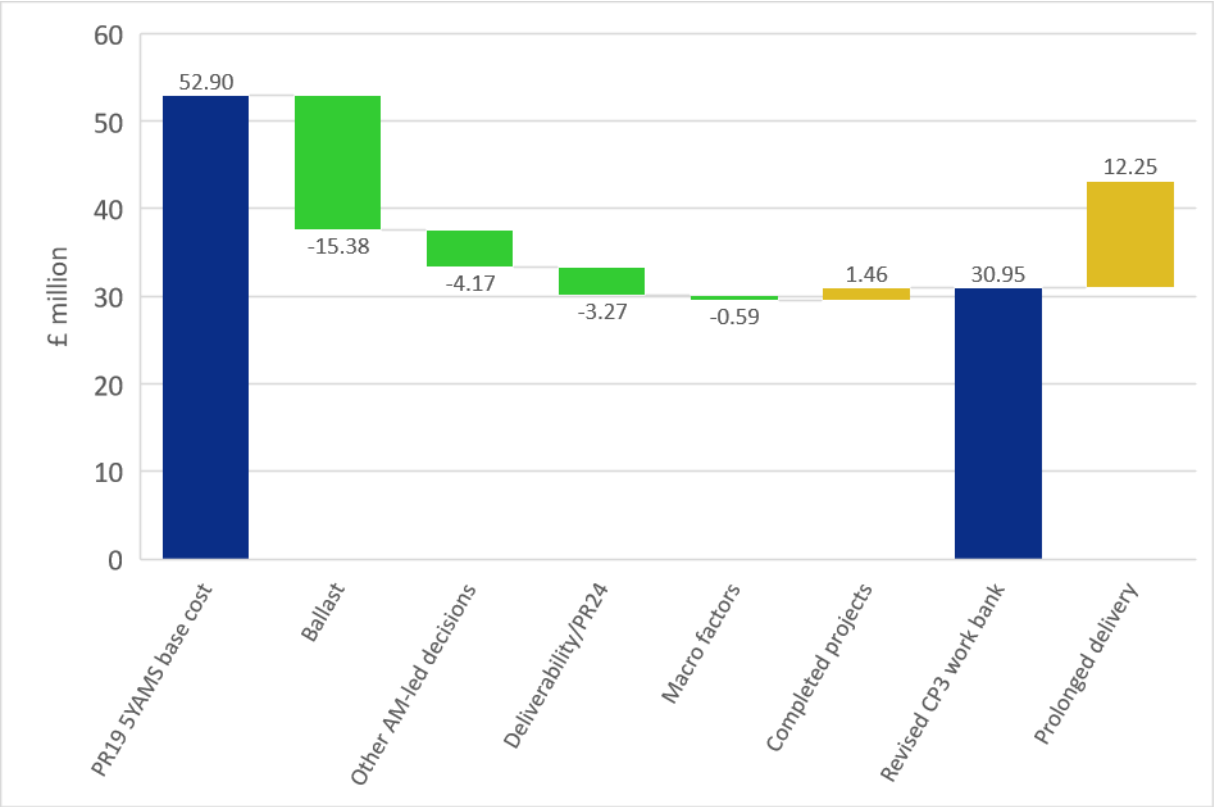
Driver	Governance grouping	
Asset management	Deliver reduced volume	Reduced volumes to be delivered in CP3, project to be closed, any future funding to be sought through PR24.
	To be closed	No volumes to be delivered in CP3, project to be closed, any future funding to be sought through PR24.
Deliverability 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.

The workbank review outputs were presented in 2022/23 AMAS and agreed by ORR. Reporting of renewals delivery is now against this baseline. Renewals volume delivery in 2023/24 was ahead 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[10]	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.

[10] 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[11], 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 actual	24/25 forecast
Opening balance	91.3	90.5	101.8	127.1	160.0
Transfers in	13.6	20.6	34.3	43.1	42.8
Withdrawals	(14.5)	(9.4)	(9.4)	(13.0)	(21.3)
Interest	0.2	0.1	0.4	2.7	7.7
Closing balance	90.5	101.8	127.1	160.0	189.2

[11] 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	154.5	+9.8
Withdrawals	(87.0)	(67.6)	+19.4
Interest	5.9	11.0	+5.1
Closing balance	139.1	189.2	+50.1

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 June 2023 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 are underway and should be concluded by mid June 2025. HS1 competitively procured the supplier of these early works and the total cost of the project is £577k. EIL and SETL were involved in the tender evaluation process. The project cost will be recovered via an Additional IRC (AIRC) over a one year period from Q4 2024/25.

3.7.2. Other upgrades

4G network

To improve customer experience, we 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.

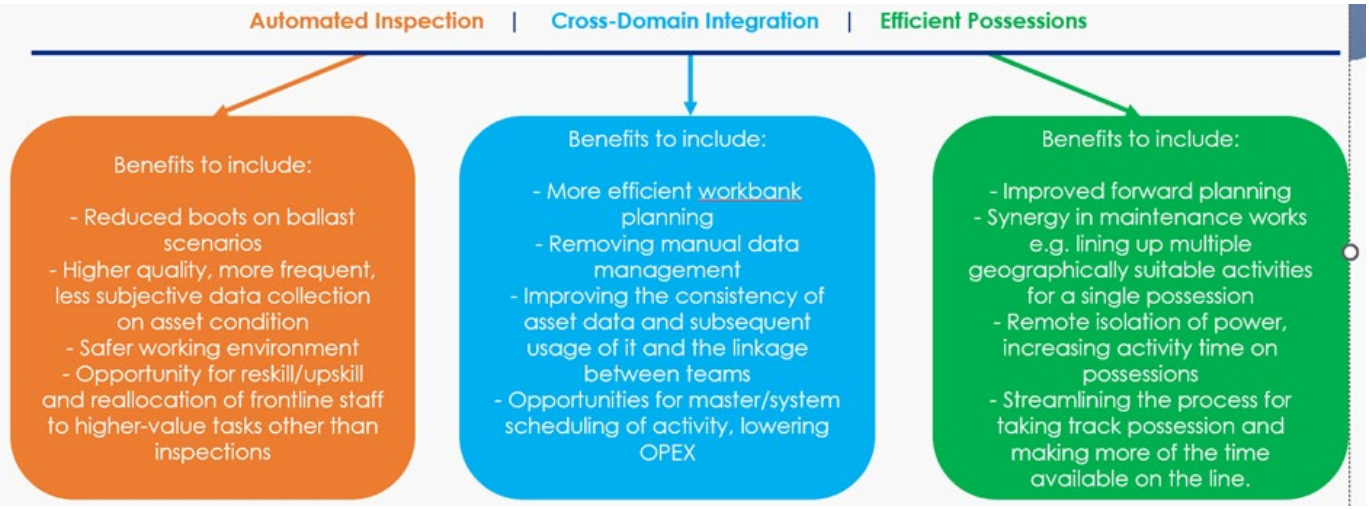
In August 2023, we began a project with EE to install the new radio network on HS1 as part of this programme. The project is being funded by the Home Office. The HS1 ESN deployment project is planned to run for 18 months, using the same teams as and the learning from the 4G installation project to improve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

3.8 Innovation, R&D

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



In the first four years of CP3, 18 R&D initiatives were approved 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 (RCM) 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.
- **Digital Planning Tool:** in partnership with EGIS, the purpose of this trial is to digitise the planning process at the tactical level to realise efficiency and reduce abortive and failed possessions. This is in conjunction with the R&D trial for Enterprise AI Digital Twin for planning at the strategic level which completed in 2024, leading to overall transformation of the planning process on HS1.
- **CEMIT AI:** in partnership with CEMIT, the purpose of this trial is to deliver trainborne RCM at line speed, which is difficult to achieve on HS1 due to speed. This has the potential to transform the understanding of the track-train relationship and monitor a host of metrics when combined with FOAS and other RCM practices in trial on HS1 which will ultimately assist with inspection and maintenance and help plan longer-term renewal activity.

HS1 and NR(HS) held an R&D showcase in May 2024 to demonstrate to stakeholders the benefits, outputs, and value for money of the projects delivered in CP3. The day was well received by attendees from the ORR and DfT, as well as by HS1 and NR(HS) stakeholders, our TOCs, and 16 suppliers who demonstrated the results of our investment. NR(HS) Heads of Engineering and their R&D partners shared information on the breadth of improvements made by our R&D projects, in terms of long-term cost efficiency, safety, performance and sustainability benefits. The HS1 system has two important challenges to lean into as the end of CP3 approaches:

- **Data and systems architecture:** the HS1 system needs to continue working towards the unified systems architecture that will embed data-driven decision making at all levels of the business; and
- **People and culture:** the HS1 system needs to continue to understand the impact of change on its people and should continue the good work started in embedding an innovative culture to ensure that all areas of the network understand how innovation supports the growth HS1 needs to see.

2024/25 is focused around the close out of the existing CP3 R&D portfolio. As part of the governance in place there is a requirement for each successful project to have a business case developed, including the expected efficiencies implementation could deliver, and proposed route to introduction for the solutions trialled. At the portfolio level we are working on a tracker that can roll up potential benefits to portfolio level and provide the ORR and TOCs with the high-level visibility they require.

Expected efficiencies from the CP3 R&D projects have not been included in O&M costs for CP4 as trials and business case development are ongoing at the time of this submission. Expected efficiencies are incorporated into long term renewals costs through the Cost Policy assumptions as explained in the Cost Levers Scoring Report supporting document (see Section 13.5.1).

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 and 2023/24 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 5YAMS.

4.1 Safety performance

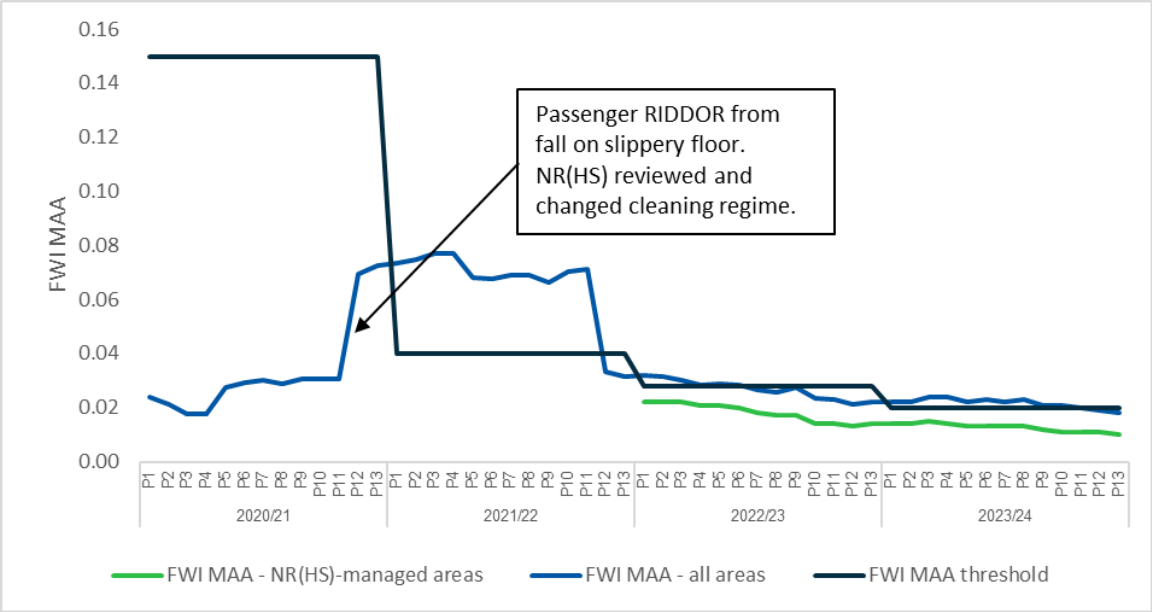
Our top level safety metrics are:

- 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[12], 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 that is a wayfinding solution to help customers navigate their way around the station; this was identified as important to passengers in our survey feedback.

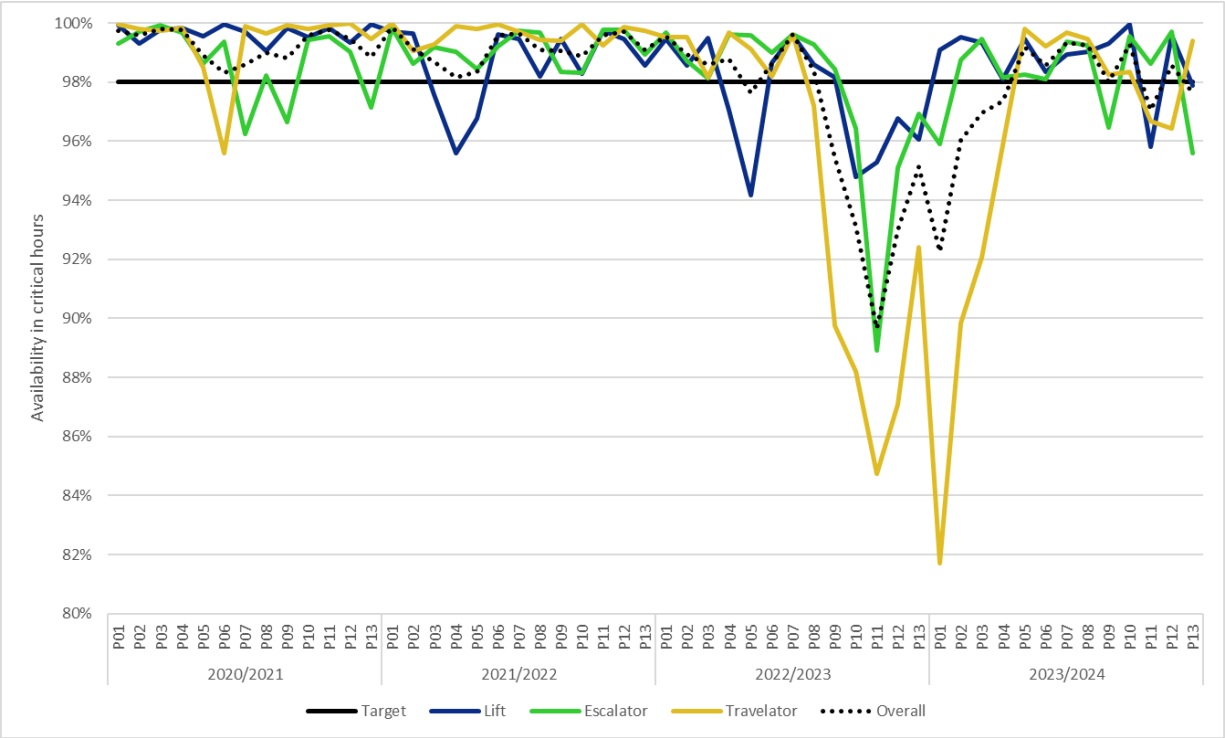
4.2.1. Lifts, escalators and travelators

During PR19, HS1 system stakeholders agreed to a budget for renewals 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%.

[12] 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 to back around target. NR(HS) will continue to track the contractor against the improvement plan until services are delivered consistently.

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 in Section 4.3, LET renewals in CP3 have generally been delivered to budget. Based on 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

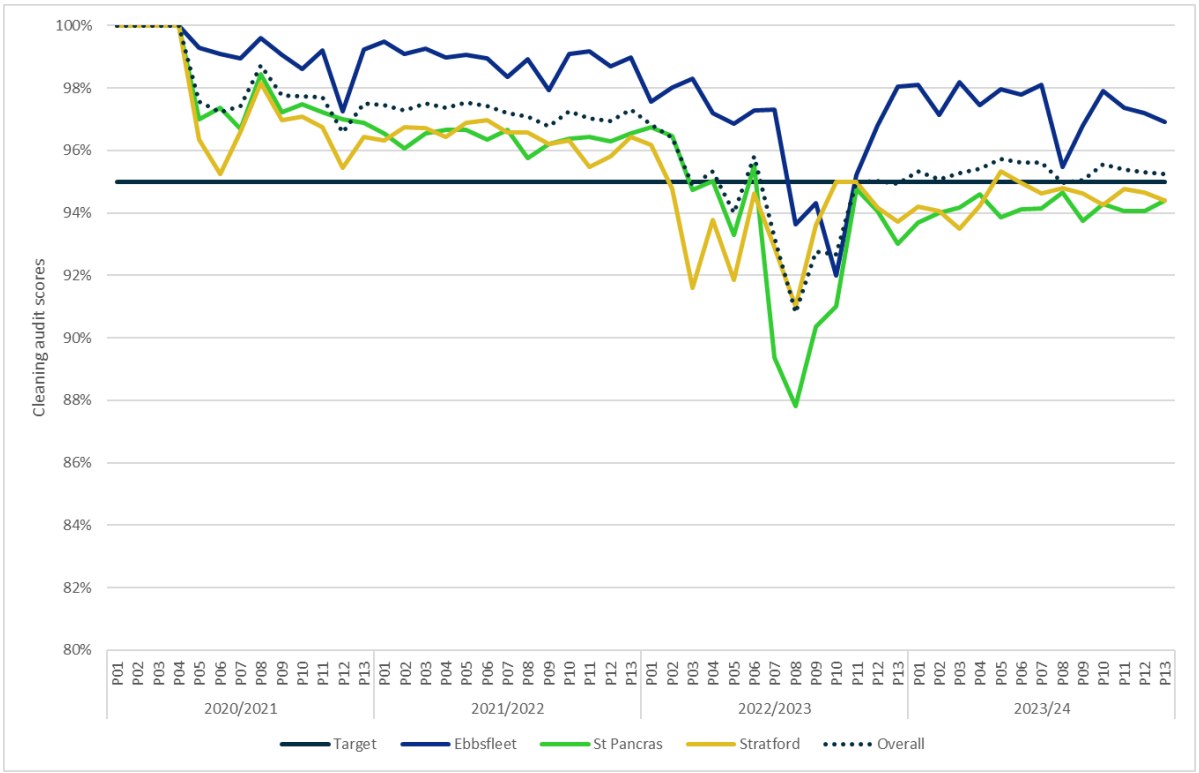
renewals strategy to more smaller scale operational renewals from less frequent full scale asset renewals.

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 with 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 P13 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 for both route and stations 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 c.40% 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)

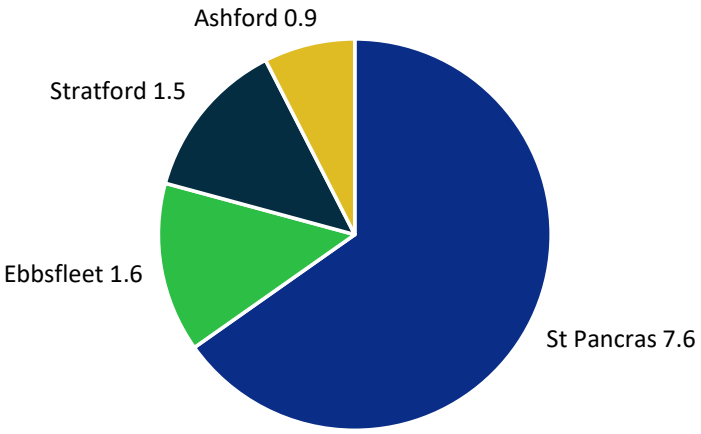


Table 19: Escrow account movements in CP3 - all four stations combined (£m nominal)

	PR19 CP3 estimate	CP3 outturn forecast	Variance	% variance
Opening balance	48.2	52.7	4.5	9%
Receipts	49.3	54.0	4.8	10%
Withdrawals	(22.9)	(27.5)	(4.6)	20%
Interest	3.3	5.4	2.1	63%
Closing balance	77.9	84.7	6.8	9%

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 10% higher than the CP3 forecast for all four stations with higher than forecast inflation;
- Withdrawals are expected to be 20% 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 63% higher than the CP3 forecast overall.

- The net effect is that the closing balance for all four stations combined is expected to be 9% 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	54.4	2.7	5%
Stratford	8.9	9.3	0.4	5%
Ebbsfleet	11.5	11.8	0.3	3%
Ashford	5.9	9.3	3.4	57%

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	14.50
Stratford	4.47	EMR	8.96
Ebbsfleet	4.90	SETL	16.57
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.

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 in mid-CP3. We achieved large savings through retendering supplier contracts for LET and MEP assets and cleaning. We also delivered cost savings early in CP3 through our 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.[13] 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 EU Entry/Exit System (EES) 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.

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:

- 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.

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

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 PLANS

5 Overview of CP4 plans

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 has had to recover. We recognise the increased importance of affordability for train operators following 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 plans compared to previous periodic reviews. We have based our plans 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 plans also do not include any asset management impact from the flooding event in HS1's Thames tunnels. NR(HS) is planning for a permanent asset resolution at the Thames Kent Portal to ensure the assets at that location are fit for purpose. Subject to the conclusion of the redesign of the asset, NR(HS) assumes that costs associated with the permanent asset resolution could be contained within the CP4 cost envelope.

Good asset management is the foundation of our plans. 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 to 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. HS1 has procured a 10-year Power Purchase Agreement (PPA) with a renewable generator, providing c.40% of baseload electricity.

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. The ORR FD concluded there were further efficiency opportunities in NR(HS) costs which have been applied. **The determined CP4 efficient budget results in an overall reduction of 5% in O&M costs compared with the CP3 efficient budget**. For HS1 costs, we are delivering a 6% 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)[14] of 11% between CP4 exit (2029/30) and CP3 exit (2024/25); this is equivalent to a 7% 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. The ballast cleaning programme, a strategic renewal to provide mid-life intervention and extend asset life, is the largest work package in CP4. 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 which the ORR and operators supported. The ORR FD also concluded that there are efficiency opportunities that should further reduce costs for long term renewals. We use a renewals annuity arrangement to smooth the funding of renewals

[14] The AFP may need to be adjusted for the impact on risk cost resulting from the performance regime recalibration that will be undertaken starting in September 2025 and the possible introduction of provisions to compensate for reactionary delay.

spend over time. **The route renewals annuity for CP4 is £28.1m 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 15% to 20% lower than current charges, as shown in Table 22. Relative to PR19 determined charges, there is a decrease of 2 to 3%. This is a good outcome given the largely fixed cost base and 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 OMRC
International passenger services	2,605	3,168	2,537
Domestic passenger services			
St Pancras – Ashford	1,935	2,234	1,896
St Pancras – Springhead Jn	1,011	1,170	988
St Pancras – Ebbsfleet Up	870	1,005	852
St Pancras – Ebbsfleet Down	927	1,071	906

*These are the 2023 VRO charges issued in February 2024 and OMRCC as at January 2024.

Since our May 2024 5YAMS, in which we forecast 200 trains per year over CP4, there has been a change in the outlook for freight services. Freight ceased operating on HS1 in mid-2024 and, due to market conditions and uncertainty, the most appropriate freight forecast for CP4 is zero trains per year. We are required to propose an indicative freight charge and have used a shadow model with a forecast of 200 trains per year to calculate this charge. We have also reallocated certain freight-specific fixed costs to common costs, which are funded by passenger operators, in response to the ORR DD and approved in the FD.

The indicative freight OMRC charge based on the shadow model is £684 per train. This is a 30% decrease from the PR19 determined charge of £981 per train reflecting the reallocation of costs. The freight OMRC per train is 52% lower than the current charge of £1,424, following the April 2024 volume reopener adjustment.

For freight operators accessing Ripple Lane only from the NRIL network, the Ripple Lane (Domestic Sidings) charge is £77.82 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.

HS1 reviewed the proposed 40-year plans to ensure these are robust and applied a similar Cost Policy approach to that applied to route renewals. The ORR FD concluded there were similar efficiency opportunities as for route that should further reduce costs for station long term renewals. **Based on these plans, the Long Term Charge for CP4 for all stations combined is £8.47 million per annum, a decrease of 27% from PR19**. This decrease is across all the stations, as shown in Table 23.

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

	PR19 LTC	PR24 LTC
St Pancras International	7.55	5.32
Ebbsfleet International	1.62	1.35
Stratford International	1.54	1.24
Ashford International	0.87	0.56
Combined total	11.58	**8.47**

Taking the latest estimates of the stations O&M costs (Qx) this gives a total combined charge for the HS1 stations of £48.5 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** strategy and summarises our approach to **security and 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 the determined efficient 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 changes to governance; our approach to estimating renewals costs for the remainder of the 40-year period; the ORR determined efficiencies and the resulting costs. We discuss the methodology we have used to calculate the renewals annuity and the resulting level of annuity for CP4.

Section 14 discusses **route upgrades** planned during CP4 and beyond.

Section 15 discusses **route access charges** for CP4. It describes how our route charging model allocates costs between operators to calculate charges and sets out our charges for CP4.

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

We set out the combined route OMRC and stations Qx and LTC costs for passenger operators in Appendix A7.

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, along with the ORR's determined efficiency opportunities, has resulted in:

- A reduction in route costs for the HS1 system relative to PR19, with a corresponding decrease in passenger operator OMRC per train compared to PR19 and current charges. This is a good outcome given we are moving into a phase with a maturing asset and increased renewals profile. There is a reduction in freight OMRC per train compared to PR19 and current charges, following a reallocation of costs.
- A decrease in stations LTC across all stations compared with PR19. The LTC for each operator is lower than PR19.

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 provide the combined costs for route OMRC and stations LTC and Qx for CP4 in Appendix A7.

We are pleased that our 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 10% 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, most recently in preparing the November 2024 5YAMS.

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. In its response to our Draft 5YAMS consultation, EIL supported this approach.

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. In November 2024, we engaged with SETL on the updated traffic forecast to be incorporated in November 2024 5YAMS. We agreed with SETL that we expect that domestic train paths will increase early in CP4 as additional services are added, and then remain constant for the remainder of CP4. Our long-term forecast after CP4 assumed slow growth back to the underpin level. ORR FD agreed with our November 2024 forecasts for domestic travel.

There is significant uncertainty around domestic traffic growth which depends on factors outside HS1's control, in particular, wider rail industry structural 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 bases the majority of the billing for domestic services on the underpinned level of train paths and the charging calculations therefore use the greater of the actual train paths operated and the underpin level (with the exception of the OMRCA1 calculations[15]).

7.1.2. International passenger services on HS1

Eurostar 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 regular 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 operated a significantly reduced 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. In November 2024, we engaged with EIL on the updated traffic forecast to be incorporated in the revised 5YAMS. We had concerns that EIL's view for CP4 volumes was too optimistic given the currently observed volume and factors affecting growth. We therefore used HS1's revised forecasts for CP4. Our forecasts assumed that there would be small growth in Eurostar train paths from current volumes over 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.

The ORR FD concluded a small upward revision to the forecast for international traffic was needed based on further evidence from EIL.). We have applied the ORR's forecasts (see Table 24 and Table 25).

[15] The OMRCA1 element of the charge is billed on the basis of actual trains operated. See Section 15.1 for an explanation of the elements of OMRC.

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, these new paths could come from the incumbent operator expanding its operations.

7.1.3. Conventional freight services

Only a small fraction of freight between the UK and the Continent is transported by rail. In 2023/24, 1,384 freight trains operated through the Channel Tunnel; 204 of these (15%) operated on HS1.

During CP3, freight services on HS1 were operated by DB Cargo which ran regular services between London and Spain (Valencia). All movements on HS1 were at night, operated at 120 km/h and used Class 92 locomotives. Through most of CP3, freight paths on HS1 were relatively stable at around 400 per year.

More recently, a number of factors resulted in a reduction in freight volumes, triggering a freight volume reopener in early 2024 which increased access charges. Because of this, along with overall service quality for international freight flows and the impact of Brexit, DB Cargo has not operated services on HS1 since mid-2024. DB Cargo continues to engage with customers concerning potential international flows, including those which would access HS1. This dialogue is insufficiently mature to be able to forecast future volumes for freight with any certainty. For November 2024 5YAMS we therefore revised our CP4 freight forecast from 200 trains per year (as used in our May 2024 5YAMS) to zero; this forecast is supported by DB Cargo and approved in the ORR FD.

To set an indicative charge for freight on HS1 in the event of services resuming, we have created a shadow charging model. This assumes a freight volume of 200 trains per year which was the most recent estimate of positive volumes. This has also been used by the ORR to determine freight charges.

Our forecast of domestic freight using the Ripple Lane exchange sidings is 2002 trains per year, all accessing Ripple Lane from the NRIL network (see Section 15.4.2). This has been increased from our May 2024 5YAMS, based on updated forecasts including DB Cargo's continued use of Ripple Lane that it will access from the NRIL network.

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 (except OMRCA1); 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 (underpin)	52,824	52,734	53,032	52,770	52,824
Total domestic paths operated	*48,529*	*49,413*	*49,413*	*49,413*	*49,413*
Total international passenger	17,218	17,265	17,313	17,360	17,408
Total HS1 freight	**0**	**0**	**0**	**0**	**0**

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 that are fixed costs (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

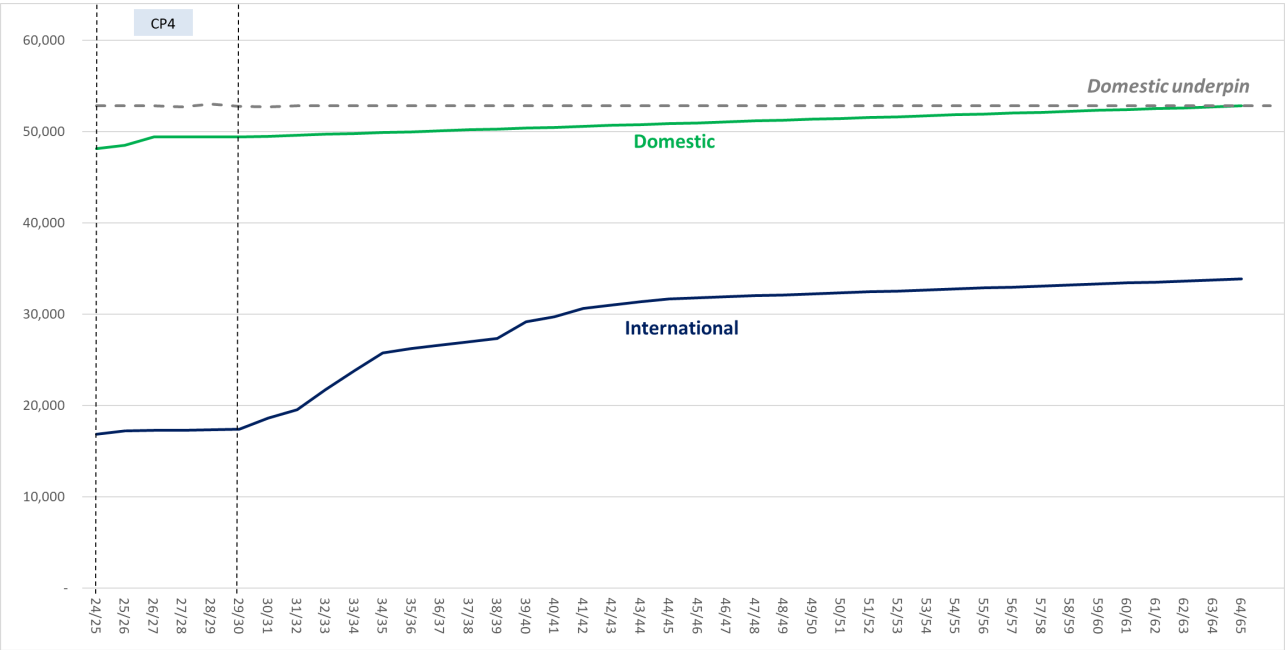
Trains per annum	1 April 2025 to 13 Dec 2025	14 Dec 2025 to 12 Dec 2026	13 Dec 2026 to 11 Dec 2027	12 Dec 2027 to 9 Dec 2028	10 Dec 2028 to 8 Dec 2029	9 Dec 2029 to 31 March 2030
Total domestic passenger*	37,436	52,670	52,652	52,652	52,670	16,104
Total international passenger	12,123	17,204	17,218	17,284	17,346	5,389
Total HS1 freight	0	0	0	0	0	0

* The split between domestic services aligns with the Domestic Underpinning Agreement.

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. In 2016, the ONS 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 (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 to align 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[16] 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 NRIL 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. HS1 also applies our Cost Policy that takes account of the uncertainty in renewals pricing in the longer term in the form of risks and opportunities.
- 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 (as a proxy for CPIH).

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 work 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.

We therefore consider 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, as a proxy for CPIH, to be the appropriate

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

inflation index at this time. If DfT's 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 forecast 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

The ORR DD proposed that we should use a real vanilla WACC of 2.48%. We have adopted this assumption for the calculation of CP4 OMRC charges.

For Specified Upgrades, the ORR and other stakeholders agreed that use of a bespoke WACC should continue for large upgrades and that a single cost of capital should be set for smaller upgrades in CP4. The ORR noted that the rate for smaller upgrades should be the cost of capital agreed for the ERTMS Early Works project and that we should clarify what constitutes a small upgrade. For any small Specified Upgrades in CP4, we will therefore use the cost of the HS1 revolving credit facility at the time (which is based on SONIA + 0.75bp) which will be used to fund these small projects, which is, consistent with the agreed approach for the ERTMS Early Works. Our definition of a small Specified Upgrade is an upgrade with a cost of less than £700k with an AIRC repayment window of one year. The ORR agrees with this approach.

For the ERTMS Early Works project, we agreed on a nominal cost of capital of 5.70% (LIBOR + 0.75bp) which was the cost of the HS1 revolving credit facility used to fund 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. This assumes that the DfT's work to increase the number of banks that could take deposits comes into effect by CP4 (see Section 20.1). Otherwise, the proportion of funds HS1 can place in Authorised Investments will be restricted below 80%.

The ORR DD concluded that we should be able to generate greater returns on escrow investments and increase the annual investment returns from 3.30% to 4.30% (in nominal terms) over the 40-year period. This assumed that HS1 Ltd and DfT will find a solution to enable higher returns from the start of CP4.

As explained in Section 20.1, there are two possible enhancements to improve returns. As there is considerable uncertainty around the timing of the second enhancement and, indeed, whether it will be possible at all; it is not realistic to assume that it will be in place during CP4.

The comparator interest rates in the ORR DD are generally short-term forecasts which are not appropriate for HS1 escrow account interest rate forecasts. Our assumptions reflect long-term forecasts for interest rates for short-term deposits.

We have reviewed our escrow account interest rate assumptions and updated them to reflect more recent forecasts (following the same forecasting methodology as previously used). The updated rates are shown in Table 27. These do not reflect any enhanced returns on Authorised Investments that could be achieved with the second step of DfT's project to improve escrow investments as there is uncertainty around whether DfT will progress with this (see Section 20.1). The ORR FD approved these interest rate assumptions recognising HS1 and DfT comments on what is achievable in CP4.

Table 27: Escrow account interest rate assumptions

	CP4	CP5 onwards
For Authorised Investments	3.45%	3.70%
For funds remaining in the escrow account	2.00%	2.00%

We have assumed a route escrow account opening balance at the start of CP4 of £189.2 million (as in Section 3.6.2) and stations escrow account opening balance (total for all four stations) of £84.7 million (as in Section 4.4).

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 forecasts had increased since the 'Asset Management' traffic forecasts. To understand if there was any impact on the plans, NR(HS) and HS1 undertook 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 NR(HS) 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. A temporary solution is in place and NR(HS) is planning for a permanent asset resolution at the Thames Kent Portal to ensure the assets at that location are fit for purpose. Subject to the conclusion of the redesign of the asset, NR(HS) assumes that costs associated with the permanent asset resolution could be contained within the proposed CP4 cost envelope.
- 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 5YAMS for the impact of introducing EES as it is not expected to affect stations renewals.
- NR(HS) has included additional costs in the Annual Fixed Price to reflect the 30 October 2024 budget changes to employer NICs (see Section 12.3.2).

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.

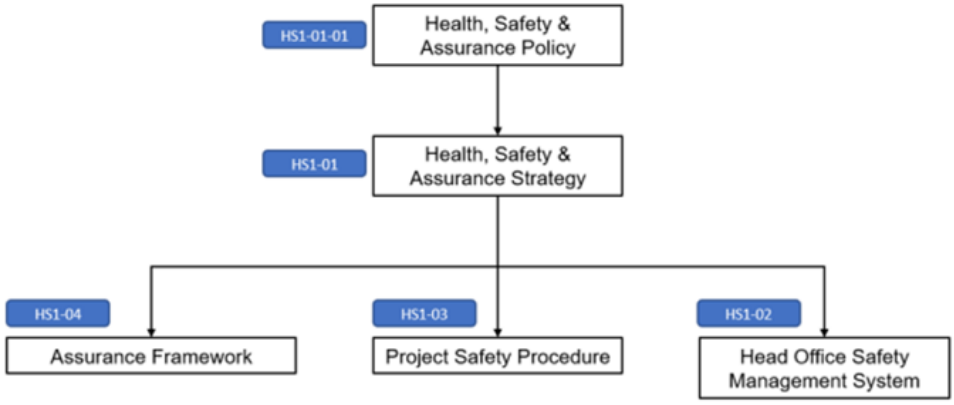
The NR(HS) Safety Strategy for CP4, developed in close consultation with HS1, is in Appendix 10 of the NR(HS) Route 5YAMS.

The ORR DD supported the CP4 safety strategy. The ORR did not propose any changes to the HS1 or NR(HS) safety strategies but requested to see increased focus on safety by design throughout CP4 and asked us to include a commitment in the 5YAMS. We recognise the increasing opportunities to mature our approach to safety by design, as we start to undertake more design work in CP4. We commit to reporting on safety by design in our CP4 AMASs.

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

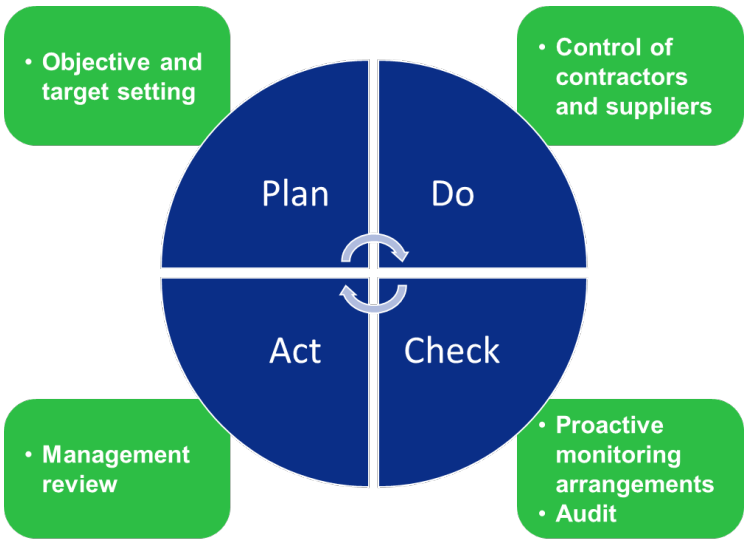


The systems and process that have been developed will be maintained and enhanced based on best practice, lessons from HS1 and other organisations, and audits. System documentation will be maintained, reviewed and updated and will be allocated to owners across the business. The external focus of the management 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 subcontractors 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.

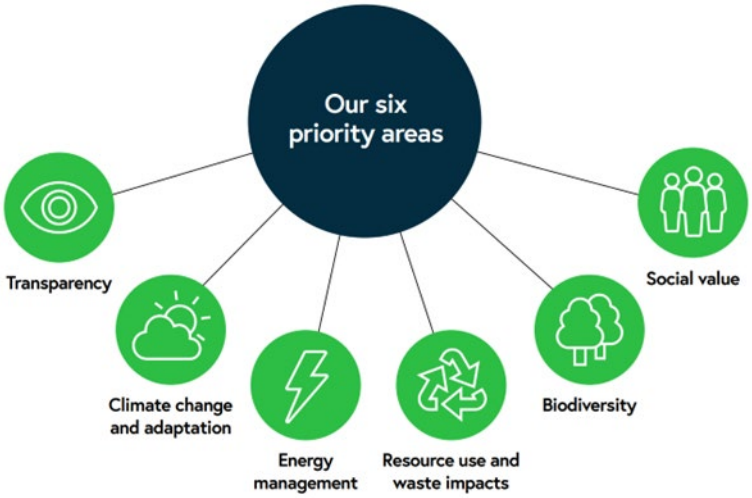
We provide more detailed information on the HS1 Trespass and Security Strategy, the Cyber Security Strategy and the work we have been doing in these areas as a confidential supporting document.

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.[17]

The ORR DD supported our environmental sustainability priorities. The ORR recommended we commit to lead a working group in year 1 of CP4, with involvement from DfT, suppliers and other

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

relevant stakeholders, to seek a way forward on the issues of zero emissions vehicles, renewable energy, circular economy and biodiversity.

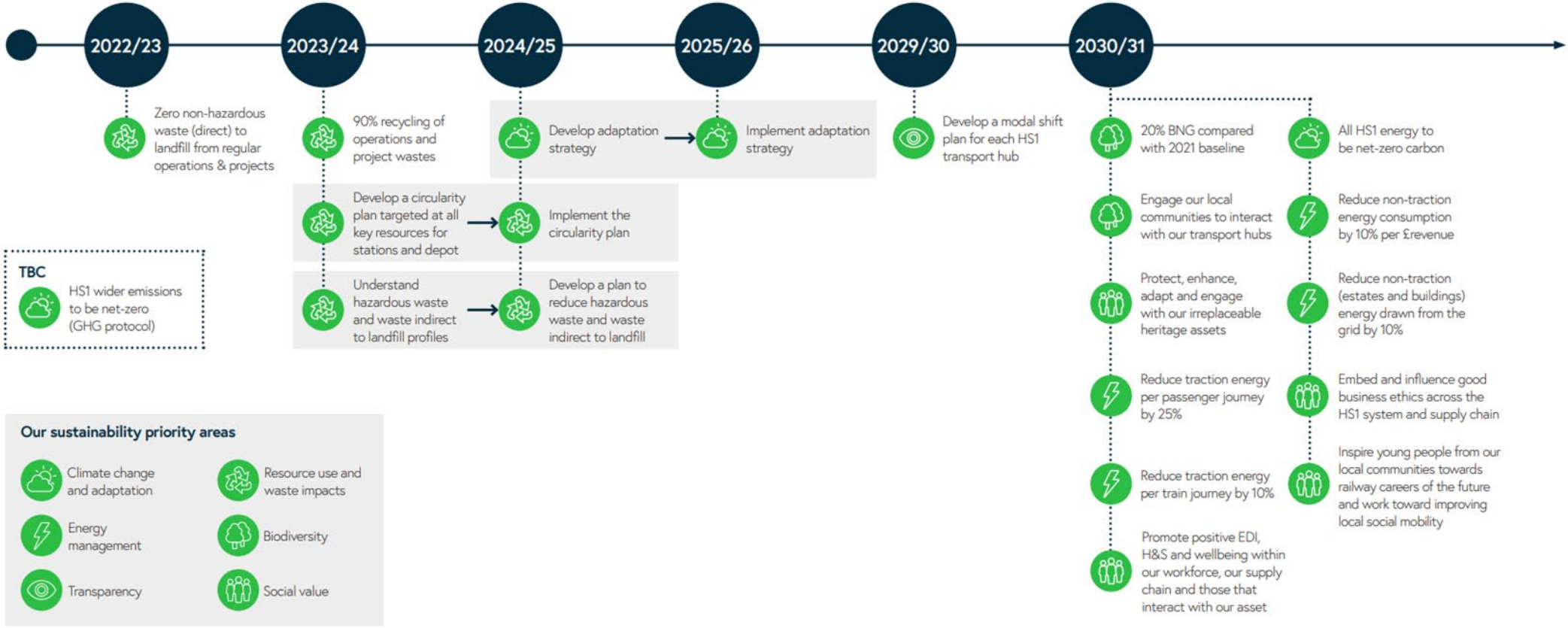
These four different areas need different approaches for overcoming barriers. We have made commitments for each of them as set out in Appendix A5:

- EV fleet infrastructure requires involvement of DfT as the owner of Singlewell depot. We will hold a working group with NR(HS) and DfT to discuss possible solutions to introducing charging infrastructure at the site.
- Since the May 2024 5YAMS, we have made progress with DfT in establishing a possible mechanism for third party funding of solar panels. HS1 will lead on this initiative.
- HS1 and NR(HS) commit to exploring options to integrate circular design principles and sustainable procurement into future projects and expanding our existing circular economy plan to reflect this. As the asset owner, HS1 will involve DfT in this workstream if required.
- We will undertake a biodiversity re-baseline survey and develop a management plan to achieve net gain that allows HS1 and NR(HS) to make a business decision on implementation. The management plan will have regard to priorities set in Local Nature Recovery Strategies and the Government's Environmental Improvement Plan.

We have also made commitments with regards to Scope 3 emissions. We commit to developing supplier engagement targets and liaising with key suppliers to monitor their progress on delivering against these targets. We also commit to incorporating supplier-specific data into our annual Carbon Footprint Analysis to develop an updated Scope 3 emissions baseline.

The ORR accepted our commitments on sustainability in their FD.

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.[18] 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 power quality monitoring devices to gain a better understanding of power consumption across the traction power system. The hardware has been installed and the devices are now operating; this will allow us to collect and analyse data to explore potential efficiencies. The introduction of regenerative braking on the Eurostar fleet would provide a further reduction but a shortfall 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.

[18] 2019/20 figures are used as the baseline for the HS1 Energy Strategy to align with the targets.

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 668 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 incurred to implement the scheme will be recovered from the TOCs, as will one-off implementation costs for HS1 of approximately £57k 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, these costs will be treated as pass through costs (see Section 18.8).

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 will change 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. This change was supported by EIL and SETL in their responses to the Draft

5YAMS consultation. HS1 will work with operators to establish an updated approvals process to align with operator requirements. 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 were to be replaced with air source heat pumps under the CP3 station renewals programme; replacement has now been deferred to CP4. 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, though they are in early stages so more work is required to understand the business case for them based on localised usage of power. HS1 is taking a step by step approach and progressing with a tender for the roof at St Pancras in the first instance and learnings from this will be captured for future schemes in other parts of the asset. A tender for this first scheme will go live in March 25.

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%)	CP4
Stratford station gas boiler replacement	240 (0.5%)	CP4
Ebbsfleet station gas boiler replacement	422 (0.9%)	CP4
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 aims to achieve 100% net-zero carbon energy by 2030 by progressively introducing Power Purchase Agreement (PPA) volume, aligned with a targeted reduction in total consumption. Effective 1st April 2023, approximately 40% of HS1's baseload electricity consumption is classed as net-zero carbon, delivered via a 10-year Corporate PPA. Throughout the first year of CP4, we will review our energy procurement strategy and timelines to ensure this target remains feasible. Our interim target to deliver the majority of baseload electricity (up to 80%) through PPAs by April 2025 will not be met due to current market conditions, however we are closely monitoring the situation and continue to engage with our customers on this matter. 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.[19]

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 (see Section 3.8) to support our asset management include:

- A trial of ArcGIS demonstrating a number of uses and benefits;
- 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 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.

[19] 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 further improvements we wish to make in CP4; these are recorded as CP4 commitments in Appendix A5. The CP4 commitments include 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). Following the ORR DD, we added further CP4 commitments relating to weather resilience strategy and LET and MEP data monitoring. ORR accepted this commitment in their FD.

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 route and station recommendations. More detail is available in the 2023/24 AMAS and the upcoming 2024/25 AMAS.

10.2.3. Asset Management Maturity: ISO55001

NR(HS) route and UKPNS have achieved ISO55001 certification. Both are regularly audited against ISO55001 and maturity improvements are embedded into strategy documents.

HS1 achieved ISO55001 certification for route and station asset management in July 2024. NR(HS) has completed the station asset management assessment is awaiting issue of the ISO55001 certificate.

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, processes and governance to ensure that we can deliver tangible, efficiency-driving and safe changes to our network by starting CP4 with a robust innovation budget.

To enable our CP4 R&D strategy, we updated the definition of R&D to *"Research, trialling, developing and introducing technologies, processes, or ways of working, for technologies which are entirely new or where application on the High Speed 1 System is materially different. The specific activities (e.g. trialling, creating processes etc) which are eligible for R&D funding will vary for each technology."*

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 included 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 theCP4 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 including 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.

Should any stakeholder consider that the range and / or balance of projects does not reflect their priorities for system improvement and benefit realisation, their recourse is to raise this with the ORR, who will address this as necessary with HS1 and NR(HS).

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.

CP4 R&D funding is £3.995m split as shown in Table 29. The ORR FD concluded that this level of R&D funding is appropriate.

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 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 plan the following:

- The R&D Panel will continue in CP4, led by the Head of High-Speed Engineering (Innovation). The focus of the panel will be on technical and engineering aspects of proposed projects, with system participants having the opportunity to contribute to the panel via their technical leads.
- 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) Annual Fixed Price.) Funds are expected to be fully allocated to projects in CP4 as NR(HS) will maintain a pipeline of projects. However, if there is any underspend, this will be carried forward to the CP5 budget. In the event of a planned overspend, where parties agree there is a need to progress a scheme beyond its approved budget, NR(HS) and HS1 will agree a funding approach with the other parties; the governance structure will not facilitate any unplanned overspend.
- 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. It is important that we have full system attendance in order to fully engage with all system R&D opportunities.
- The gate process will remain in place. We recognise that R&D schemes typically require a lighter approach than the renewals governance structure adopted for CP3 R&D projects. We will therefore introduce an agile method of project management, reducing gate paper documentation and enabling R&D schemes to seek approvals, access funding and conclude trials more swiftly and efficiently. NR(HS) and HS1 will develop an approach before the commencement of CP4.

NR(HS) has made the following appointments ahead of CP4 to manage R&D and embed an innovative culture across the system:

- The Head of High Speed Engineering (Innovation), funded under the NR(HS) AFP, will have oversight of the R&D programme. This role delivers the wider NR(HS) innovation strategy, enabling the NR(HS) evolution programme, and will be key in supporting successful R&D schemes to be enabled and embedded into BAU, supporting a safer and more efficient O&M delivery.
- The Change Project Manager (R&D) in the Business Change team, funded through the R&D fund. Their role is to:
    - Engage with key R&D participants and projects ensuring good knowledge of transformational activity is understood;

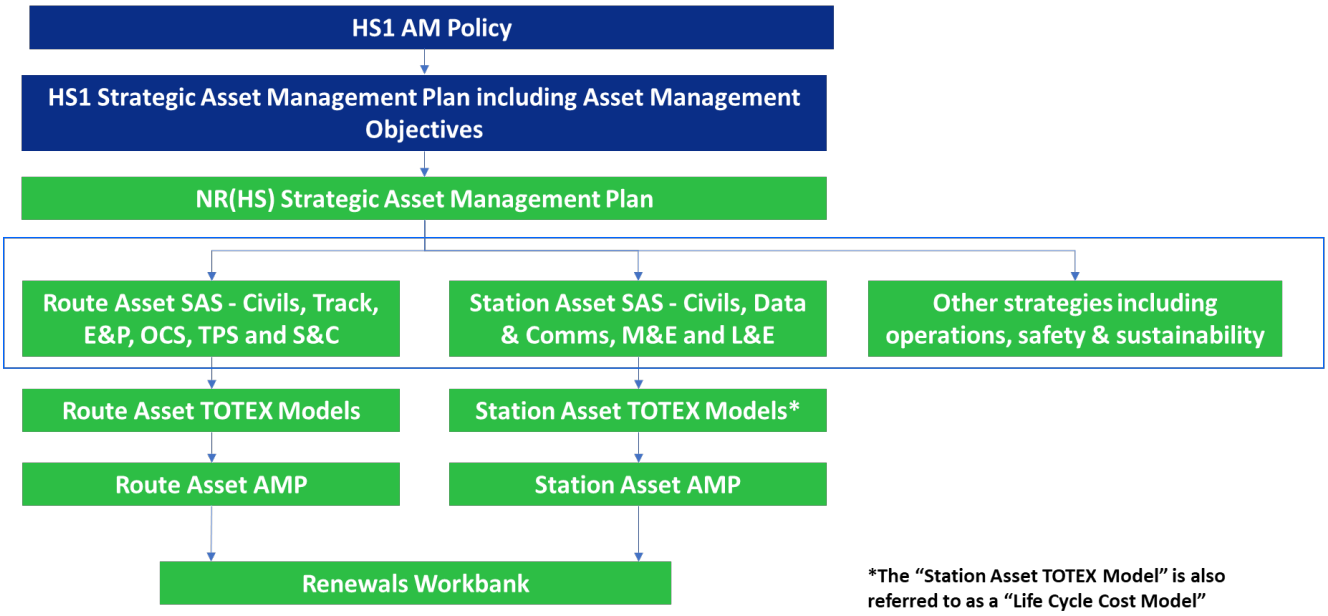
- Be influential in the successful transition of R&D projects from the R&D portfolio into business-as-usual (BAU) activities for the HS1 system; and
- Focus on the recording of key success metrics that will determine if R&D projects are adopted on a long-term basis.

There is currently no defined funding mechanism for stations R&D, which is not a desirable position. We are aware that the ORR is interested in how a stations R&D fund could be established with an appropriate funding mechanism. In previous years, we have funded station energy innovation projects from Qx costs. A similar approach for R&D could be considered, noting that this would require agreement from the operators. There may also be opportunities to include R&D or innovation requirements in the procurement process for stations renewals works. HS1 and NR(HS) are open to discussions with stakeholders on an approach to stations R&D.

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 ORR FD concluded that the structure of our asset management documents is in line with best practice. 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 SAMP was reviewed and updated in April 2024 to ensure it remained appropriate. The update reflects the positive move towards passenger growth, as we have moved away from uncertainty on exiting the pandemic. It includes better line-of-sight between the AMOs and the KPI data used to measure achievement of the objectives. The scenarios and AMOs remain unchanged, as a result there is no impact on the SASs or workbank.

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. **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. **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. 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

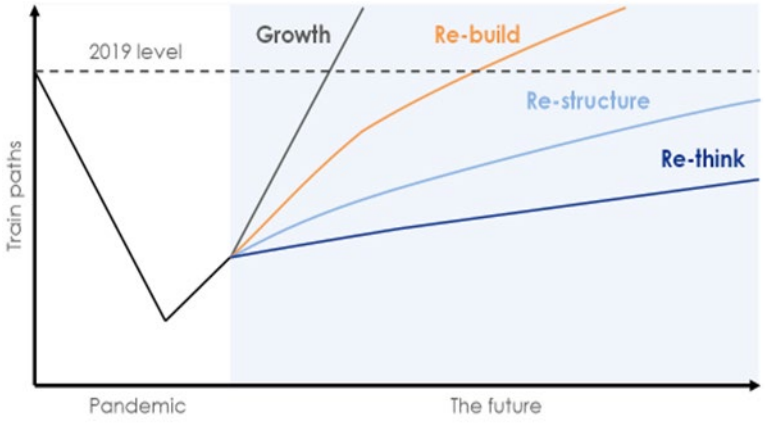
10.5 Recovery scenarios

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.

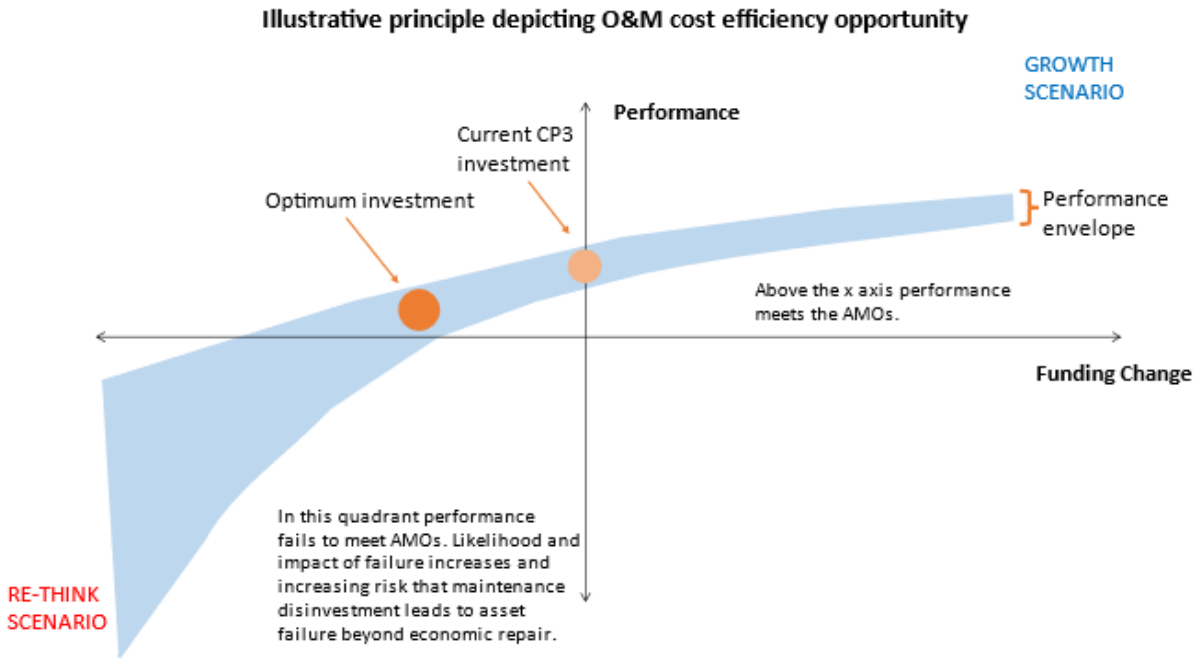
- **Asset classes directly affected by train path volumes:** Track assets and Overhead Catenary System (OCS) assets are the two main categories of HS1 assets which are sensitive to the number of train paths operated. Of these two asset classes:

- 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 and the successful provider was appointed in April 2024. 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.

We have CP4 commitments for NR(HS) to:

- Produce an asset maintenance data and information system strategy for the deployment and integration of EAMS, GIS, and BIM systems; and
- 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.

Following the ORR DD, we made a further CP4 commitment to (i) report on the progress of the improved LET monitoring plan outlined in the SAS and (ii) review the station MEP asset data monitoring plan for opportunities to improve it. ORR accepted these commitments in their FD.

10.6.1. Asset capability and condition

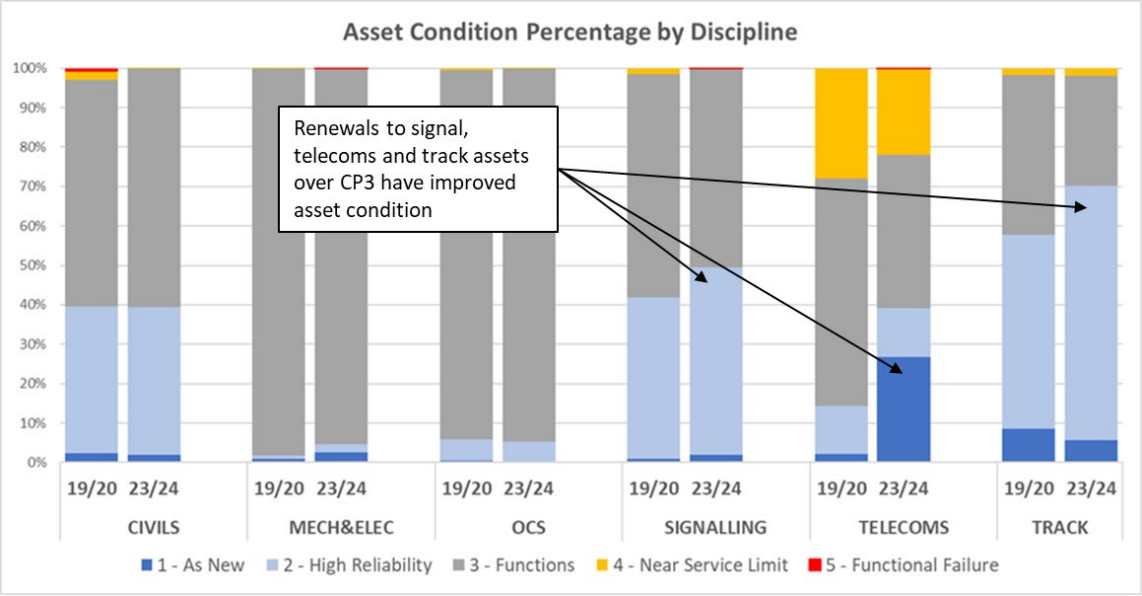
Asset capability has remained constant since commissioning with no projected reductions within the HS1 concession period. The maximum line speed remains the highest in the UK at 300km/h and the route availability meets all passenger and freight customer needs at 22.5 tonnes (axle loading). The maximum 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.

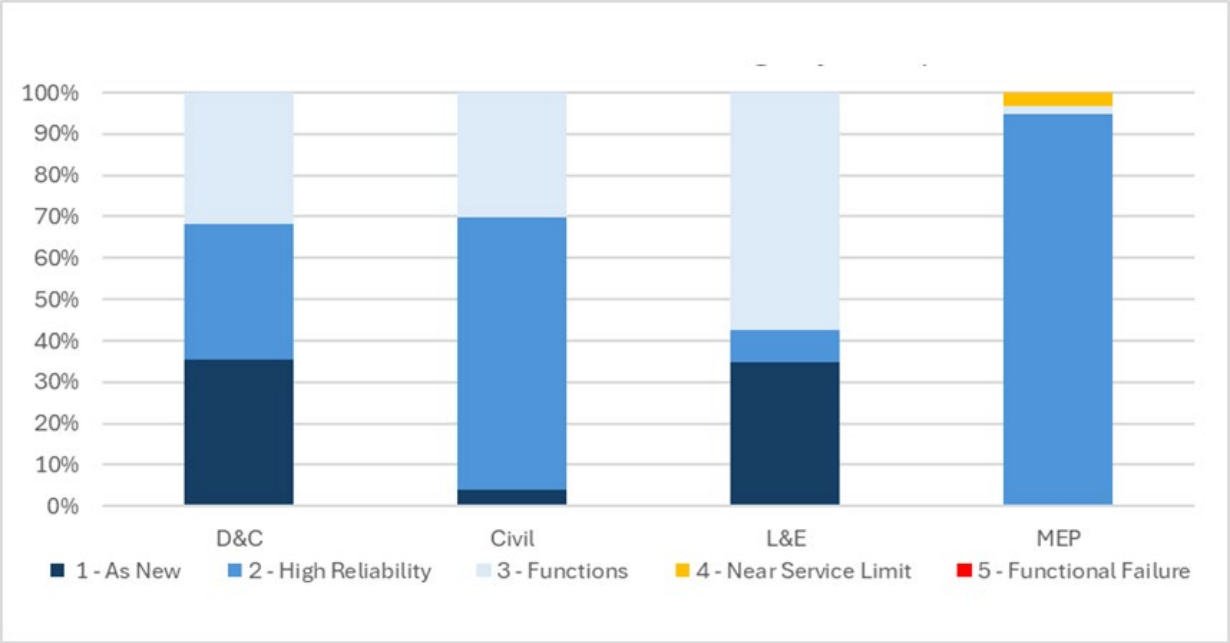
Figure 28: Route asset condition scores



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.

Figure 29 shows the current station asset condition scores by discipline, these take the condition information held in Concept, moderated by HS1 and NR(HS) to reflect the current condition. Station assets overall are generally performing well and meeting their expected condition, although some specific lift, escalator and travelator assets have experienced performance issues due to difficulties obtaining parts from the original manufacturer. We continue to manage minor leak issues on the transition roof at St Pancras station, until significant renewal work to address this is delivered in CP4.

Figure 29: Station asset condition scores



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 2024/25.

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)

Station SASs

- Station Civils
- Lifts & Escalators (which includes Travelators) (LETs)
- Data and Communications (D&C)

- Mechanical and Electrical (M&E)
- 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) 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.

To better understand the risks associated with climate change and severe weather, HS1 Ltd led the production of a climate risk assessment in CP3, which informed the SASs. In addition to the asset-specific improvements planned for CP4 set out in the tables below, we have committed to including a weather resilience strategy in each of the SASs as they are updated in CP4.

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. Rail head treatment strategy and rail milling trial. 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. Automated plain line inspections, laser-based switches and crossings inspections. Use data to identify deterioration trends Remote condition monitoring (RCM) for switches and crossings condition
S&CS	Risk based maintenance regime. RCM introduced for some track circuits allowing condition-based interventions. Fibre optic acoustic sensing to monitor S&CS condition changes.	Integration of maintenance and engineering team to improve asset information sharing. Further RCM introductions
Civil	Trials of RCM. Introduced risk-based inspection and maintenance. R&D trials – cloud and photogrammetry exams for structures and train-mounted video inspections of tunnels.	GIS introduced and integrated to EAMS. Develop drone use for vegetation management and major structure exams. Introduction of improved condition marking index. Major structure asset management plans.
M&E	RCM on fans Knowledge sharing with NRIL	Maintenance redesign including standards and training. Integrated M&E systems view, including spares holding. Better use of asset data to forecast deterioration.

Asset	AM improvements in CP3	AM improvements planned for CP4
OCS	Train mounted LIDAR and optical recognition equipment trialled.	Move to automated visual inspections, condition monitoring and contact wire measurements. Use of in-service Class 395 rolling stock for constant monitoring Data driven maintenance reductions.
TPS		Incorporate remote earthing facility into replacement sectioning switches

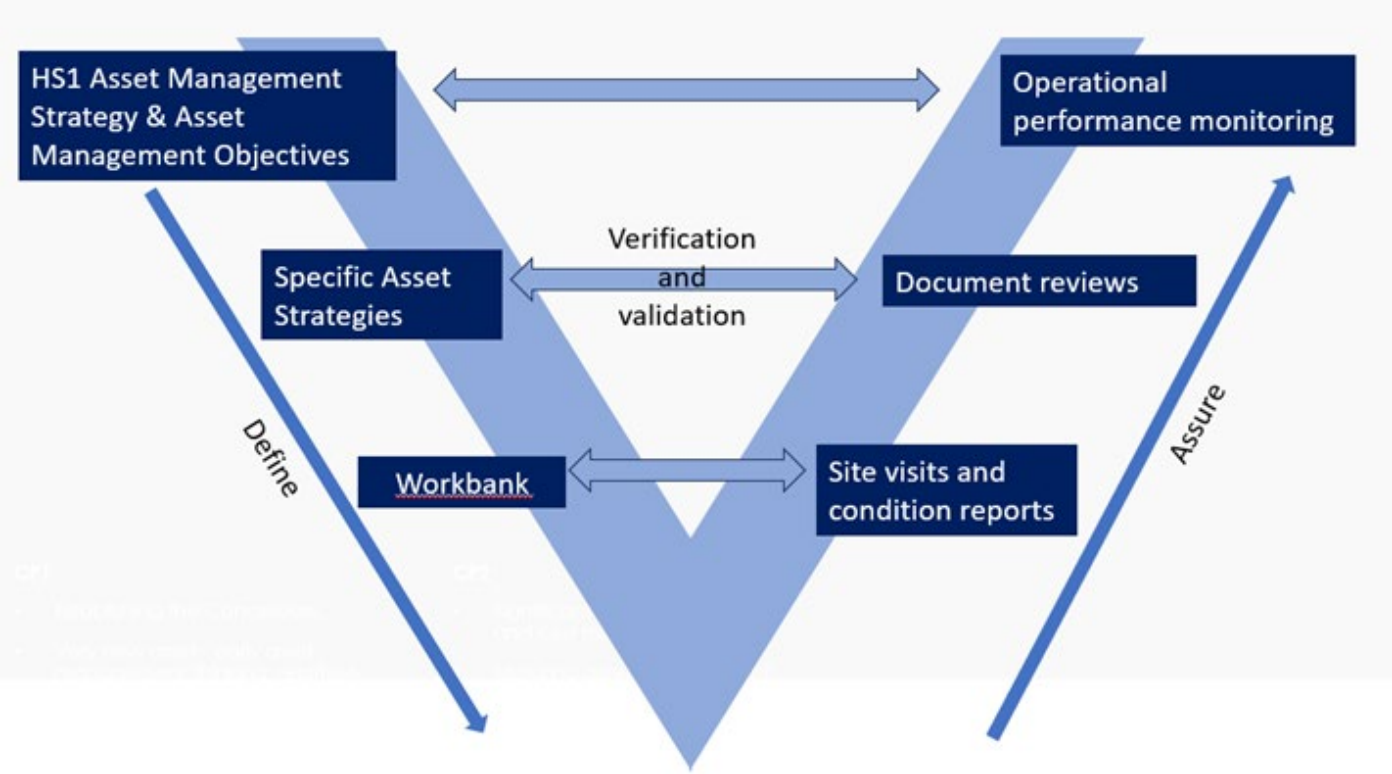
Table 31: Station asset management improvements in CP3 and planned for CP4

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. 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. Introduction of a risk-based model to forecast renewals.	Develop measurable fault / KPI data. 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 30 below.

Figure 30: 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.

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.

10.8 ORR conclusions

While the ORR has been positive about improvements in HS1 asset management since PR19, the FD concluded that the maturity of HS1's asset management varies significantly between asset groups. The Track and Electrification asset groups were the most mature and represented best practice for the other asset groups to emulate, particularly the less mature asset groups (Route Civils; Signalling; Stations Mechanical Electrical & Plumbing; and Lifts Escalators and Travelators).

The ORR recognised that HS1's strategies include some initiatives to improve maturity in these less mature asset groups. However, it concluded that HS1 was not sufficiently prioritising these improvements early in CP4, instead relying on a gradual evolution of maturity over several control periods, which impacts efficiency and resilience in CP4. The ORR has noted the expectation that maturity of asset management capability can be accelerated further than the plans set out in the 5YAMS and other supporting documents. These conclusions provided the basis for the ORR's FD conclusion on material efficiency opportunities in NR(HS) O&M costs for CP4 and long term (CP5 to CP11) route and stations renewal costs which have been applied (see Sections 12.3.2, 13.5.2 and 16.1.2 respectively).

However, as set out in our response to the ORR DD, HS1 and NR(HS) are not clear what existing or improved outcomes can be achieved by going further than proposals in the 5YAMS, and there are a number of statements in the Final Determination which require clarification with the ORR to avoid any misunderstanding. These are set out in detail on page 4 of NR(HS)'s 5YAMS. In summary these are:

- The ORR highlighted the Track deterioration model developing in CP3 as a success; c.£2m of funding was provided for this in the PR19 FD. Whilst we have committed to developing totex and deterioration modelling capability over CP4, this will be applied on a proportionate basis. Funding has not been sought to develop models for other key asset groups to the same level as the track deterioration model. It may be possible to allocate some of the CP4 R&D funding to further develop modelling capability in specific areas. This will need to be assessed against other planned work for maturity commitments and R&D priorities to deliver other efficiencies. Reallocation of R&D funding away from planned activities may result in other efficiencies not being realised.
- HS1 and NR(HS) held clarification sessions with the ORR regarding maturity in Civils drainage assets, through which we understood the ORR considered our plans sufficient and no further commitments required. However, noting the ORR's FD conclusions, NR (HS) will investigate and assess the benefits and deliverability of a drainage performance model during CP4. This will build on the commitments already made in the SASs and the SAMP and will consider if R&D funds could be utilised to do this (noting the potential risk to other efficiencies of reallocating R&D funds).
- The ORR would like to see the step change in asset management maturity to provide resilience against climate change and other external factors. The SASs already contain our approach to understanding the effects climate change may have on the asset. Over CP4, NR (HS) will further review the climate risk assessment led by HS1 Ltd in CP3, to update the SASs and inform future maintenance activities – this is supported by an additional commitment in both the NR (HS) and HS1 Ltd 5YAMS to include a weather resilience strategy in the SASs by the end of CP4. Alongside this, the potential drainage performance model noted above will also support our efforts in understanding the impact of climate change on the HS1 network.

Engagement between HS1, NR(HS) and the ORR will be crucial in delivering the asset management maturity commitments in CP4. HS1 and NR(HS) will work together to build upon the existing engagement with the ORR to ensure that all parties are aligned on the necessary level of asset management maturity throughout CP4 and demonstrating its achievement. Any deviations from the plan can be documented and change controlled through the AMAS.

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 significant intrusive renewals project 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 31.

Figure 31: 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 32 sets out the Operations Strategy initiatives to be delivered in CP3 and CP4.

Figure 32: Operations Strategy initiatives

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

The ORR DD supported our CP4 operations plans but noted that there are opportunities for further improvement. ORR requested that we include a commitment to demonstrate improvements in operations, around managing recovery of train services.

NR(HS) has made significant progress since its May 2024 5YAMS submission with the appointment of Service Delivery Managers (SDMs). All five SDMs will be fully trained by the start of CP4. The 2024 Olympics and Paralympics provided an opportunity to test the Service Delivery Concept ahead of the SDMs starting in-post. This was successful, resulting in NR(HS) achieving high levels of performance with just 0.90 seconds delay per train recorded during the period.

We expect NR(HS) to demonstrate that changes around managing recovery of train services have been made and benefits are being realised and we commit to reporting on this in our year 1 AMAS. ORR accepted our commitment in their FD.

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.

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.

NR(HS) has made commitments over CP4 that will support asset management maturity and increased efficiency in maintenance. These include the introduction of RCM, and the use of machine-based technology to support better asset data gathering. The deployment of EAMS and GIS will also support more efficient asset management.

A summary of our assurance of NR(HS) O&M costs is provided in Section 12.3.2.

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 Multi-Purpose Vehicle (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) have proposed 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 O&M costs

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 the O&M expenditure determined 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. Our cost base for CP4 assumes a steady state HS1 asset; we have not accounted for any shock events or made any allowance for new operators (assumed to be addressed as part of an Interim Review). In their responses to our Draft 5YAMS consultation, the TOCs supported this approach and agreed that an Interim Review would be the appropriate mechanism deal with such events.

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. 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 Benchmarking to international comparators (OMR Effectiveness Study by Rebel) Assurance of NR(HS) asset management proposals HS1 review and challenge of NR(HS) O&M costs Critical review of NR(HS) management fee 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 Efficiency review of HS1 organisation and IT infrastructure Benchmarking to international comparators (OMR Effectiveness Study by Rebel) 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: • Efficient procurement strategies (insurance, electricity); and • Robust negotiation on rates revaluation.
Traction electricity	Reducing consumption through Energy Strategy initiatives Minimising unit costs by ongoing efficiency in purchasing
Freight-specific costs	Efficiencies achieved in NR(HS) Annual Fixed Price

The ORR FD concluded there were opportunities to make the estimates for NR(HS) O&M costs that are passed on to operators more efficient (by £11.5m over CP4) from asset management maturity and changes to contractual mechanisms. We have agreed with NR(HS) a profile to apply

the value of the efficiencies to the NR(HS) Annual Fixed Price (AFP) to align with the ORR FD. The specific efficiencies are covered in more detail in the Section 12.3.

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.

Table 33 summarises the O&M efficient costs determined for CP4, which includes the ORR determined £11.5m reduction in NR(HS) O&M costs that are charged to operators. 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) Route 5YAMS with adjustments for the Operator Agreement 1.1% increase above RPI (which will be reviewed in CP4) and the freight-specific element of the NR(HS) costs (see Section 12.3.6 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	53.6	51.3	49.9	48.1	47.3	250.2
R&D costs	0.8	0.8	0.8	0.8	0.8	4.0
HS1 costs						
Subcontract	4.1	4.2	4.3	4.4	4.4	21.4
Internal	10.4	10.6	10.8	10.6	10.2	52.6
Pass through costs	24.5	24.4	24.3	24.4	24.4	122.0
Freight costs*	0.2	0.2	0.2	0.2	0.2	0.8
Total O&M cost	93.7	91.6	90.2	88.4	87.2	451.0

* This reflects freight's share of variable O&M costs (OMRCA1) and the cost of Ripple Lane domestic sidings. As there are zero freight services forecast for CP4, the share of variable O&M costs is zero.

There is an overall reduction of 5% in O&M costs between the CP3 efficient budget and the CP4 efficient budget as shown in Table 34.

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

	CP3 efficient budget	CP4 efficient budget	Difference	% difference
NR(HS) costs	269.5	250.2	-19.3	-7%
R&D costs	2.6	4.0	1.4	+54%
HS1 costs				
Subcontract	24.5	21.4	-3.1	-13%
Internal	54.0	52.6	-1.4	-3%
Pass through costs	123.6	122.0	-1.6	-1%
Freight costs	2.2	0.8	-1.4	-64%
Total O&M cost	**476.4**	**451.0**	**-25.3**	**-5%**

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 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	£0.5m 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 are close to the very challenging range identified in the study.
Lower management fee for NR(HS)	£1.4m - £2.2m by CP4	£0.3m 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.

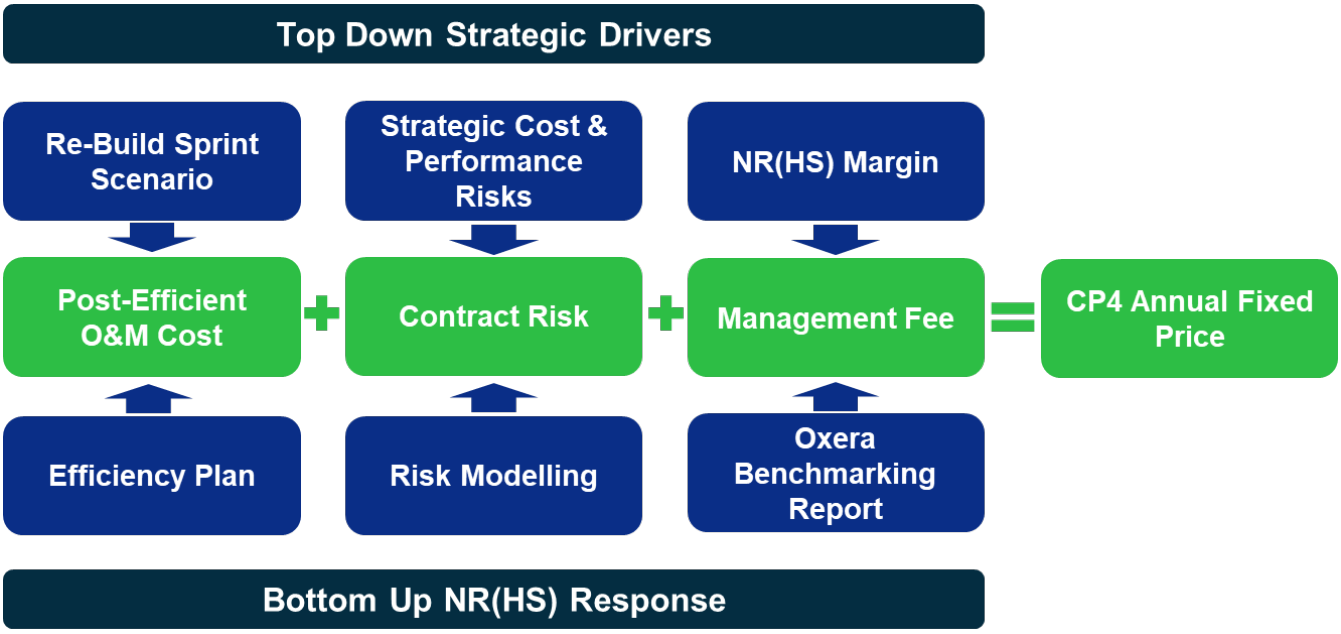
12.3.1. Structure of Annual Fixed Price

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 33: 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 as presented in the May 2024 5YAMS.

HS1 met with NR(HS) to review selected items of NR(HS)'s O&M costs to test how the costs have been developed. HS1 and NR(HS) agreed the areas for HS1 to review and the level of detail required. As NR(HS)'s detailed O&M cost breakdowns are considered commercially sensitive information under the Operator Agreement, it is not possible for HS1 to provide full assurance of the NR(HS) O&M costs. The ORR had access to more detailed information for its review and assurance of NR(HS) costs. HS1 elected to review:

- Costs associated with the NR(HS) Operations team, as this drives the operating cost element;
- Costs associated with the S&T maintenance teams, as this was highlighted in the Rebel benchmarking report as being inefficient; and
- Efficiency targets proposed for CP4.

In summary, the findings of our analysis were:

- The approach to the direct labour numbers is reasonable and in line with the asset management objectives;
- We have concerns about staff absence rates;
- We have concerns about the level of indirect management staff in the wider maintenance teams and productivity levels;
- While Rebel deemed the number of S&T response staff to be high, it is difficult to see how to incentivise NR(HS) to reduce this given the high levels of operational response required (a 30 minute response time) without adjustments to stakeholder priorities. We welcome NR(HS) introducing multi-skilling of these teams to use them more productively.
- NR(HS) is driving some of the changes in productivity by moving resource from maintenance across to renewals activities. We support the shift to more renewals type activities;
- The proposed efficiencies are sensible. Improvements have been identified that will bring further savings; and
- Based on the Operations team review and the S&T maintenance teams review, which gives insight into wider maintenance costs, we are broadly supportive of the NR(HS) O&M cost.

Without sight of the full NR(HS) organisation, its costs, and what rate of organisational change the current operation can absorb without impacting operational performance or the railway safety case, it is difficult for HS1 to propose an increase in the proposed rate of change and introduction of efficiency. Over CP4, HS1 will continue to review the delivery function in line with emerging best practice and the need to meet customer expectations on availability and operational resilience. We provided further detail of our review to ORR in a supporting document.

In the November 2024 5YAMS, NR(HS) increased the AFP to £258.8m to reflect the uncontrollable cost increase imposed by the changes to employer NICs announced in the 30 October 2024 Budget. The increase in NR(HS) staff costs has been calculated on a bottom-up basis. NR(HS) supplier costs have been assumed to increase by the same percentage as NR(HS) staff costs since the subcontracts are almost exclusively for provision of staff (with an adjustment to exclude 20% of the rail plant contract as it relates to materials). Overall, the cost impact to the AFP across staff costs, supplier costs and associated management fee was 1.2% (£3m) over May 2024. This increase for employer NIC changes was approved in the ORR FD. The ORR FD however concluded that there were efficiency opportunities in NR(HS) O&M costs and determined that the cost passed on to operators through charges is £11.5m lower over CP4 than proposed in the November 5YAMS. NR(HS) has applied this, which results in the determined efficient AFP of £247.5m. The efficiency is lower than the £14.7m reduction in NR(HS) O&M costs proposed in the ORR DD, with the ORR taking into account additional evidence provided by NR(HS).

We explain these areas identified by ORR each in turn.

Enablers (£5.25m reduction)

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.

The ORR FD concluded it was inefficient for NR(HS) to pass on certain enabler costs (most notably for NR(HS)'s staff training and development) onto operators. It considered these enablers benefit NR(HS) but not the wider HS1 system and should be funded from NR(HS)'s management fee which typically covers such costs at other companies. NR(HS) does not agree with this and noted that the benchmarking of its management fee specifically did not include investment costs funded from comparator profits so not to double count this. NR(HS) plans to engage with the ORR regarding how this investment interacts with the management fee for clarity in approach ahead of PR29.

NR(HS) has applied this as an unidentified efficiency stretch phased over CP4 to be consistent with the ORR FD. To help ensure this is achieved, HS1 and NR(HS) are committed to collaboratively exploring a number of initiatives during CP4 to unlock potential efficiency for the benefit of the HS1 System. HS1 will be holding NR(HS) to account for delivering its PR24 commitments and asset management plans for CP4 as determined by the ORR.

Asset management maturity acceleration (£1.8m reduction)

As set out in Section 10.8, the ORR concluded there was opportunity to achieve greater efficiencies by accelerating asset management maturity which would help optimise O&M costs and improve resilience. The ORR determined this should result in a £1.8m reduction in NR(HS)'s O&M costs in CP4.

NR(HS) has applied this efficiency as an unidentified efficiency stretch phased over CP4 to be consistent with the ORR FD. As set out in our response to the ORR DD, HS1 and NR(HS) are not clear what existing or improved outcomes can be achieved by going further than proposals in the 5YAMS. Therefore, engagement between HS1, NR(HS) and the ORR will be crucial to ensure that all parties are aligned on the necessary level of asset management maturity throughout CP4 and demonstrating this efficiency achievement.

Inflation indexation (£2.8m reduction)

Under the OA, NR(HS) receives a 1.1% increase above RPI on the Annual Fixed Price which is factored into the costs that are charged to operators. The ORR FD concluded that applying inflation at RPI+1.1% is inefficient, and the efficient approach would be to use RPI+0%, broadly equivalent to CPI+1%. It determined that the NR(HS) O&M cost passed on to operators is reduced by £2.8m in CP4.

HS1 and NR(HS) are committed to jointly explore what the appropriate inflation indexation should be and to reach agreement on this in readiness to implement for the start of CP5. We are not able to amend the OA to address this within the short timeframe to implement the PR24 FD outcomes. We have therefore agreed with NR(HS) to apply this as an efficiency stretch when

calculating the post-efficient O&M cost; the cost reduction is such that the £2.8m efficiency is passed on to operators when the RPI+1.1% is added through the additional adjustment to NR(HS) O&M costs are calculated in HS1's Route Charging Model (see Section 12.3.6).

Contract Risk (£1.65m reduction)

The ORR also made a determination on Contract Risk, which is applied after the post-efficient O&M costs. This is discussed in Section 12.3.4.

NR(HS) efficiency summary

NR(HS) has identified the upfront investment enablers needed to deliver efficiencies. It 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 34.

The determined AFP represents a 11% net efficiency (15% gross efficiency[20]) in terms of the CP4 exit AFP against the CP3 exit AFP determined in PR19.

Figure 34: NR(HS) efficiency summary

	Within NR(HS) control	Out of NR(HS) control
Cost increase	**Enabler 3%** *Positive management actions which increase equivalent costs or risk provision to facilitate efficiencies or enhanced business capabilities* • **Operations Strategy:** Business change & organisational improvement • **Infrastructure Evolution:** RBM & integrated planning & delivery • **Digital asset management:** EAMS & GIS capability • **People and Organisation:** Training capability and competency • **Provision for general safety and sustainability:** locally funded investment & sustainability investment	**Headwind 2%** *External factors which increase equivalent costs or risk provision compared to current rates (e.g. external cost pressures)* • **National rostering principles:** Driving requirement for increased signaller resource • **Employer NICs:** Introduction of a higher rate and lower threshold in the October 2024 government budget

Cost decrease	**Efficiency 15% (gross)**
	Positive management actions undertaken to reduce equivalent costs or risk provision compared to current rates
	• **Operations Strategy:** Optimised resourcing and delivery
	• **Infrastructure Evolution:** Optimised planning, resourcing and ways of working
	• **Digital asset management:** Data-driven decision-making in asset management
	• **People and Organisation:** Enhanced capability and TOM implementation
	• **Commercial efficiency:** Better value frameworks and review of PSA
	• **Contract risk reduction:** Reassessment of cost and performance risks resulting in a reduced risk allowance
	• **Unidentified efficiency stretch**:
	  • **Inflation**: Removal of the +1.1% allowance for inflation above RPI.
	  • **Asset management maturity**: Acceleration of efficiency identified by ORR through the FD.
		Tailwind (1%)
		External factors which reduce equivalent costs or risk provision compared to current rates
		• **Rail Plant mothballing:** Mothballing unutilised HS1 Ltd rail plant to achieve efficiencies in subcontractor costs
		• **Contracting Strategy:** Frameworks beyond the five-year regulatory horizon

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

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 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[21], therefore HS1 has only been able to review the information contained within this version. We therefore did not change 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.

The ORR DD noted there may be opportunity to review the HS1 outperformance regime to address imbalances and therefore could allow for a reduction in NR(HS)'s management fee to 6.6%. NR(HS) provided additional evidence to the ORR. Based on this, the ORR FD concluded that the opportunity to reduce the management fee by changing the outperformance regime in CP4 is smaller than indicated in the DD. The ORR decided not to include an adjustment to the management fee while noting that this was considered when determining the total adjustment required to achieve the efficient AFP and, in turn, total O&M costs that are passed on to operators. As these ORR FD efficiencies have been applied after the NR(HS)'s post efficient O&M cost calculation, the management fee cost line has not been amended since November 2024 5YAMS (see Section 12.3.5).

[21] We understand the ORR has access to the full, unredacted report.

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 went 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 proposed 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 proposed 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) which was put forward in the November 2024 5YAMS, reduced from 4.33% in CP3. More detail is provided in the supporting document CP4 Contract Risk.

The ORR FD concluded that the P80 estimate within the NR (HS) Contract Risk was overstated and should be an intermediate point between P60-P80. Based on this the ORR determined a reduction in the Contract Risk value by £1.65m over CP4 (using a P70 value). This gives a final value of Contract Risk of £5.0m (2.2% of the post-efficient O&M cost), with £1.9m for Cost Risk and £3.1m for Performance Risk. NR(HS) has flat phased this efficiency across the five years.

As part of the PR24 process, HS1 and NR(HS) had previously held discussions with the operators and ORR about opportunities to review the way in which risks are managed and distributed across the HS1 System which could better incentivise parties to effectively and efficiently manage risk. HS1 and NR(HS) are not able to do this alone as it requires collaboration and agreement across all parties. Other than an agreed consensus for improved collaboration between NR(HS) and operators to support incident recovery times, there was little appetite by operators to progress this further. NR(HS) believes there is an opportunity to review and improve the risk exposure on costs associated with third party performance risks as part of the 2025 performance regime recalibration. We will work jointly with NR(HS) and the operators as we define the scope of the recalibration, including reviewing the parameters, to ensure alignment with obligations in other agreements (such as in the Access Terms and Track Access Agreements) and that all parties are best incentivised to manage these system risks and its impact on the HS1 network.

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	34.8	n/a
Support	13.0	13.0	13.0	13.0	13.0	64.8	n/a
Total O&M (pre-efficient)	**46.3**	**46.3**	**46.3**	**46.3**	**46.3**	**231.5**	**-3.3**
NR(HS) Net efficiency	3.7	1.6	0.3	(1.4)	(2.1)	2.1	+1.2
Total O&M (post-efficient)	**50.0**	**47.9**	**46.5**	**44.9**	**44.2**	**233.5**	**-2.2**
Management Fee	4.0	3.8	3.7	3.6	3.5	18.7	-0.2
Contract risk*	1.0	1.0	1.0	1.0	1.0	5.0	-1.0
ORR determined efficiencies**	(2.0)	(2.0)	(1.9)	(1.9)	(1.9)	(9.7)	n/a
Annual Fixed Price	53.0	50.8	49.3	47.6	46.8	247.5	**-5.3**

* This includes the ORR FD Contract Risk efficiency of £1.65m flat phased across CP4.
** This reflects the value of the ORR's determined O&M efficiencies (excluding the Contract Risk efficiency). This together with the Contract Risk efficiency, when adjusted for RPI+1.1% indexation, is equivalent to the £11.5m total cost reduction in O&M costs passed on to operators.

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. Adjustments to the Annual Fixed Price

We make two adjustments 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 in the Annual Fixed Price that NR(HS) receives, which is incorporated; HS1 and NR(HS) are committed to reviewing the inflation indexation during CP4 as explained in Section 12.3.2.
- The element of the NR(HS) costs allocated to freight (as calculated in the HS1 Route Charging Model for PR24) is netted off the Annual Fixed Price (and included in the separate "freight-specific costs" category). However, for CP4 with no freight services forecast, there is no cost adjustment.

This calculation is shown in Table 37. This shows that the determined NR(HS) cost is £250.2 which is £11.5m lower than proposed in November 2024 5YAMS, in line with ORR FD.

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	53.0	50.8	49.3	47.6	46.8	247.5
+ 1.1% escalation	0.6	0.6	0.5	0.5	0.5	2.7
- allocated to freight	-	-	-	-	-	-
Adjusted AFP	53.6	51.3	49.9	48.1	47.3	250.2

12.3.7. R&D funding

As discussed in Section 10.3, NR(HS) will hold 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 £4.0m. 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.

12.4 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.

Since the May 2024 5YAMS, we have made the following changes to HS1 costs:

- Increased HS1 staff costs and some of the subcontract costs (BTPA and ORR regulatory & safety fees) to reflect the uncontrollable cost increase imposed by the changes to employer NICs announced in the 30 October 2024 Budget;
- Updated GSM-R costs to reflect the notification from NRIL that the charge for the GSM-R contract is likely to increase when it is renewed in year 2 of CP4.
- HS1 previously allocated a share of HS1 staff costs to freight. The ORR concluded that these costs are better defined as common costs (which are apportioned across passenger operators). These costs have therefore been removed from freight costs and are included in HS1 staff costs.

The supporting document 'OMRC cost changes – ER NICs and GSMR – overview' provided to the ORR set out further information on this.

The ORR FD also concluded that an annual fixed cost wash up will be implemented (see Section 18.4). The ORR FD provided a small increase (£150k for CP4) in HS1's own costs for the additional work after the ORR considered the totality of the HS1 cost changes we made since the May 2024 5YAMS. This is lower than the cost we estimated (£386k). We plan to work to this budget to develop and implement the fixed cost wash up. . Supporting document 'Fixed cost wash up – overview' explained our cost estimate with detailed information in the supporting document 'Cost of new fixed cost wash up' provided to the ORR.

Table 38: HS1 costs (£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	2.1	0.3
NGC connection fees	0.4	0.4	0.4	0.4	0.4	2.1	-1.1
BTPA	1.1	1.1	1.1	1.1	1.1	5.5	-1.3
ORR regulatory & safety	0.3	0.3	0.4	0.5	0.5	2.1	-0.6
Subtotal	4.1	4.2	4.3	4.4	4.4	21.4	-3.1

HS1 internal costs							
Staff	6.1	6.3	6.1	6.2	6.2	31.0	2.1
Technical support/ consultancy	1.2	1.2	1.5	1.3	0.8	6.0	-1.2
Office running	1.3	1.3	1.4	1.3	1.3	6.5	-1.4
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	10.4	10.6	10.8	10.6	10.2	52.6	-1.4
Total	14.6	14.8	15.1	15.0	14.6	74.1	-4.5

We forecast a £4.5 million (6%) 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: **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.). **Ripple Lane:** NRIL provided Ripple Lane exchange sidings mothballing costs of £0.2m p.a., as in the CP3 submission. **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. Our forecast for CP4 is that these costs will continue at the 2024/25 forecast outturn level (£355k p.a.) in year 1, then increase by 20% from year 2 based on new information from NRIL.
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. This is a £1.1m (35%) reduction over the five years of CP4 compared to the CP3 efficient budget.
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 with a 1.4% increase to reflect the employer NICs change. This is a £1.3m (19%) reduction over the five years compared to the CP3 efficient budget. 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.

Cost category	Comments
	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, and a 1.2% increase to reflect the estimated impact of the employer NICs change on total costs. We have also included the following costs (based on CP3 outturn): • £161k p.a. for the ORR safety levy; and • £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	HS1 provides significant technical and asset management leadership, assurance, and corporate responsibilities which include managing external contracts to drive efficiency on behalf of the train operators. These management responsibilities require considerable resource, including a minimum number of employees with the appropriate level of skills and experience. There is no man-marking of NR(HS) or other supply chain partners. Over the last five years, the environment in which HS1 operates has become significantly more complex; HS1 is an ageing asset, increasing asset management complexity and requiring enhanced escrow management. Customer information and other requirements have become significantly more challenging and extensive, stakeholder engagement and contractual challenges have both increased. Significant stakeholder engagement has resulted in additional responsibilities for HS1 which include additional stakeholder reporting and legal work to test contractual interpretations. Train path volumes are more volatile and less predictable, changing our forecasting and charging model requirements, increasing our billing complexities with quarterly wash-ups and underpin invoicing. External reporting requirements are materially more onerous and will continue to be so, for example, climate-related disclosures become mandatory from 2025.

Cost category	Comments
	As noted in Section 3.4.3, we have reviewed our structure to ensure it is appropriate for a steady-state business. Entering CP4, total staff numbers have been reduced by four from the 2022/23 peak of 41 employees. This is close to the very challenging efficiency range identified by the Rebel OMR Effectiveness Study. This is despite the significantly more complex and demanding processes and requirements. This headcount is an increase of 1 FTE since our Draft 5YAMS submission due to a recent review of the organisation structure which has further identified the increased level of workload and capability required, and the need to supplement the resources in our Finance team in particular. We believe this headcount is the minimum necessary for CP4 to deliver our corporate responsibilities effectively, this includes our asset management and safety obligations as per our Concession Agreement. HS1 will continue to streamline processes and investigate automation solutions. HS1 completed a technology discovery in 2023 but the identified automation solutions required significant investment without resulting in a material change in staff costs. Automation also poses additional risks and changes HS1's cyber security requirements. HS1 strives to obtain efficiencies for the system through effective management of our contracts. This includes the costs we manage on behalf of the train operators. This has been demonstrated over CP3 in our subcontract and pass through cost savings. HS1 previously allocated a share of HS1 staff costs to freight. The ORR concluded that these costs are better defined as common costs (which are apportioned across passenger operators). In the May 2024 5YAMS, the freight allocation of HS1 staff costs was £0.3m in total over the five years of CP4. This has now been removed from freight costs and included in HS1 staff costs. Our CP4 entry cost is aligned to the CP3 efficient budget, with a 0.96% increase to reflect the impact of the employer NICs change announced on 30 October 2024. HS1's organisational structure is very lean, with employees having wide responsibilities. Roles are benchmarked to ensure costs reflect market rates. Total staff costs for CP4 are forecast to be £2.0m higher than the CP3 efficient budget, partly because we have been unable to fully achieve the £2m efficiency target set for CP3, and partly due to the impact of including costs previously allocated to freight and the employer NICs changes. Headcount is forecast to be 2.4 above the CP3 budget but salaries had reduced by 2% before the employer NICs announcement. The reduction in technical support has been partly offset by permanent staff,

Cost category	Comments
	driving the increase in headcount. Medical insurance has increased by £0.3m (48%) since the CP3 budget, consistent with market increases. 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 employ additional resource to support new operators. Because of HS1's lean structure and efficient pricing of our staff costs (which the ORR confirmed), and that the ORR determined that an annual fixed cost wash up is implemented, HS1's budget has been increased so we have sufficient resource to design, implement and run the process as noted above.
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: • Consultancy support for PR29; and • Engineering and safety assurance to ensure we meet the obligations of the Concession Agreement. 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. Total CP4 consultancy costs are forecast to be £1.2m (17%) lower than the total CP3 efficient budget (and less than 60% of the CP3 outturn cost). The reduction in technical support has been partly offset by permanent staff, as we look to add value to the business by building up in-house knowledge. We have assumed no impact from the employer NICs change.
Office running	Our forecast for CP4 shows a £1.4m (17%) reduction compared with the CP3 efficient budget[22]. The costs included in this category are: • Rent and service charge (47% of total) • IT/telecoms (43% of total) • Other running costs (11% of total).

[22] This has changed since the Draft 5YAMS as rent has been aligned to the expected cash cost (rather than the accounting charge previously used).

Cost category	Comments
	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 £1.4m cost reduction in office rent in CP4 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. 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 £0.4m, driven by savings on senior recruitment.
Other: Railway	The main costs included in Other: Railway are: • £1.2m over five years for the rescue locomotive; and • £0.9m over five years for route-specific PR and marketing. The majority of this is for press, media and public affairs specialist support from our PR agency (this is separate to our retail event/press/media cost). Our forecast for CP4 is that costs will continue at the CP3 exit level, 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
REACT (energy projects)	0.05	0.04	0.04	0.04	0.04	0.22	+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
N-1	0.05	0.05	0.05	0.05	0.05	0.23	+0.2
Rates	10.9	10.9	10.9	10.9	10.9	54.3	-1.0
Total	**24.5**	**24.4**	**24.3**	**24.4**	**24.4**	**122.0**	**-1.6**

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 9.2.2). 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.
N-1	The N-1 scheme is discussed in Section 9.2.1. As noted in this section, annual costs of approximately £45k are incurred to implement the scheme. As set out in Section 18.8, we propose to recover these costs as pass through costs from CP4.

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. 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. 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). Based on the ORR FD, this does not include costs related to success fees for appeal of a business rates outcome. If operators want to take such action, these costs will need to be agreed with HS1 at the time.

12.4.3. Freight costs

Forecast freight-specific O&M costs for CP4 are shown in Table 43. The NRIL Ripple Lane line in this table is the total cost of the Ripple Lane exchange sidings. This is apportioned between trains accessing Ripple Lane from the HS1 network and from the NRIL domestic network.

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)	-	-	-	-	-	-	-0.70
NRIL Ripple Lane	0.16	0.16	0.16	0.16	0.16	0.78	-0.36
HS1 costs	-	-	-	-	-	-	-0.33
Total	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.78**	**-1.39**

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 reflect the directly incurred costs (OMRCA1) for 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. As the freight volume forecast for CP4 is zero, no costs are allocated to freight. We have calculated an indicative freight charge if services resume. The ORR concluded that the long term avoidable O&M cost (exclusive of mothballing costs) that was previously captured here was better defined as common costs (OMRCB, which is apportioned across passenger operators). This was based on HS1's zero freight scenario analysis that indicated HS1 will incur these costs as mothballing costs when there are no freight services and therefore they are not avoided (see Appendix A8). We have implemented this change.
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. 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. In the freight charging calculations (see Section 15.4.2), Ripple Lane costs are split between freight trains travelling to/from the HS1 network via Ripple Lane onto the NRIL network (HS1 freight, these costs are recovered under OMRC) and domestic 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. The CP4 forecast for freight accessing Ripple Lane to/from the HS1 network is zero, so all of these costs are allocated to domestic freight trains. We have calculated an indicative charge for HS1 freight for use of Ripple Lane if services resume.

HS1 previously allocated a share (1%) of HS1 staff costs forecast for the control period to freight. The ORR concluded that these costs are better defined as common costs (which are apportioned across passenger operators). This was based on HS1's zero freight scenario analysis that freight's

share of HS1 costs, which are fixed, will not be avoided when there are no freight services (Appendix A8). We have implemented this change.

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.

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	32.0	30.6	30.6	30.7	30.5

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 our supplier includes choices around risk, complexity and renewable energy. The purchasing strategy sets the parameters for our supplier 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. The price of REGOs in April 2024 was c.£8.50/MWh.

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.

Throughout the first year of CP4, we will review our energy procurement strategy and timelines to ensure our aim to achieve 100% net-zero carbon energy by 2030 by progressively introducing PPA volume remains feasible. Our interim target to deliver the majority of baseload electricity (up to 80%) through PPAs by April 2025 will not be met due to current market conditions, however we are closely monitoring the situation and continue to engage with our customers on this matter, noting also the private wire aspiration referred to above that may reduce the requirement for further PPAs beyond the current volumes. HS1 will find a suitable solution for the residual supply (not provided by renewable PPAs or private wire) 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 with SSE being awarded the contract. The contract duration is five years with options to extend up to ten years.

Electricity Risk Management services (ERMC) have been separately awarded to Utilyx Limited trading as Mitie Energy. 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.

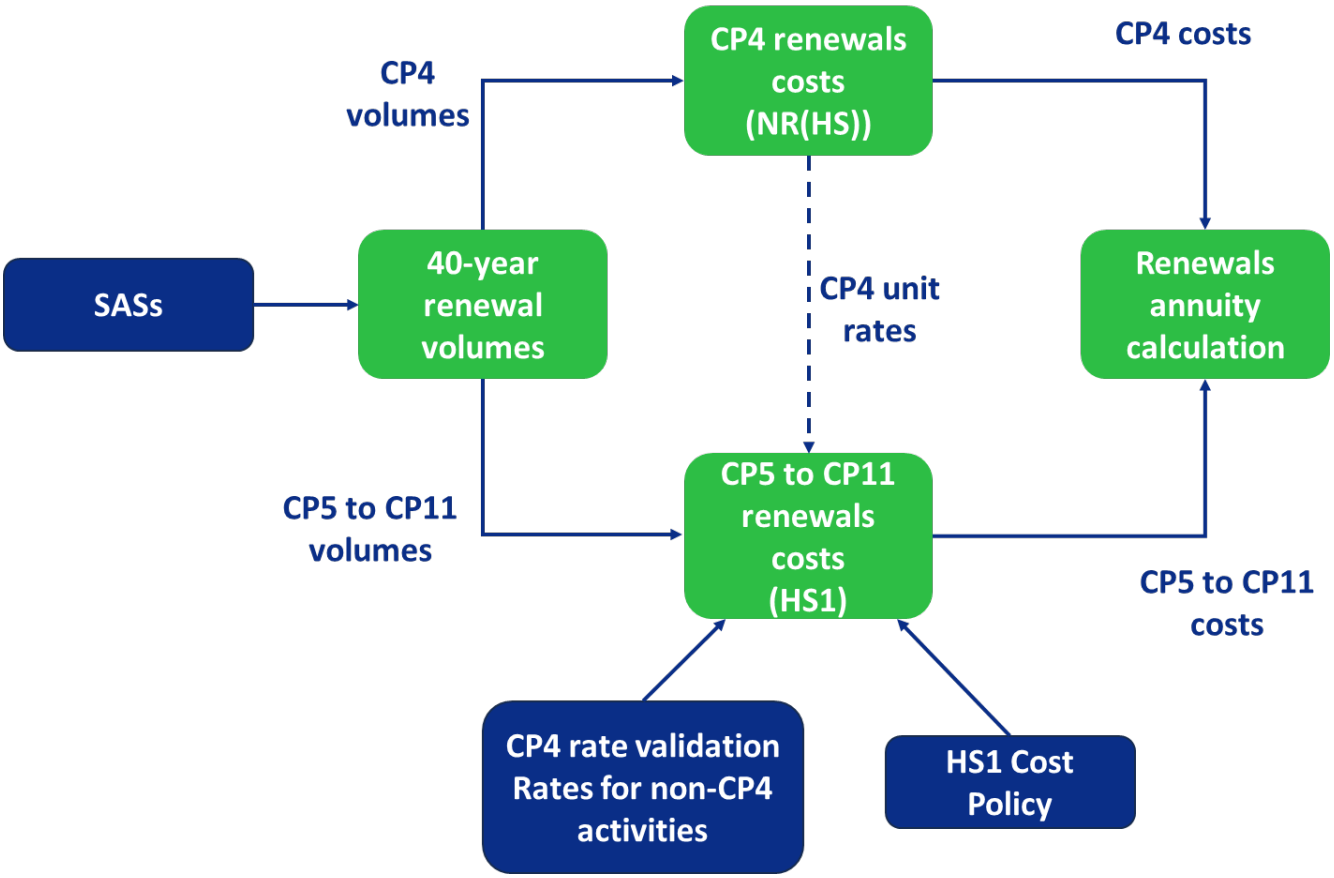
13 Route renewals

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

Figure 35: 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. 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 13.4 summarises work on the renewals capability development programme in CP3 and the outputs delivered to date, which have informed the development of our PR24 proposals.

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. The cost reductions determined by the ORR are also discussed.

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 (see Section 14.1). 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 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. 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. Following an increasing trend in S&C defects during 2023, RCM, training and planned maintenance activities have been improved. 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. GSM-R to be managed at lowest cost until ERTMS is introduced. Controls – renewal of RCCS, EMMIS, VCS and Dewatering due to obsolescence.	ERTMS planned for CP5. (Note that ERTMS is treated as a Specified Upgrade)

Civils	Civils assets are generally long life assets and are performing well. 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. 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. 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 initially 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.

We subsequently reviewed the remainder of the workbank, the majority of which was routine renewals such as component replacements.

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 £215.9m in May 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, Routine Renewals 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.

The NR(HS) R&R proposal does not include any cost adjustment to reflect changes to employer NICs in the 30 October 2024 Budget for either NR(HS) staff or subcontractor costs. Due to the diverse scale of renewal types and where they fall in the control period, the impact on CP4 renewals costs will be managed via the project change control process under the 'exceptional' category. We have not, therefore, adjusted the CP4 renewals cost.

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 outturn 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.

Routine Renewals[23]

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

[23] This initiative was referred to as Renewals to Maintenance (R2M) in the Draft 5YAMS. It has been renamed for clarity following feedback on the Draft 5YAMS consultation.

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 Routine Renewals with the indirect cost and risk application taking into account the proposed delivery method. Routine Renewals refers to renewals works that are well understood; a component replacement and/or a repetitive renewal that could form an annualised programme of work. The lower level of complexity means that there are benefits of managing the collective scope in an alternative way to the existing project governance process. For CP4, the work identified as Routine Renewals will remain in the renewals workbank and will be funded from the escrow account but we will trial a streamlined funding approval process as set out in Section 13.3.4.

NR(HS) proposed this initiative as a trial to understand the benefits of treating Routine Renewals slightly differently and, for the agreed reduced level of governance, has applied a cost reduction on both PMO and mark-up. Although the trial will be funded from escrow, NR(HS) has applied the same 8% mark-up to Routine Renewals that would apply if it was funded as part of the Annual Fixed Price and not the 10% mark-up applied to other renewals. Should Routine Renewals not be funded from the Annual Fixed Price in CP5 the mark-up would revert to 10%. The streamlined governance process and reduced markup delivers an efficiency of £2.1m over CP4.

NR(HS) will create a simple set of measures that can be used in our PR29 submission to show how the initiative is more cost effective than the current process and that the agreed work is being delivered in line with the PR24 5YAMS. The options for long term funding of Routine Renewals from CP5 onwards will be considered in our PR29 submission, together with an assessment of whether there are additional benefits of moving the payment for Routine Renewals into the Annual Fixed Price.

In its response to the Draft 5YAMS consultation, EIL welcomed the reductions in overheads and management fees associated with this initiative. EIL understood these works were being transferred to the O&M budget. To avoid ambiguity, we have renamed these works Routine Renewals (previously called 'Renewals to Maintenance') and clarified that they will remain in the renewals workbank and be funded from escrow in CP4.

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%**
Routine Renewals	25.4	7.8	1.5	2.8	37.5	5%
Capability and governance improvements	2.5	-	-	0.3	2.8	-
Total	**125.4**	**42.0**	**32.1**	**19.2**	**218.7**	**19%**

Given the significant cost and complexity of the ballast cleaning programme, and the fact that it is new for the HS1 system, HS1 requested NR(HS) to provide a separate strategy document including a first principles costed worked example. NR(HS)'s Summary of Ballast Unit Rate Development is included as a supporting document.

Ballast cleaning

The ballast cleaning programme, a strategic renewal to provide mid-life intervention and extend asset life, is the largest workbank package in CP4. The four year on-site delivery campaign spans both CP4 and CP5 (year 4 of CP4 to year 2 of CP5) with a three year planning window in years 1 to 3 of CP4. In total, the four year programme covers 83km of track, 45km in CP4 and 38km in CP5. Of the 45km 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. Since the Draft 5YAMS, the following engagement has been completed:

- RIA hosted a round table event to frame the problem; and
- Bi-lateral meetings with selected supply chain to discuss volumes, efficient packaging of work and conditions to establish best cost.

Following submission of the May 2024 5YAMS, we met with the ORR for a "deep dive" session to discuss the timing, cost and delivery of the ballast renewal programme.

The ORR DD concluded that the volume and type of ballast renewal is appropriate and is satisfied that the cost estimate reflects the likely cost to deliver this work efficiently. ORR supports the ongoing work by HS1 and NR(HS) to finalise plans for this renewal but was concerned that the project programme is likely to slip and recommended that we consider more realistic delivery profiles and set out the risks of delays in our 5YAMS.

To address this recommendation, we worked with NR(HS) to document how this risk has been considered through the PR24 process and how we are mitigating against it; this is included as an appendix to the Renewals Strategy (Appendix B Management of Ballast Programme Delivery Risk). While there are still challenges to be resolved, significant progress has already been made to begin readiness work, establishing a strong footing to address challenges early in CP4. The Renewals Strategy appendix sets out lead indicators of success covering access, procurement, engineering requirements, testing and delivery, and achievements to date for each of these. It also summarises key development and design outputs for years 1 to 3 of CP4. Following this further review, we continue to believe the ballast delivery profile set out in our May 2024 5YAMS is an appropriate and realistic profile.

We also considered the impact of a delay in the delivery of ballast renewals (using the ORR DD proposed profile) on the renewals escrow balance over CP4 and CP5. There is limited impact on the escrow balance as the funds for the works remain in the escrow and are available to use when the works take place.

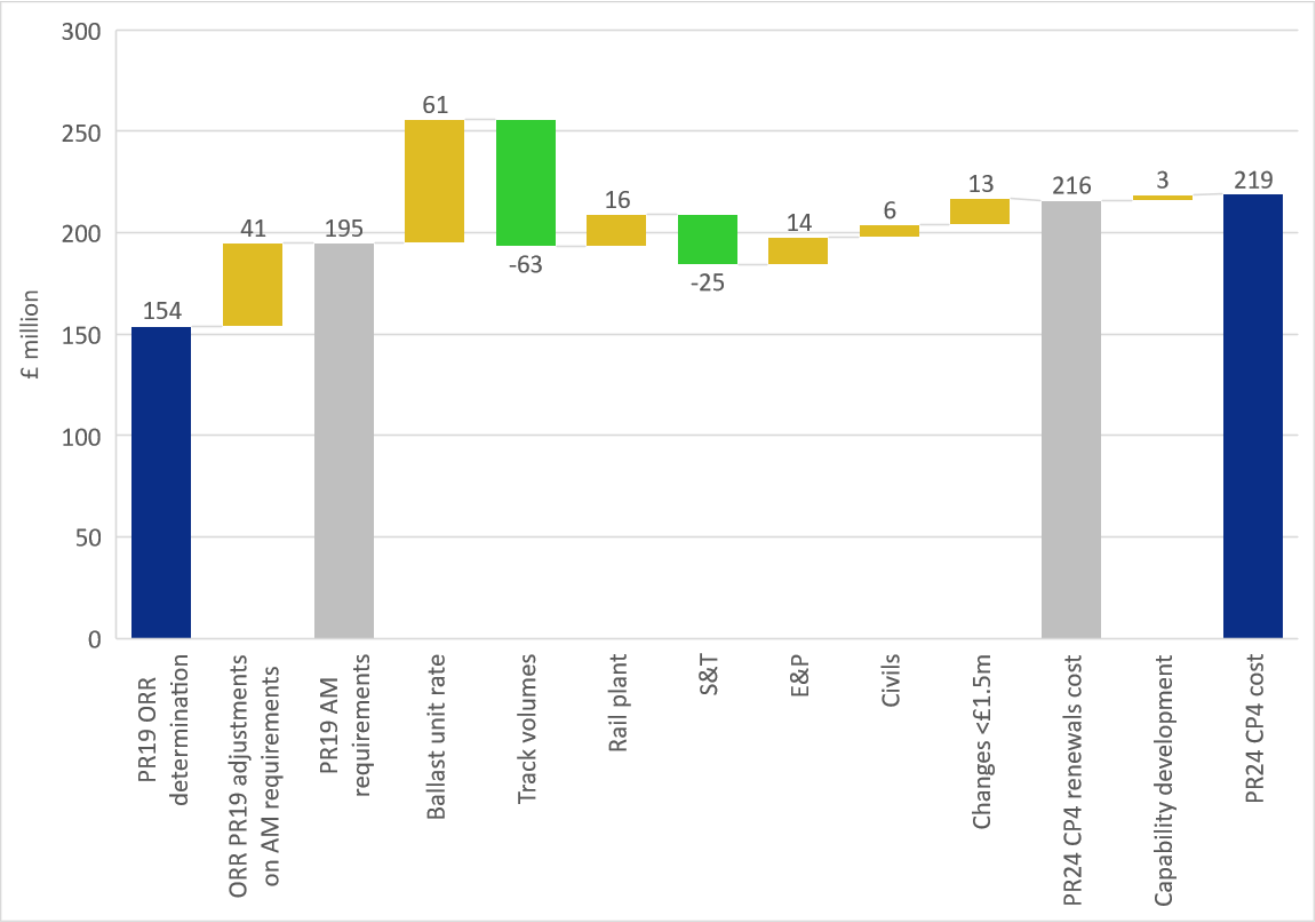
We commit to develop, socialise and implement a stakeholder engagement plan for the ballast campaign in year 1 of CP4, continue the development works and update system stakeholders of progress towards delivery in accordance with the plan.

Based on this, the ORR FD approved our plan for the ballast cleaning programme.

Comparison with the PR19 estimate of CP4 renewals costs

Figure 36 compares our forecast of CP4 renewals with the PR19 estimates for CP4 renewals (inflated to February 2023 prices).

Figure 36: CP4 renewals comparison PR19 to PR24 (£million, February 2023 prices)

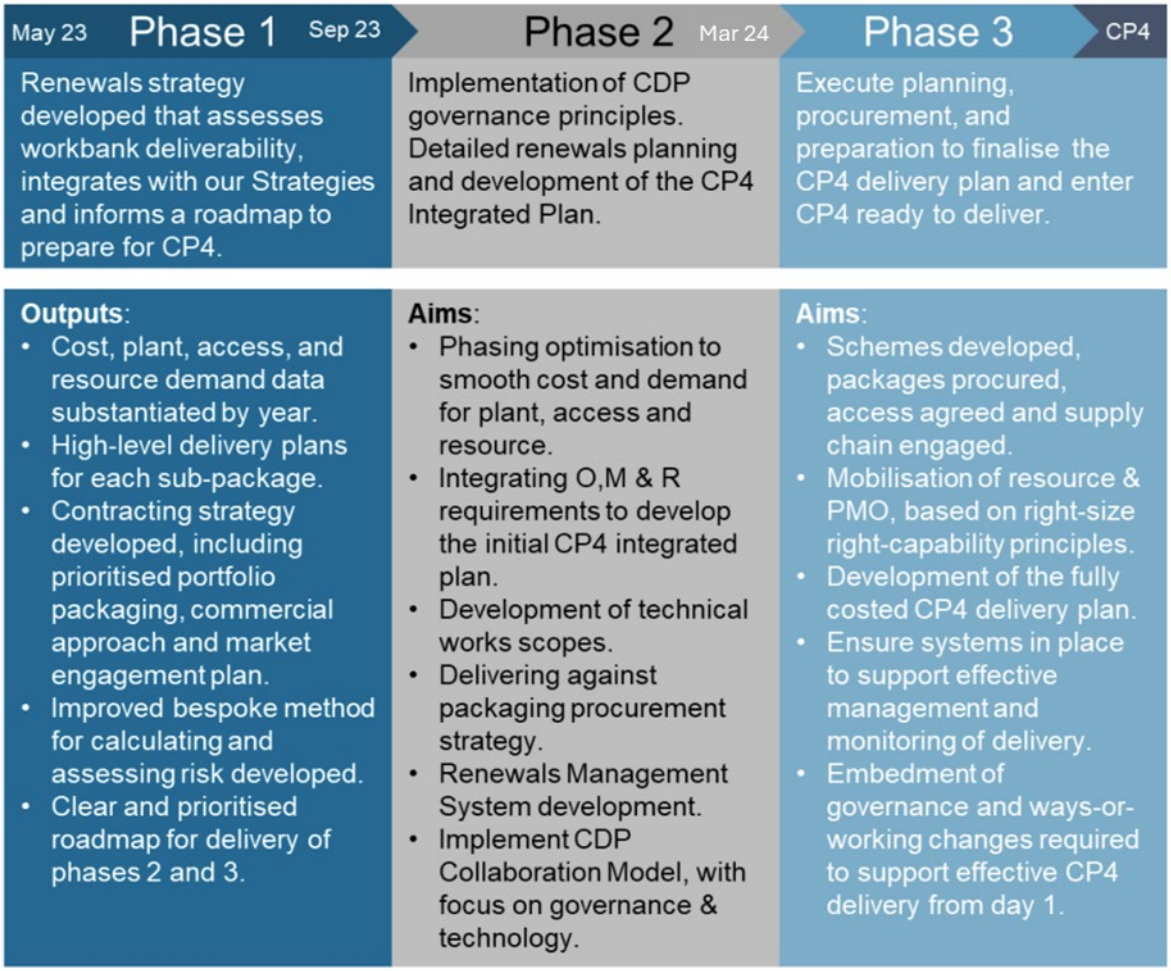


13.3.3. CP4 project delivery

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 37. 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 37: 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) received funding to develop 14 renewals that are planned to be delivered in years 1 and 2 of CP4. The scope of development activities includes programme, access, technical work scopes, procurement route, ground investigation and design requirements, delivery methodology and site constraints as well as early contractor involvement and site surveys. This will allow the projects to reach Gate 2-3 maturity ahead of CP4 and enable strong delivery of a number of complex projects in years 1 and 2 of CP4.

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 planned for roll out prior to the start of CP4. Changes to the project governance and controls have been agreed with the ORR, DfT and the operators. This is a move to a portfolio-level governance approach, whereby HS1 manage

project variances within the overall portfolio budget, reporting quarterly to regulators on changes or seeking approval where required as detailed in the agreed change categories.

Within the NR(HS) Route 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.

Routine Renewals governance proposal

Our proposals for more streamlined governance for Routine Renewals are as follows:

- The Routine Renewals works for the five years of CP4 are defined in the renewals workbank and will be agreed with the ORR.
- In January of each year, NR(HS) will provide a Routine Renewals proposal that lists the Routine Renewals to be undertaken in the year and the associated cash flow each month/quarter. HS1 will review this and, provided it is in line with the Routine Renewals works approved by the ORR, will give NR(HS) approval to proceed.
- The Routine Renewals proposal will also be appended to, and discussed in, the AMAS together with information on the Routine Renewals completed in the previous year.
- At the end of every quarter, NR(HS) will provide a request for payment to HS1 based on the approved cash flow projection and confirming the work done.
- In the case of a significant variation from the yearly Routine Renewals proposal, NR(HS) will provide a change request reflecting the cash spent and scope delivered for that quarter and the revised scope and cash flows for the rest of the year.
- Updates on Routine Renewals progress against plan will be included in the quarterly renewals updates provided to the ORR and the TOCs.
- At the end of each year, the Routine Renewals proposal will confirm the work and cost of work undertaken in the previous year, the Routine Renewals proposal for the next year and the overall anticipated final cost of the CP4 Routine Renewals portfolio. It is initially proposed that the volume of work done will be evidenced through information in EAMS and engineering verification reports and this information will be included or referenced in the Routine Renewals proposal. NR(HS) will ensure that there is clear and auditable evidence that the work has been done.
- The ongoing governance of the overall CP4 renewals budget and the way it is allocated across all the renewals portfolios (Routine Renewals, Civils, Track, E&P, S&T) will be managed using the existing project change control process.

13.4 Renewals capability development programme

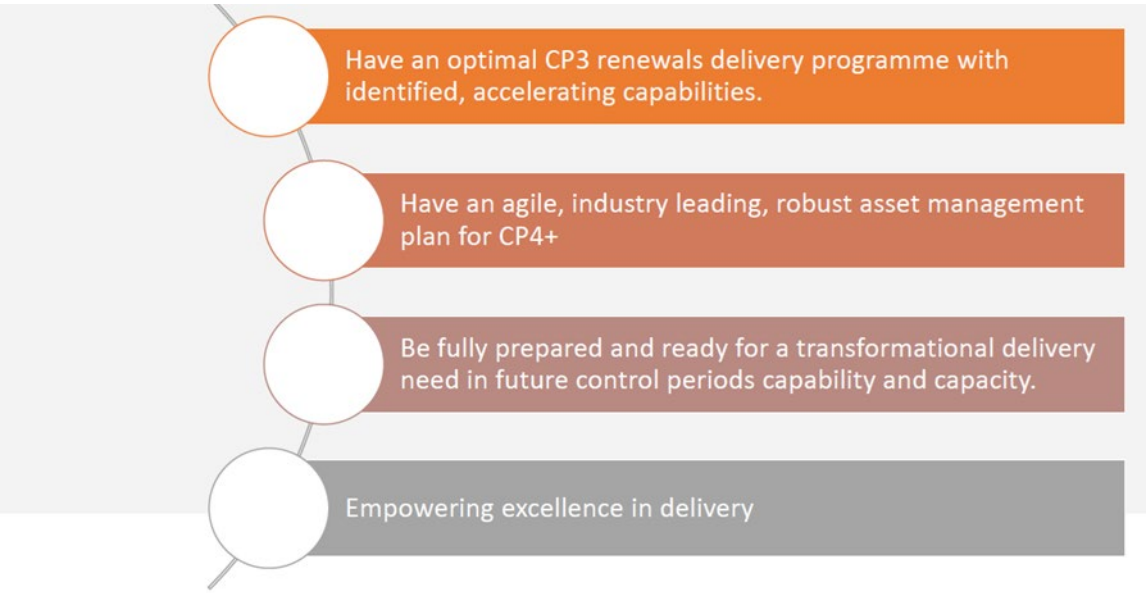
In 2018, to inform the PR19 submission, HS1 appointed Bechtel to undertake a deliverability study, develop a renewals plan and build understanding of:

- 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 38 shows the vision of the programme.

Figure 38: Renewals capability development programme vision



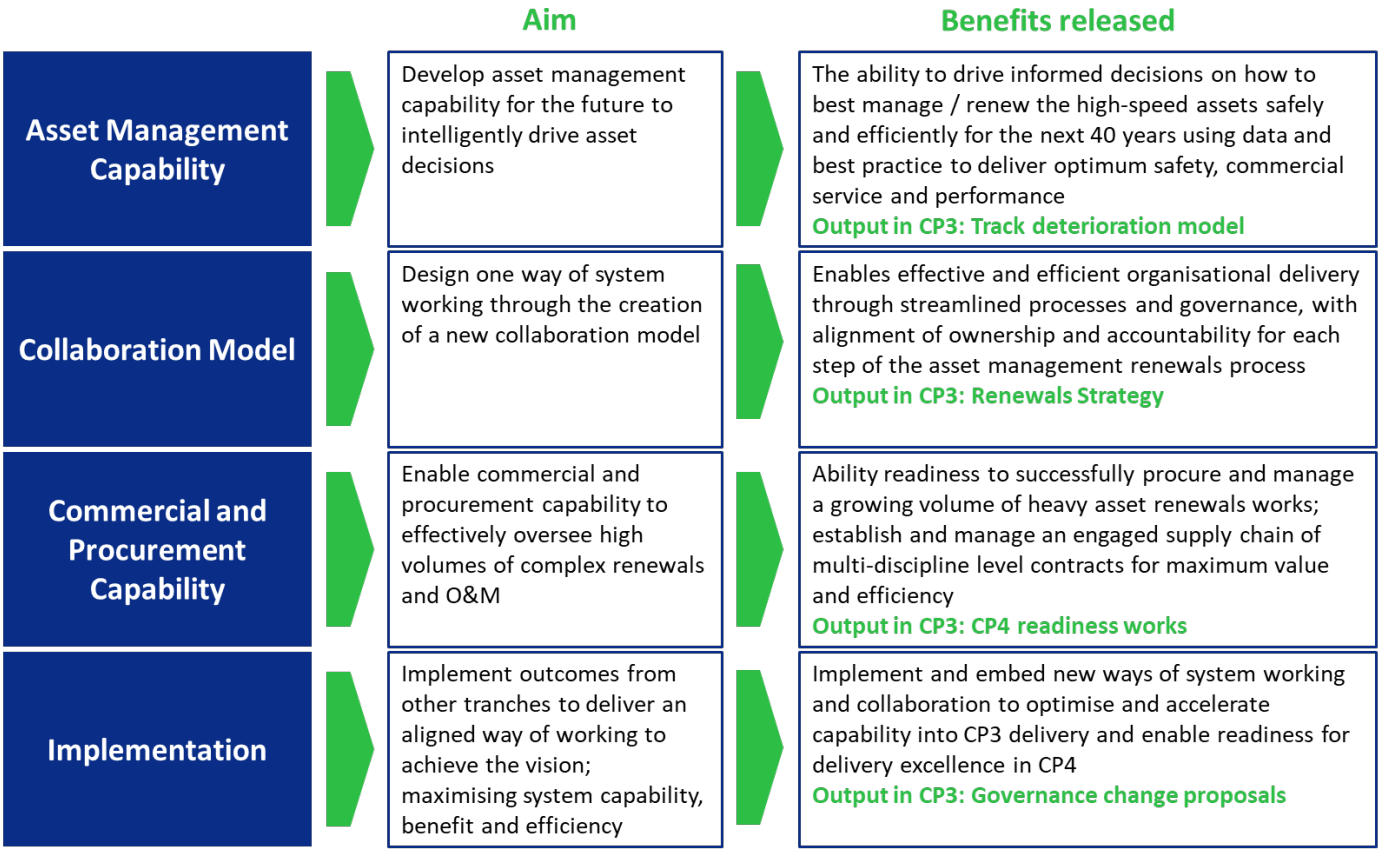
The objective was to develop a plan for capability change in the HS1 system to support the transformation from a railway being operated and maintained, to one that also requires a

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 39 sets out the aims and benefits of the capability development programme and the outputs delivered to date.

Figure 39: Renewals capability development programme outputs



The capability programme, with input from HS1, contributed to the development of NR(HS)'s Renewals Strategy (see Section 13.3.3) 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 5YAMS. The ORR and the operators support the application of the Cost Policy.

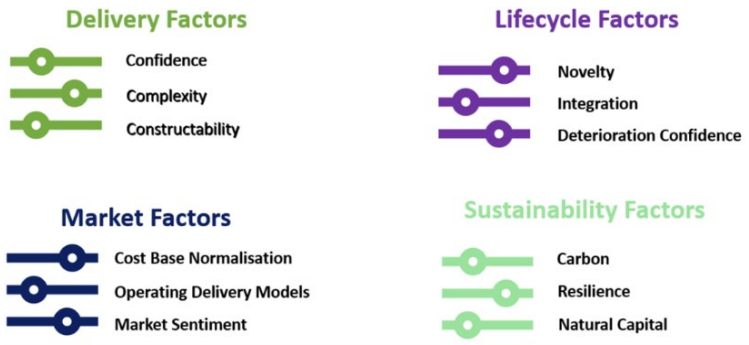
The policy builds on a base cost estimate, derived by applying unit cost rates to the 40-year renewals volumes, and calculates a probabilistic anticipated final cost range which considers long-term future uncertainty scenarios that could impact the base cost estimate over time.

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.

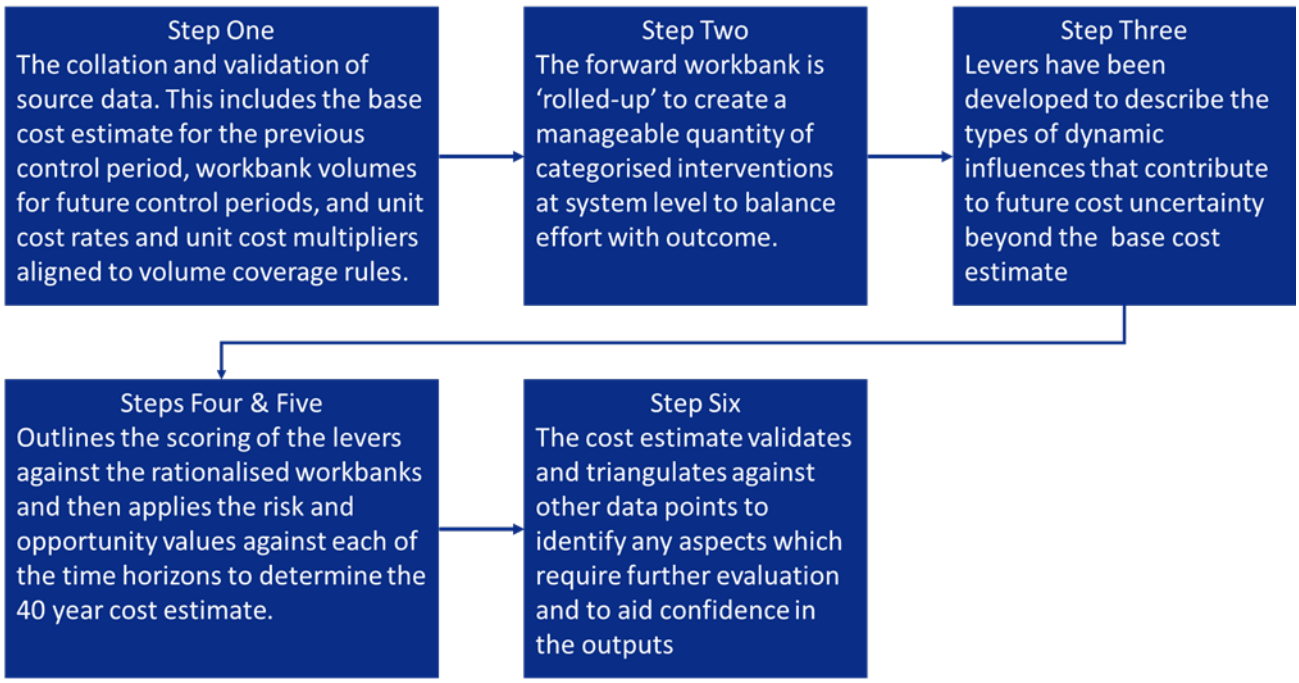


- Sustainability Factors: wider environmental and social factors.

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 40 .

Figure 40: Cost Policy methodology



13.5.2. CP5 to CP11 cost estimates

HS1's approach

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.

The ORR FD referred to HS1's portfolio of delivered renewals as low and routine, which is expected considering the age of the asset. This has resulted in little actual HS1 cost data being available for renewals costs within the 40 year workbank. The ORR stated that HS1's approach to estimating the base costs is logical and reasonable, in the absence of better data. However, its analysis indicated that, as the base rates are not HS1-specific, this was overstating the estimated costs. The ORR FD concluded that there should be a 4% reduction in long term renewals costs (CP5 to CP11) across all asset types for route and stations. It applied this as an efficiency overlay after the application of the Cost Policy as discussed later in this section. The ORR expects HS1 to gather better quality, HS1-specific cost data by the end of CP4.

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 10%	P50 -8%	P50 -19%	Assumed by H2 & H3 significant efficiency opportunities are realised (new technology for life extension, rule book harmonisation and methodology).
Track	P80 2%	P50 -8%	P50 -24%	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 2%	P50 1%	Stretch Range- Min -32%	Drainage renewal is pessimistically profiled. Proactive monitoring and jetting strategy to be in place. Earthworks and bridge component renewals in H2 & H3 - some off network therefore lower operations risk profile. H3 assumes a step change in the possessions and isolations opportunities coupled with modular replacement.
E&P	P50 6%	P50 6%	Stretch Range- Min -23%	Workbank volumes across the 35 years become more repetitive after H2 and methodology understood. The workbank consists of large volumes of component replacements, within H3 it is assumed technology consolidates.
S&CS	P50 2%	P50 17%	Stretch Range- Min N/A	H2 have new volumes, not previously delivered so risk of uncertainty in complexity. 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 5YAMS) documents the scoring approach process, the decisions made and the scores. The report includes an addendum which explains in further detail the rationale for the P values selected. On the advice of PA Consulting and Mott MacDonald, we updated the modelling methodology between the Draft and Final 5YAMS; this change is explained in the addendum and increased total route renewals costs by £7m (0.4%).

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. We have made a CP4 commitment to further develop the Cost Policies for route and stations, evolving them into integrated cost models, linking volumes and HS1 outturn renewal costs, considering risk application/methodology improvements.

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.

ORR determined cost efficiencies

The ORR was supportive of HS1's approach to estimating long term renewals costs, including the application of the Cost Policy. However, the ORR determined efficiency opportunities for CP5-CP11 renewals costs in two areas:

- A 9% reduction in the renewals costs of Signalling and Civils assets based on efficiencies from the acceleration of asset management maturity in these asset classes (see Section 10.8); and
- A 4% reduction in costs across all assets from improvements in estimating base cost data for long term renewals (as outlined above in this section).

These efficiencies are applied to CP5-CP11 renewals costs *following* the application of the Cost Policy, in line with the ORR FD. Because of this approach, the Cost Levers Scoring Report will not be updated, but will be used during CP4, within the cost model.

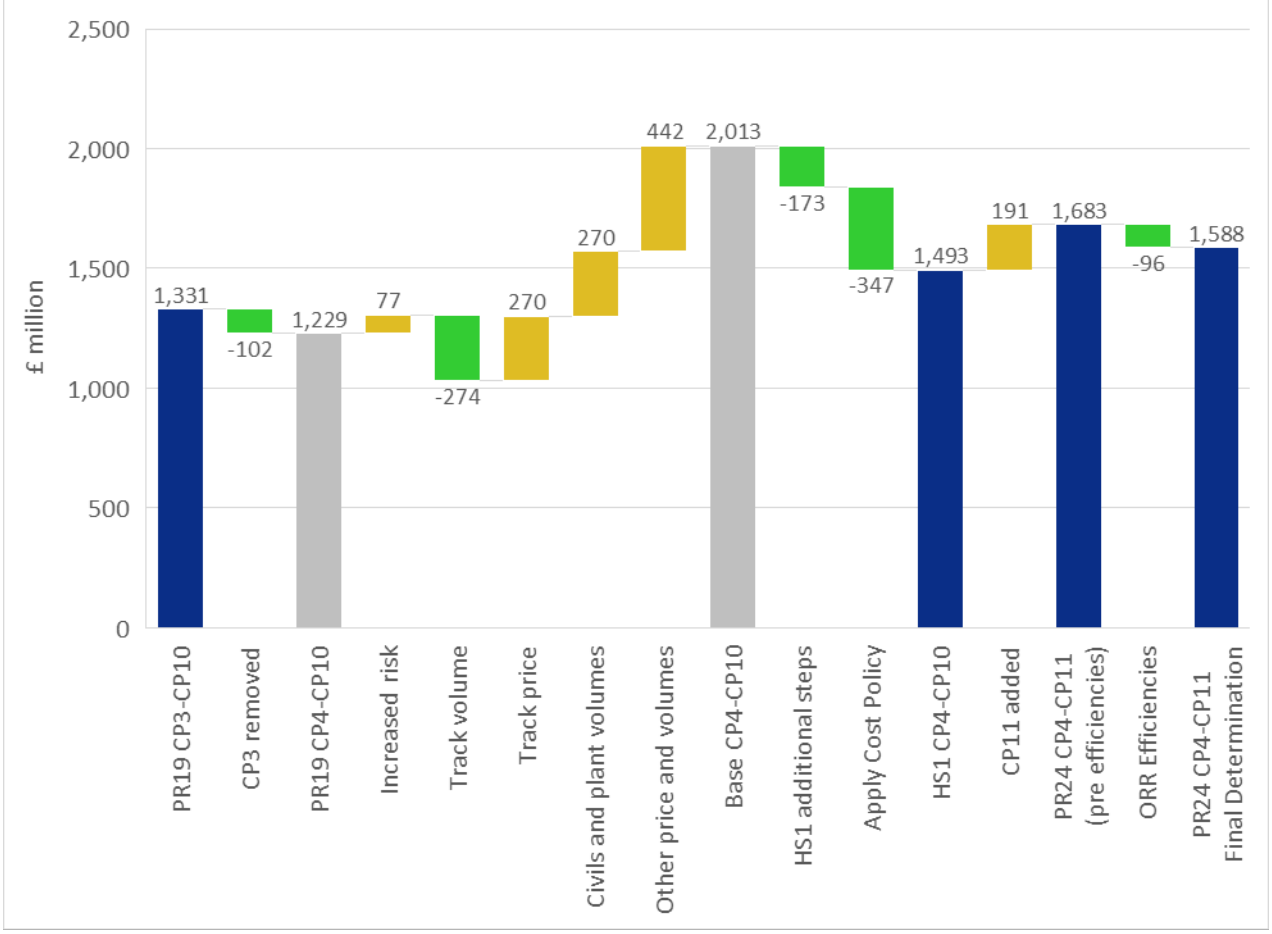
Comparison with PR19

Changes from the PR19 estimate of the 35-year renewals costs are set out in Figure 41. 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 £520m reduction in the renewals costs for CP4 to CP10;
- The above changes resulted in a total renewals cost of £1.493bn for the comparable years (CP4 to CP10), a 22% 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 £1.683bn.
- The ORR FD efficiency opportunities, which reduced costs by £96m to give the efficient cost of the 40-year workbank as £1.588bn.

Figure 41: 40-year renewals comparison PR19 to PR24 (£million, February 2023 prices)



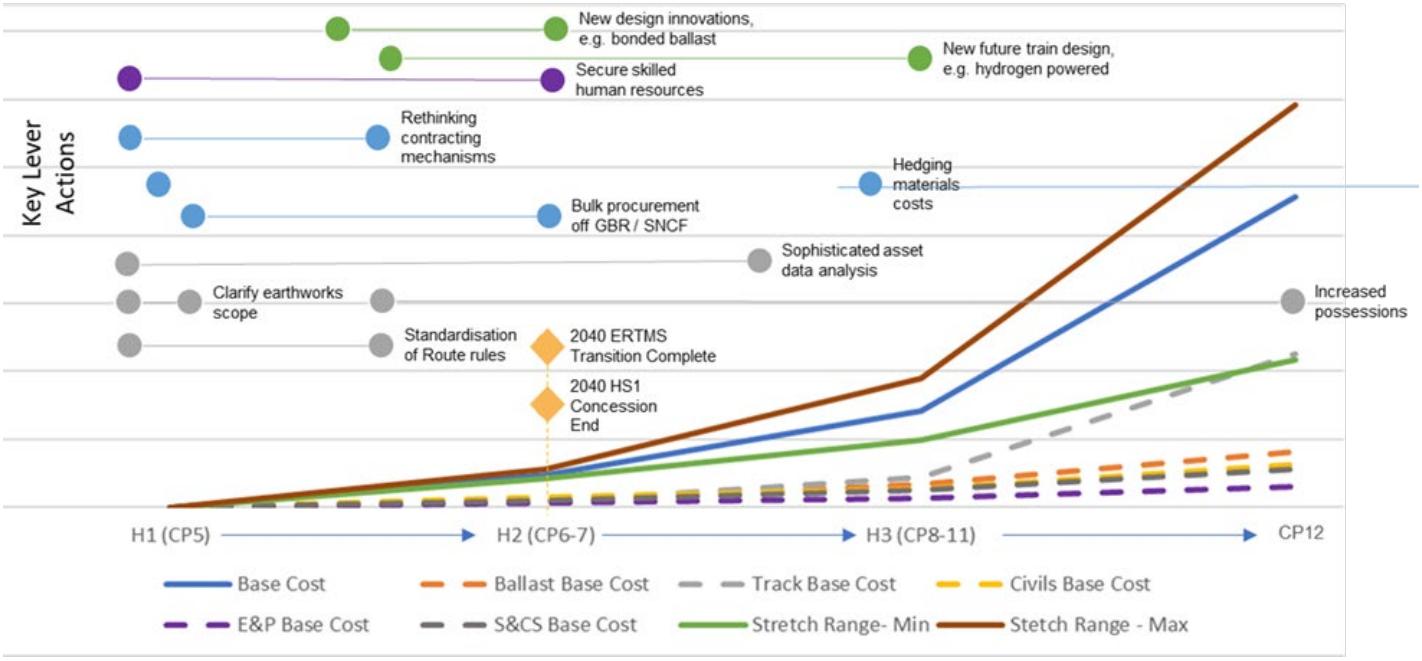
13.5.3. 40-year renewal efficiency realisation

Figure 42 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 42: 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 with no negative balances during this period.

We consider this approach to the annuity calculation may be an expensive way to avoid cost fluctuations for users 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[24] 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, for the Draft 5YAMS in February 2024 and the Final 5YAMS in May 2024, HS1 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 incorporated 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).[25]

We made the following adjustments to our annuity calculations for the November 2024 5YAMS in line with the ORR's DD position and which were approved in the FD:

- We have removed the underfunding factor from the route annuity. The ORR considered that the underfunding adjustments determined for CP2 and CP3, together with the beneficial movements to the escrow in CP3, have addressed its previous concerns about historic underfunding of the escrow balance.
- We have allowed small negative balances in later years in the annuity modelling. The ORR concluded that the annuity modelling should allow this because of the uncertainty in renewals profile in later years, which is expected to be smoothed as plans develop and

[24] Periodic Review of HS1 Ltd 2024 (PR24) - Approach and process paragraph 2.18 and 2.41
[25] HS1 5YAMS February 2020, see Sections 12.6.1 and 12.6.2 for details on the underfunding uplift in the annuity.

improved asset management planning should allow for a more efficient profile of renewals expenditure. It also noted that there will be further changes to amend the annuity at future periodic review if necessary.

We raised concerns about the risk of future escrow underfunding and higher charges to the detriment of operators, particularly if the changes outlined above were to be applied alongside the ORR's long term renewals cost efficiencies.

The ORR must be very careful about setting a precedent that in future periodic reviews negative balances are allowed closer to the immediate control period, increasing the risk of underfunding renewals in the short term. This could require HS1 to finance these works. HS1 does not necessarily have the ability to raise incremental funds to finance renewal work, as this was never the intention on concession. Should a circumstance require HS1 to finance these works, if it is possible to raise funds, this is likely to be costly and result in increases in future charges to recover this to the detriment of the operators. We asked that the ORR confirm in its FD that the adjustment to allow small negative balances is only supported if:

- A sensitivity analysis of the impact on escrow underfunding is undertaken and indicates the risk is appropriately balanced between short term affordability and future escrow underfunding; and
- It is strictly not allowed for the modelling to have negative balances in the two control periods immediately following the periodic review to mitigate the risk of costly renewals financing.

The ORR FD acknowledged our concerns and agreed that there should not be negative balances in the first two control periods of the 40-year forecast. The ORR noted in its December 2024 consultation the potential that as a result of the ORR's determined renewals cost reduction in PR24 that operators' charges may need to rise in PR29. However, the ORR is satisfied that any risk to future charges and renewals funding can be appropriately managed through future periodic reviews.

We have incorporated the small negative balances into annuity modelling along with:

- 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 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 (see Section 15.2.2). In their responses to the Draft 5YAMS consultation, the passenger operators were supportive of this approach.

- 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 £28.1 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, with the overlay of the ORR FD renewals cost efficiencies. We believe it is important that the approach to the renewals annuity 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. For our proposals set out in the November 2024 5YAMS (prior to the ORR's determined efficiencies being applied) we did not believe that an additional risk premium for potential future price shocks is appropriate to include at this time, such as an adjustment to our inflation assumption (e.g. CPI+X); we set out our reasons for this Section 7.2.1.

Figure 43 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 43: Renewals costs, annuity payments and escrow balance (£m, nominal terms)

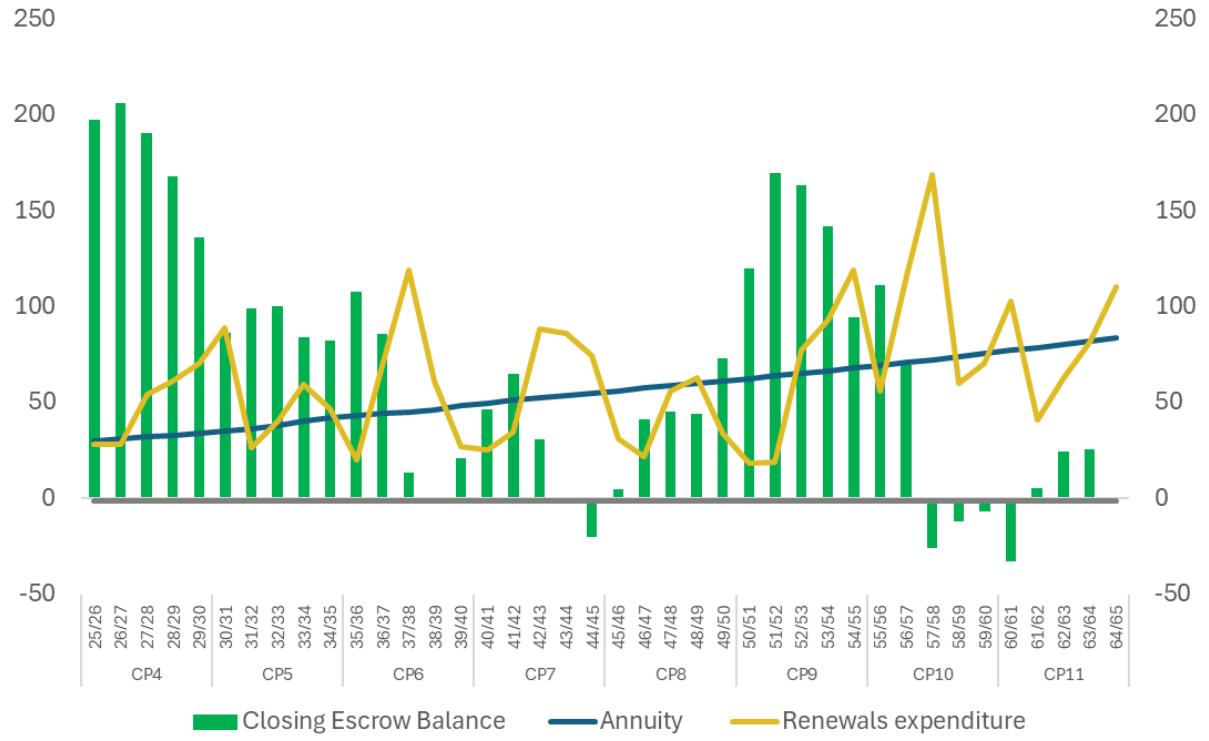
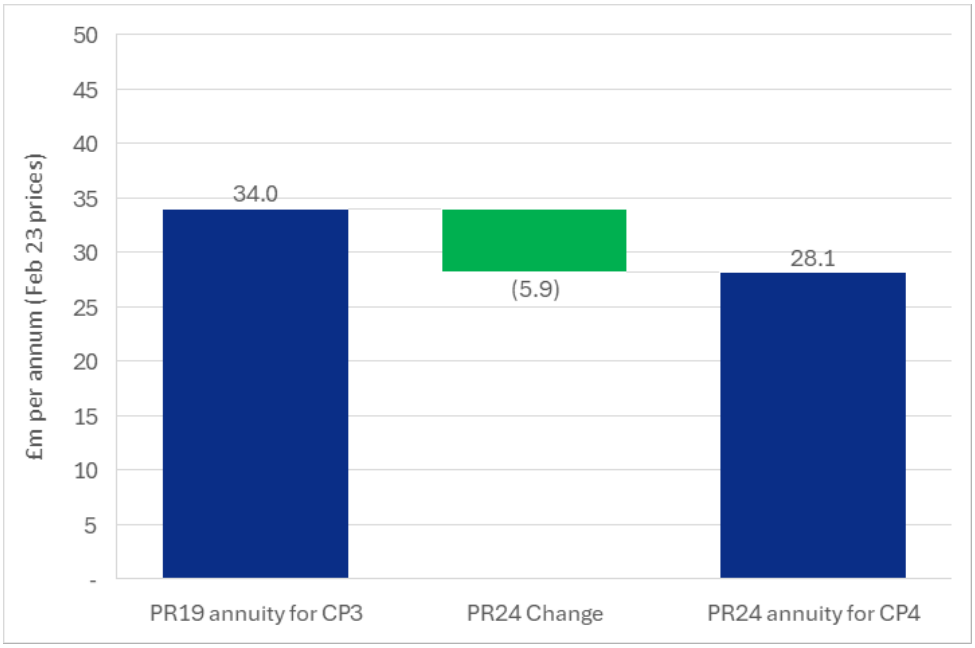


Figure 44 shows the change in the CP4 renewals annuity from the CP3 annuity determined in PR19.

Figure 44: Change in annuity charge CP3 to CP4 (£m, February 2023 prices)



14 Route upgrades

14.1 Specified Upgrades

The implementation of ERTMS 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 2024/25 – known as ERTMS Early Works – will provide the 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 Pass through costs 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 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 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 cost of capital assumptions agreed with ORR.

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 other fixed 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 18.3). 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 principal 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 used routinely 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 to December 2024 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 amendments

For the November 2024 5YAMS, we amended the HS1 Route Charging Model to allocate OMRCA1 costs across operators using forecast volumes for SETL, not the domestic underpin volume (the allocation of other elements of OMRC is unchanged). This is consistent with how this element is billed.

We also amended the charging model to reallocate certain freight-specific fixed costs which the ORR DD concluded were better defined as common costs as explained in Section 12.4.3.

As explained in Section 13.6.2, we amended the annuity modelling in the charging model to:

- Remove the CP1 and CP2 escrow underfunding uplift; and
- Allow small negative escrow balances in the later years of the 40-year window.

The ORR FD approved the HS1 Route Charging Model with these changes.

15.2.4. 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).

Since PR19, HS1 has updated the train-km length for International (all services) used in the Route Charging Model to allocate certain charges between operators in Stage 3. This was following a full analysis of the HS1 route which found that this length needed to be amended to

be consistent with the confirmed distance. Following stakeholder feedback provided during the Draft 5YAMS consultation, we reviewed the intermediate train-km lengths used for domestic services between St Pancras and Ashford International, Ebbsfleet International and Springhead Junction. These existing track lengths were set in the CP1 Charging Model and handed to HS1, along with other contractual documents, as part of the concession sale process. It is not clear from these documents what the basis was for generating these lengths set in the original Charging Model but we expect that this went through sufficient review and scrutiny at the time.

Based on HS1's research we believe the existing parameters remain consistent with the information and specification provided to us. We informed stakeholders in August 2024 that we would therefore retain the existing parameters for the intermediate train-km lengths in the PR24 route charging model. The ORR FD approved the HS1 Route Charing Model with these train-km lengths.

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 Class 374	Class 395
Charge per train per train-km		
OMRCA1	£5.86	£2.36
Charge per train per minute		
OMRCA2	£12.11	£2.63
OMRCB	£35.10	£37.73
OMRCC	£13.85	£13.85

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	109.948*	£2,536.8
Domestic			
Ashford – St Pancras (and vice versa)	31.0	91.500	£1,896.3
Springhead Jn – St Pancras (and vice versa)	16.5	39.500	£987.6
Ebbsfleet – St Pancras	14.0	39.500	£852.1
St Pancras – Ebbsfleet	15.0	39.500	£906.3

* This has been amended from 111.3km in PR19 to be consistent with the HS1 Sectional Appendix.

This represents a reduction for passenger operators of c. 15% to 20% relative to current charges, which account for the VRO reapportionment of fixed costs during CP3 (see Table 53). Relative to PR19 determined charges, there is a small decrease (2 to 3%). 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)

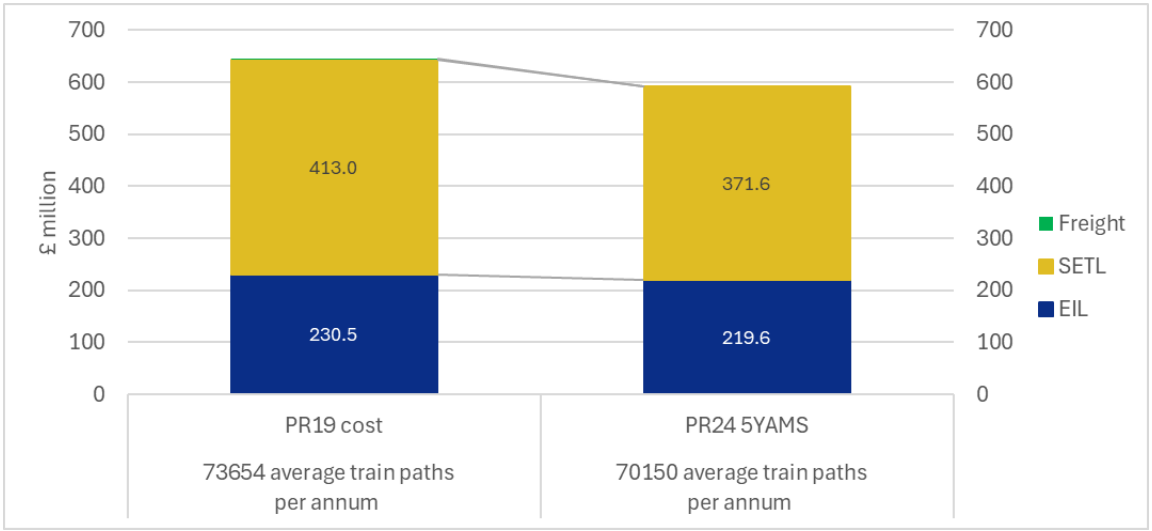
Service Group	PR24	Current*	% change	PR19	% change
International (all services)	£2,537	£3,168	(19.9%)	£2,605	(2.6%)
Domestic					
Ashford – St Pancras (and vice versa)	£1,896	£2,234	(15.1%)	£1,935	(2.0%)
Springhead Jn – St Pancras (and vice versa)	£988	£1,170	(15.6%)	£1,011	(2.3%)
St Pancras – Ebbsfleet (Up)	£852	£1,005	(15.2%)	£870	(2.1%)
St Pancras – Ebbsfleet (Down)	£906	£1,071	(15.4%)	£927	(2.2%)

* 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, (ii) the ORR's FD conclusion to apply an efficiency opportunity to the NR(HS) Annual Fixed Price and (iii) 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. However, we have applied structured and transparent engineering judgement and sensible economic assumptions that result in a renewals annuity that is lower than PR19. We also removed the route annuity uplift for underfunding of the escrow account in CP1 and CP2 and allowed small negative balances in later years in the annuity modelling. 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 ORR FD conclusion that efficiency opportunities should be applied to longer term renewals costs also supports the reduction in annuity costs.
- 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 (8.4%) as shown in Figure 45.

Figure 45: Change in OMRC cost stack PR19 to PR24 (February 2023 prices)



To consider overall affordability, we set out the combined route OMRC and stations Qx and LTC costs for passenger operators in Appendix A7.

15.4 Charges for freight operators

As set out in Section 7.1.3, the most realistic forecast is for zero freight volumes on the HS1 route in CP4. To set an indicative charge for freight in the event it can resume services on HS1, we have created a shadow charging model with a freight volume of 200 trains per year (based on the most recent positive volume forecast from freight).

Freight costs comprise:

- Freight variable costs (OMRCA1); and
- Freight long term avoidable costs (OMRCA2) capture the Ripple Lane charge for HS1 freight. The ORR concluded that certain other freight-specific fixed costs were better defined as common costs and we have implemented this change (see Section 12.4.3).

The Ripple Lane exchange sidings is accessed by HS1 freight trains travelling from the HS1 network to the NRIL network (and vice versa) as well as domestic 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 A6.

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 (based on the shadow model).

Table 54: CP4 OMRC freight charges (February 2023 prices)

	Charge per train-km	Charge per train (Dollands Moor to Ripple Lane)
OMRCA1 (variable)	£6.95	£613.4
OMRCA2 (avoidable)	£0.80	£70.7
Total OMRC	£7.76	£684.1

Compared with the PR19 determined costs and charges, we are delivering a significant reduction (65%) in the total OMRC costs for freight in value terms. This includes the reallocation of certain freight-specific fixed costs to common costs, which are funded by passenger operators. As a result, there is a decrease in the OMRC per train charge for the operator as shown in Table 55, despite the reduction in freight volumes forecast to operate in CP4. The OMRC per train is 52% lower than current charges, which were adjusted in April 2024 for the freight volume reopener.

Table 55: Changes in freight costs and charges (February 2023 prices)

	PR24	Current*	% change	PR19	% change
Total OMRC to be recovered (5 years)	£0.68m	£1.97m	(65%)	£1.97m	(65%)
OMRC per train	£684	£1,424	(52%)	£981	(30%)
Train volume forecast (per annum)	200	200	0	454	(56%)

* These are the FY2024/25 VRO charges issued in April 2024.

The freight charge for CP4 reflects only the OMRCA1 for freight (as Ripple Lane costs have been fully allocated to domestic freight for CP4, see Section 15.4.2). If freight services resume, HS1 will recover OMRCA1 in addition to the OMRCA1 recovered from the passenger services as there is no volume reopener for OMRCA1 charges in the HS1 contractual framework. As OMRCA1 reflects the wear and tear cost of trains running on the network, it is reasonable for HS1 to recover these costs (noting that HS1 retains the O&M portion of OMRCA1 to cover O&M costs incurred, while the larger renewals portion is deposited into the escrow). If freight services resume, HS1 will notify all stakeholders in the system with the expected volumes and impact on OMRCA1 recovery. For Ripple Lane charges, if HS1 freight resumes HS1 will engage domestic freight operators on a reapportionment of this charge to support fair cost allocation and recovery.

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 (once adjusted for mothballing costs). These costs are apportioned based on share of total volumes between:

- 'HS1 freight' that accesses Ripple Lane to/from the HS1 network; and
- 'Domestic freight' that uses the sidings to access only the NRIL network.

The forecast volumes reflect the outlook that no freight volumes will access the sidings to/from the HS1 network, but there will be a higher volume of domestic freight than forecast in the May 2024 5YAMS.

Table 56: Ripple Lane costs for CP4 (February 2023 prices)

	Total cost	HS1 freight	Domestic freight
Total cost (over control period)	£779k	n/a	£779k
Train volumes forecast (over control period)	10,010	0	10,010
Proportion of total cost	n/a	0%	100%

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 increase compared to PR19 due to the lower volumes forecast.

Table 57: Changes in Ripple Lane (Domestic Sidings) charges (February 2023 prices)

	PR24	PR19	% change
Total cost (over control period)	£779k	£980k	(21%)
Train volumes forecast (over control period)	10,010	13,725	(27%)
Per train charge	£77.82	£71.42	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 21% 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 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 £1,050 per train for EIL and £329 per train for SETL.

16 Stations CP4 plans

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) developed the CP4 and 40-year renewals cost estimates, including direct and indirect costs, and how HS1 applied the Cost Policy to longer term renewals pricing. The HS1 stations benchmarking study commissioned from Rebel is also covered in this section. This was a qualitative assessment of HS1's asset management approach and planning assumptions compared with domestic and international organisations with comparable asset portfolios. The cost reductions in long term renewals determined by the ORR are also discussed.

Section 16.2 sets out the CP4 renewals works. Renewals expenditure will be lower than PR19 forecasts at all stations, except Ashford International. This is driven by the efficiencies achieved in Station Communication System Renewal (SCSR) works.

Section 16.3 sets out the 40-year renewals profile where increases in the costs of MEP and Civils renewals results in a small increase in total expenditure relative to PR19 forecasts for comparable periods (not taking into account the ORR FD efficiency overlays).

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 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 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 CP3 Data and Communications renewal also resulted in a significant decrease in the number of future renewals that will be required.

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 Supplies.
- 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), subcontract 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. We considered whether there have been any significant changes in the external environment that would mean that this approach is not valid; we believe that there has been very little change.

- 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 of indirect costs that were agreed in CP3 have been used in CP4 and the 40-year renewals. In CP4, 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 this was assured by HS1. These were applied across the 40-year period, with the exception of risk cost. NR(HS)'s risk percentage is applied in CP4, while for CP5-CP11, we have applied the risk percentage based on the Station Cost Policy approach, described in greater detail below. HS1 followed a similar approach for Ashford.

The NR(HS) mark up of 10% on the base cost has then been applied across the 40-years.

The indirect cost percentages for the main categories are summarised in Table 58, along with the 10% mark up, for the three stations managed by NR(HS). The exact indirect cost percentages that have been applied to each type of renewal are shown in the totex models; these contain the risk cost percentage before the Cost Policy is applied.

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.

Table 58: Proposed CP4 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%**

There are no heritage related on-costs applied at any of the stations. Where a specific project at St Pancras is likely to be affected by English Heritage requirements (e.g. renewals of original wall finishes), this has been reflected in the base cost.

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 risk cost, which is 10% for CP4. Due to the small volume of work, we have assumed that the contracting approach will be for contractor-managed turnkey type projects where the contractor will take on most aspects of the 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 CP4 indirect costs and mark up for Ashford station

	Civils	D&C	LETs	MEP
Design	5%	5%	5%	5%
Risk	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 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.

The ORR FD conclusion on base cost data applied to stations as well as route (see Section 13.5.2). For the same reasons, the ORR FD concluded that there should be a 4% reduction in long term renewals costs (CP5 to CP11) across all station asset types. It applied this as an efficiency overlay after the application of the Cost Policy as discussed later in this section. The ORR expects HS1 to gather better quality, HS1-specific cost data by the end of CP4.

Application of Cost Policy to station renewals

For PR24, HS1 has developed a Cost Policy which provides a structured and transparent approach to long term (CP5 to CP11) renewals pricing that considers the inherent uncertainty of forecasting so far into the future. We have applied the Cost Policy to long term (CP5 to CP11) station renewals. The process was similar to that applied for route renewals, as set out in Section 13.5. Before application of the Cost Policy, HS1 reviewed the costs for CP5 to CP11 as above. We then excluded the risk and management mark up to get the base costs to which we applied the Cost Policy. We worked with PA Consulting and Mott MacDonald to develop the risk and opportunity scenarios and then applied the Cost Policy to all four stations and their respective four asset types. The management mark-up was then added to get the overall renewals cost profile.

Scoring was undertaken in workshops held in April 2024 with representatives from HS1, NR(HS) 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 60; percentage variances are shown against the base cost.

Table 60: Selected P values by asset type and time horizon – station renewals

	H1 (CP5)	H2 (CP6-7)	H3 (CP8-11)	High level explanation
Civils	P80 6%	P50 9%	P50 -10% (-3% in Stratford, Ebbsfleet and Ashford)	H1 and H2 reflect uncertainty in the degree of complexity and constructability coupled with the stations becoming much busier. The savings in H3 are due to the introduction of new materials, modular build, more automated construction and design for manufacture and assembly (DfMA). In St Pancras in H3 we are expecting significant change in station layout and more open plan spaces reducing civils volumes.
D&C	P80 0%	P50 6% (7% in Stratford, Ebbsfleet and Ashford)	P50 -17%	We are anticipating a long term shift away from central station systems like CIS to personalised data on mobile devices. New ways of working and technology will mean that work can be delivered faster and in the day with no need for night working.
LETs	P80 1%	P50 22%	Base Cost 0%	The increase in H2 is due to technology moving away from hydraulic lifts to machine room-less lifts (MRL) making the renewal more complex. In H3 the base cost value is used. The P50 value has a cost reducing opportunity (that LET cost increases would be significantly lower relative to RPI in 20-40 years' time) that HS1 believes is unlikely to be realised, given our long term inflation assumptions align with CPIH/CPI.

	H1 (CP5)	H2 (CP6-7)	H3 (CP8-11)	High level explanation
MEP	P80	P50	P50	The increase in H3 is driven by a number of factors: • Uncertainty of how to undertake large scale cable and pipework renewal in a busy station environment; • The likelihood of above inflation increase in the cost of mechanical assemblies; and • The impact of climate change leading to the need for bigger and more complex renewals.
	1%	-2%	22%	

The Station Cost Levers Scoring Report (provided as a supporting document for this 5YAMS) documents the scoring approach process, the decisions made and the scores.

ORR analysis in the DD indicated that there was a small skewing of the stations renewals cost estimate, increasing it by approximately 0.5% from CP5 onwards. We applied a 0.5% reduction to station renewals costs starting in CP5 to correct for this in our November 2024 5YAMS (and was approved in the ORR final determination).

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 set out in a structured and transparent way. As part of our commitment to continuous improvement, the Cost Policy will be developed for subsequent control periods. We have made a CP4 commitment to further develop the Cost Policies for route and stations, evolving them into integrated cost models, linking volumes and HS1 outturn renewal costs, considering risk application/methodology improvements.

ORR determined cost efficiencies

The ORR was supportive of HS1's approach to estimating long term renewals costs, including the application of the Cost Policy. However, the ORR determined efficiency opportunities for CP5-CP11 station renewals costs in two areas:

- A 9% reduction in the cost of Lifts, Escalators and Travelators and Mechanical, Electrical & Plumbing asset groups from the acceleration of asset management maturity (see Section 10.8); and
- A 4% reduction in costs across all asset groups from improvements in estimating the base cost data for long term renewals (as outlined above in this section).

These efficiencies are applied to CP5-CP11 renewals costs *following* the application of the Cost Policy, in line with the ORR FD.

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 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 61 sets out the types of works to be undertaken for each asset discipline.

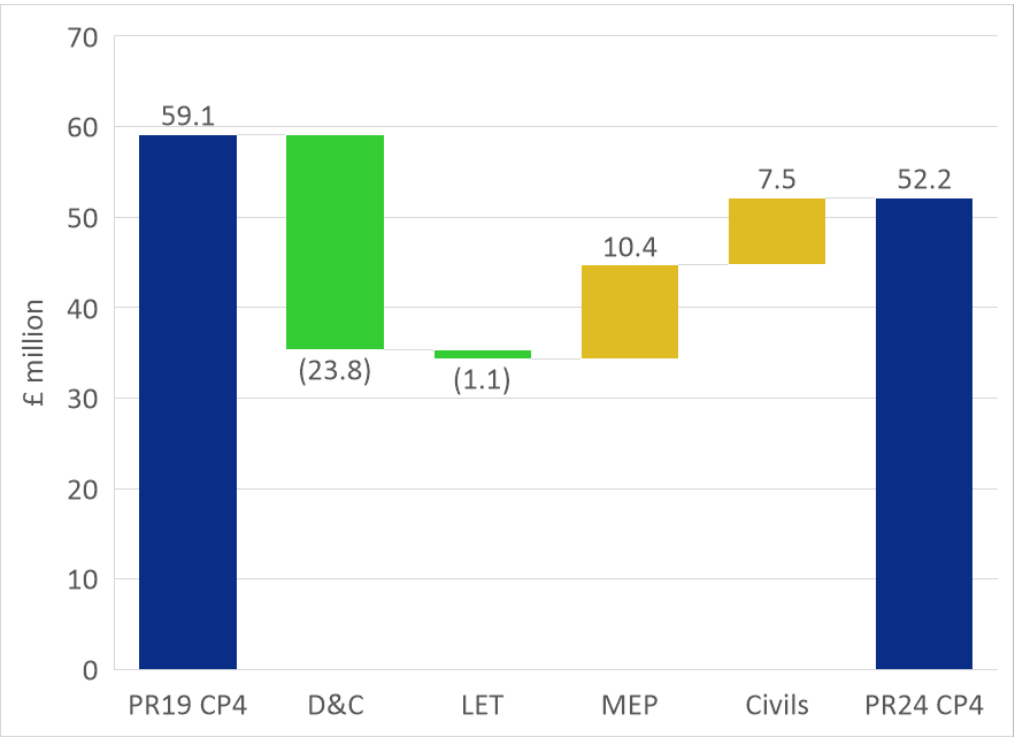
Table 61: CP4 works across all stations

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 £52.2 million as shown in Figure 46. This has decreased by £7.0 million compared with the PR19 forecast for CP4. CP4 cost of works declined for St Pancras and Stratford and was unchanged for Ebbsfleet. At Ashford International, a large volume of CP3 renewals was able to be deferred into CP4 which results in an increase in expenditure relative to PR19 forecasts.

Figure 46: 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, although there is a more of an impact at Stratford that lowers CP4 expenditure. Ashford L&E expenditure is higher relative to PR19 forecasts reflecting the deferral of work from CP3.

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 will report on the approaches planned for CP4 renewals delivery in the 2024/25 AMAS.

In the DD, the ORR highlighted three specific projects in St Pancras in CP4 (uninterruptible power supply units; heat pumps; and toilets) which had complex interactions with third-party areas. ORR proposed a 5% efficiency challenge on these projects until HS1 Ltd could demonstrate satisfactorily that the scope is not excessive for the needs of the railway station and that the renewal is not providing material benefits to third parties without their contribution. We provided additional details regarding third-party interactions for the three station projects. After reviewing this information, ORR was satisfied that it did not need to apply the 5% efficiency challenge.

For any station renewals which interact with third parties, ORR will expect clear evidence that this interaction has been considered in the project scope. This will be added as a regular part of our governance for all station projects.

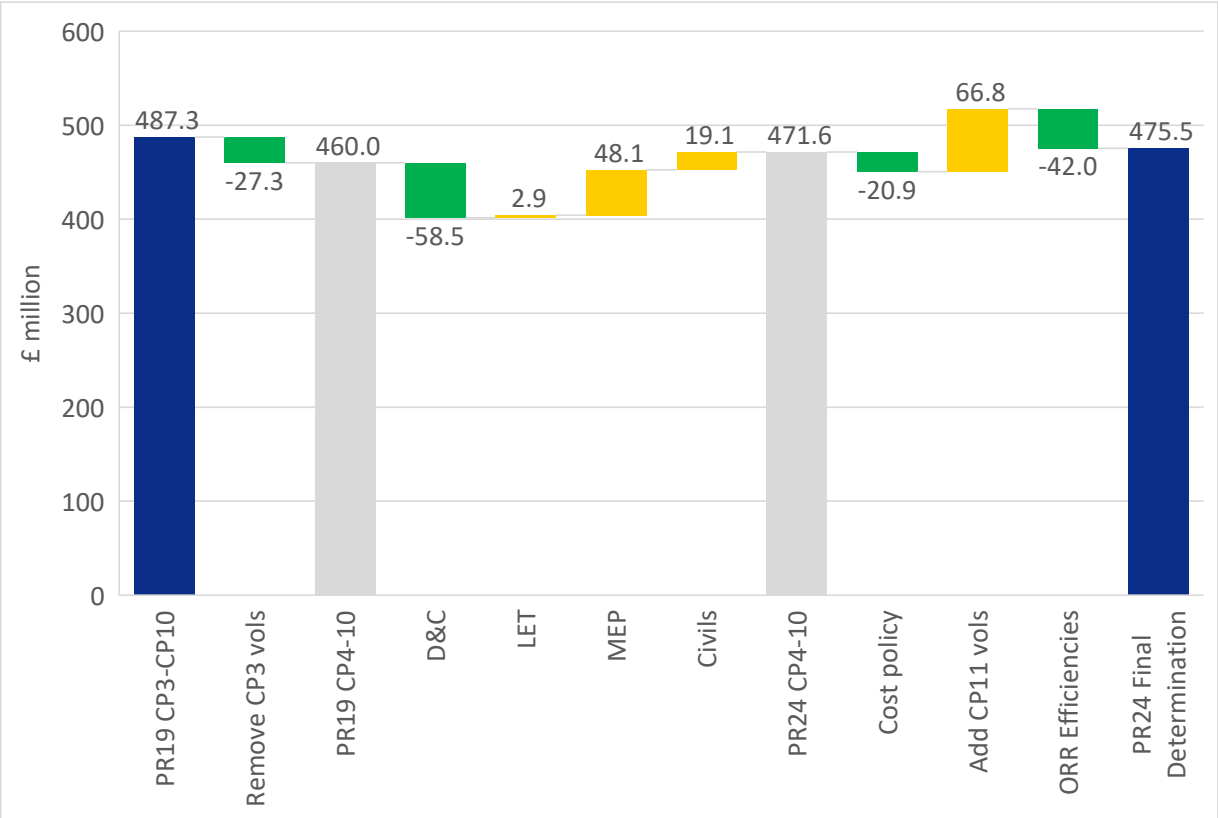
The ORR also recommended that that the governance of station renewals should be reviewed including sharing best practice from route renewals. We have made a commitment to reviewing the governance of stations renewals in year 1 of CP4. The focus of the review will be to align the governance of stations renewals to the governance of route renewals, for example, better use of leading indicators and better packaging of works. Our approach to CP4 renewals governance, which covers both route and stations, is set out in Section 13.3.4.

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 £475 million as shown in Figure 47. For comparable periods (CP4 to CP10), this is a 2.5% increase relative to PR19 estimates (which does not take into account the application of the Cost Policy or the ORR's determined efficiencies).

Figure 47: 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 increases in the mechanical, electrical and plumbing renewals and St Pancras civils renewals expenditure. This is mainly due to increases in the cost of work relative to PR19 across a range of assets in these disciplines.

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.

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 capacity optimisation and enhancements and 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 funding for such assets now 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. We have shared the long term shadow model with the ORR.

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
- In the May 2024 5YAMS, the calculation ensured that the escrow account reached zero balance at the end of the 40-year period with no negative balances during this period. Since the November 5YAMS, we have allowed small negative balances in later years in the annuity modelling in line with the ORR DD conclusion (see Section 13.6.2).

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). Since the May 2024 5YAMS, we updated the stations annuity modelling to apply a partial traffic weighting adjustment similar to traffic weighting of the route annuity. In line with the ORR FD conclusion, the traffic weighting is applied to LETs and MEP assets, the station assets groups which are subject to more wear and tear, but not to other station assets. We have used the same traffic forecasts as for route as the index for future growth in demand.

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. We had proposed to use updated floor plans for certain stations that more accurately reflect current floor space usage to allocate LTC across the zones; we are still consulting operators on agreement for this so these have not been used at this time.
- 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.

In response to operator views that retailers and other third parties benefiting from station assets should contribute to HS1 renewals, the ORR reviewed the contractual arrangements for stations and provided its position on cost allocations in the DD. We are consistent with the contractual framework as set out by the ORR. The ORR DD noted that where infrastructure interacts with areas covered by other leases/sub leases with third parties the ORR would consider, on a case-by-case basis, additional core factors to help ensure the project scope was appropriate and efficient. The ORR's review concluded that 28 of the 31 CP4 station renewals projects had no material issues, in terms of interactions with third parties but that there were opportunities for small scope efficiencies on three specific projects in CP4, where some of the project scope may fall outside of LTC and should be funded by third parties. We reviewed these three projects; and provided clarification in our response to the ORR DD how the assets in these projects are independent of the assets of other users of St Pancras International station. The ORR FD concluded that the additional information demonstrated that the scope is not excessive and these renewals are not providing material benefits to third parties without their contribution.

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);
- Traffic forecasts for each control period from CP4 to CP11 (same as those used for route which are partially applied, i.e. LETs and MEP assets only);
- 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

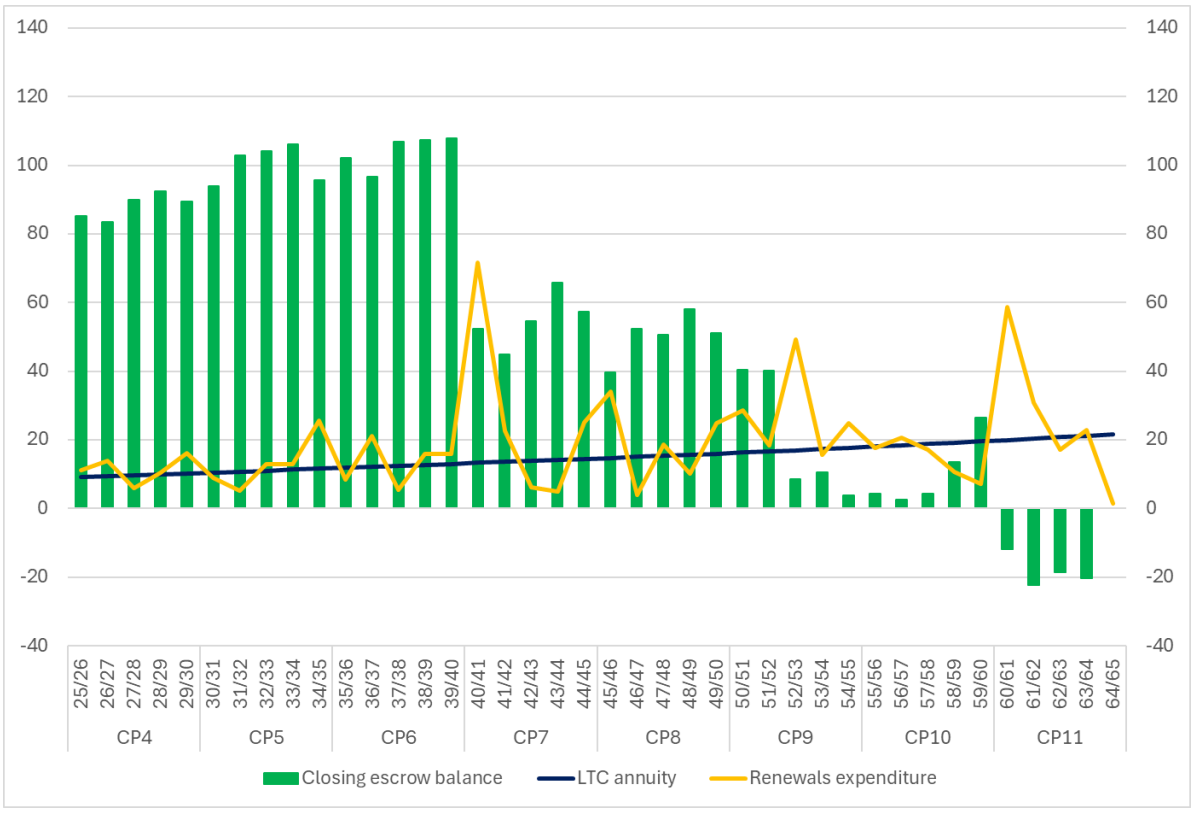
Table 62 below shows the LTC for each station based on our renewals cost profile compared with PR19. As a result of our review of station renewals costs, the LTC has fallen compared with PR19 at all stations. The combined LTC for CP4 is £8.5 million compared to £11.6 million for CP3.

Table 62: Stations Long Term Charge (£m pa, February 2023 prices)

Station	CP4	CP3	£ change	% change
St Pancras	5.32	7.55	(2.23)	(30%)
Ebbsfleet	1.35	1.62	(0.28)	(17%)
Stratford	1.24	1.54	(0.29)	(19%)
Ashford	0.56	0.87	(0.31)	(35%)
Total	**8.47**	**11.58**	**(3.11)**	**(27%)**

Figure 48 shows 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 48: 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).

HS1 needs to use the percentages defined in the SAC to apportion the LTC across the zones for CP4 as shown in Table 63.

In the November 2024 5YAMS, we had proposed to use updated floor plans for St Pancras and Ebbsfleet stations to derive the percentages used to allocate the LTC into the dedicated zones. To use these, HS1 needs agreement from operators to amend the SAC to incorporate these updated zone allocations through the SAC change process. We have been consulting the operators on this but the matter has not yet been finalised. If we are able to get agreement, we will make the necessary adjustments to LTC allocation at that time. To note, the updated floor plans allocations do not include any amendments for the implementation of the EES kiosks as we are not minded to change the designated areas at the station (see Section 5.2 of the St Pancras LCR). Table 63 sets out these proposed allocations relative to the allocations used in PR19 and defined in the SAC.

Table 63: Stations LTC zone allocation, St Pancras and Ebbsfleet

Zone	St Pancras			Ebbsfleet		
	Current floor plan	PR19	PR24 /SAC	Current floor plan	PR19	PR24 /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%

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 64.

For **Stratford International** station, SETL pays 100% of the LTC. For **Ashford International** station, EIL pays 100% of the LTC.

Table 64: 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 65. There is a decrease in the LTC relative to PR19 for all operators. SETL's LTC decrease is lower than the other operators due to the larger share of LTC it pays at Ebbsfleet relative to the PR19 determination.

Table 65: Stations LTC by operator (£m pa, February 2023 prices)

	PR24	PR19	£ change	% change
EIL	4.32	6.31	(1.99)	(32%)
EMR	1.11	1.55	(0.43)	(28%)
SETL	3.04	3.72	(0.68)	(18%)
Total	**8.47**	**11.58**	**(3.11)**	**(27%)**

For completeness, Table 66 provides each operator's LTC if the zone allocations used were based on the current floor plans percentages, which will be the outcome if we can reach agreement to amend the SAC.

Table 66: Stations LTC by operator based on current floor plan (£m pa, February 2023 prices)

	PR24	PR19	£ change	% change
EIL	4.09	6.31	(2.22)	(35%)
EMR	1.08	1.55	(0.47)	(30%)
SETL	3.31	3.72	(0.41)	(11%)
Total	**8.47**	**11.58**	**(3.11)**	**(27%)**

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 67 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. The combined route OMRC and stations Qx and LTC costs for passenger operators are set out in Appendix A7.

Table 67: Total stations charges for CP4 (£m pa, February 2023 prices)

	LTC	Qx*	Total		LTC	Qx*	Total
St Pancras	5.32	28.38	33.70	EIL	4.32	14.50	18.82
Ebbsfleet	1.35	4.90	6.25	EMR	1.11	8.96	10.08
Stratford	1.24	4.47	5.72	SETL	3.04	16.57	19.61
Ashford	0.56	2.28	2.84				
Combined	**8.47**	**40.03**	**48.50**	**Combined**	**8.47**	**40.03**	**48.50**

* These are the latest Qx estimates available deflated to February 2023 prices to be consistent with the LTC.

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 proposed largely rolling over this framework to CP4. The ORR FD concluded that an annual wash up of fixed costs based on year-end volumes should be introduced; this is significant change from the current approach of charging fixed costs.

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 proposed changes to the Access Terms in several areas, due to the Access Terms being stress tested during Covid-19 and other developments. The operators also proposed changes that HS1 does not agree with, some of which are outside of the scope of PR24. The FD sets out the ORR's final position on these proposals most of which will be implemented. In this section we explain these proposals, as well as the 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 steps to help improve escrow returns. Some of this work will require further exploration by DfT, with HS1's assistance. If taken forward, this would incur external costs that would need to be recovered from the operators.

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.

As part of the PR24 process, the ORR reviewed these proposals (as well as proposals made by the operators) and gathered more information from stakeholders on these. It set out its decisions on the proposed amendments in the FD. Where the ORR has taken a different view to HS1, we have reflected this in the sections below. HS1 will make the necessary legal drafting amendments to the Access Terms in line with the ORR FD.

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.

In order to allocate risk and incentives fairly, the parameters of the regime need to be calibrated 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. Following a process of iterative consultations, stakeholders have agreed with our preferred approach to delay PR24 recalibration to a time during CP4 when data more representative of future operations is available. We currently expect sufficient data for a recalibration is likely to be available around mid-to-late 2025. We have set a commitment for CP4 to begin recalibration of the performance regime by 1 September 2025. The ORR has approved our proposed amendments to the Access Terms to provide for this recalibration. This included the ability for HS1 o make decisions on whether to proceed with implementing a recalibration, based on the best interests of the system. HS1 would consult all relevant parties before doing so.

Following this recalibration, NR(HS) will need to update its Annual Fixed Price with the revised pricing of performance risk from the delayed recalibration, as is typically done when the recalibration occurs as part of a Periodic Review process. Therefore, we the Access Terms needs to expressly allow HS1 to adjust the operators' OMRC charges to reflect any savings or increases to performance risk cost resulting from the recalibration. The ORR FD approved this proposal.

We had also proposed that HS1 be able to adjust OMRC charges for other unplanned mid-control period recalibrations. The ORR DD did not support this, noting that changes to the pricing of performance risk resulting from unplanned recalibrations should be covered by the cost envelope for Contract Risk that the ORR determined for the control period. We have accepted this position.

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. In the November 2024 5YAMS, we proposed that the Access Terms allow HS1 to split the costs of an unplanned mid-control period performance regime recalibration between the relevant parties (HS1 Ltd and train operators). The ORR FD approved this on the basis that it is fair that each party contributes, noting that costs must also be transparent to all parties.

A summary of the amendments to Section 8 of the Access Terms and ORR's determinations is set out in Section 18.11.

In a situation where a new operator enters the network, the performance regime parameters will need to be established as part of its FTAA. This may result in a revision to NR(HS)'s Performance Risk to reflect the impact of a new operator entering the network and, in turn, an adjustment to existing operators' OMRC charges. We expect this would form part of an Interim Review process under the Concession Agreement.

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. We will consult with affected stakeholders on any proposals.

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[26]; this will require changes to the Access Terms. This has the potential to affect NR(HS)'s performance risk pricing, and may trigger a recalibration of the performance regime.

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 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 'Routine Renewals' based on more data-led modelling and stakeholder engagement (see Section 11.2 on the Engineering Access Strategy). 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[27];

[26] 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.

[27] www.orr.gov.uk/sites/default/files/2021-10/ghd-possessions-efficiency-review-independent-report-april-2021.pdf

- 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.

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 Routine Renewals 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 Routine Renewals 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 in this Extended Possessions Allowance category. These possessions will only be rolled over between years if they are included in the Engineering Access Statement in force at the time in accordance with the HS1 Network Code. This would ensure operators are properly consulted and would reduce the likelihood of a large, unintentional build-up of possessions allowance over the control period.

NR(HS) will continue to track and report on possessions to the operators and will also include a breakdown of possessions by category and whether a possession is within the current year's allowance or in the allowance rolled over.

The allowances combined give the resulting CP4 possessions requirements shown in Table 67.

Table 68: 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

We will amend the Access Terms to update the efficient Possessions Allowance identified by NR(HS) as set out in Table 67. This will include defining the two categories of Possessions Allowance, the number of each type of possession within each category, and that possessions are only rolled over if approved through the Engineering Access Statement governance process for that year. The possessions regime penalties under Section 4 of the PAT will apply if the combined total allowance is exceeded. No changes to the wider possessions regime or process are being made.

This allowance provides the appropriate balance to ensure NR(HS) has sufficient access to the infrastructure to undertake necessary works to meet our asset stewardship obligations while incentivising NR(HS) to deliver these works efficiently (as explained in Section 18.2.1). More detail on how the Possessions Allowance was developed, including the breakdown into Standard and Extended Possessions Allowances and efficiency considerations, is provided in the supporting document NR(HS) Possession Allowance CP4.

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 this process 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 current 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 some concerns 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. This could drive perverse incentives and outcomes. HS1 has identified three amendments to be made to the VRO provisions in the Access Terms:

- Subsequent VRO trigger

  We will amend the definition of the trigger for a subsequent VRO to refer to the forecast volumes used in the previous VRO.

  Currently, the baseline for triggering the subsequent VRO is the volume of trains that triggered the previous reopener. This however is not appropriate. As Covid has demonstrated, a VRO is likely to be triggered during times of high uncertainty and volume forecasts for the remainder of a Control Period are likely to change year to year and not remain flat. Therefore, the reference for the subsequent VRO will be amended to be the volume forecast for the year in question as given by the previous VRO. This is on the basis that this was the volume used to calculate the existing charges that we recover against.

  If the definition was not amended, it could create perverse incentives to use flat volume forecasts, otherwise there is a risk of under recovery of fixed costs. This may also lead to unnecessary VROs and adjustments to operators' charges if flat volumes are used but volumes are more likely to grow or decline. EIL and SETL supported this proposal in principle.

- Simplify the VRO definition

  This amendment clarifies the definition of a VRO event to make it simpler to understand. This includes changing 'Review Event' to 'Volume Event' and simplifying the descriptions in the definition of a Volume Event. This does not change the definition meaning or approach. SETL supports this proposal in principle.

  In making the above two changes to the Access Terms, we have also amended wording around the reapportionment process to reflect that we recover the costs over the whole remainder of the Control Period (not the next timetable year only) and that HS1 includes the forecasts used to execute the VRO in the notice to operators. This is to be consistent with the approach to VROs followed in CP3.

- VRO trigger for zero freight circumstances

  We will include an additional trigger in the Access Terms whereby, in the event that freight ceased operating, HS1 can reapportion the remaining fixed costs of freight to the passenger operators as they would be the remaining operators in the system. As the ORR has concluded that certain fixed costs should be reallocated as OMRCB which are allocated to passenger operators (see Appendix A8), the remaining freight fixed costs are those associated with Ripple Lane (see Section 15.4.2).

The ORR FD also implements an annual fixed cost wash up for passenger operators (see Section 18.4.2), which has implications for the VRO. We will also amend some provisions in the HS1 Passenger Access Terms (PAT) relating to how the VRO is implemented. This includes the timing of when the revised OMRCA2 and OMRCB apply, which will be at the start of the financial year not the timetable year.

HS1 had initially discussed additional changes to the VRO provisions with stakeholders. These included:

- 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.

The objective of these changes was to clarify HS1's approach taken during the highly volatile and uncertain circumstances in CP3. However, these changes are complex and intricate to work through to understand and mitigate possible unintended consequences and risks. We were not able to consider these changes sufficiently within the ORR's revised timeframe for Access Terms amendments. Therefore, we did not proceed with these proposals at that time.

The passenger operators also had proposals for amendments to the VRO provisions. These built on our initial discussions with a wider range of possible amendments. They have also proposed other changes, some of which are outside the scope of PR24. HS1 does not support these proposals, although some will be implemented on the basis of the ORR's FD.

In particular, the ORR approved EIL's amendment to use operators' forecasts as the basis of reapportioning OMRCA2 and OMRCB following a VRO being triggered where an FWT is not available. We do not agree with this amendment as this approach could create a perverse incentive where, in times of uncertainty and volatility in train volumes, operators would likely take

positions on forecasts that favour their commercial interests. In such a situation, because the domestic underpin acts as a floor, domestic operators would be unfairly disadvantaged relative to international operators. We recognise this perverse incentive is mitigated to some extent where there is a fixed cost wash up that allocates costs based on actual volumes at the end of the year.

The complete set of the operators' proposals for amendments to the Access Terms along with the ORR's FD outcome and HS1's position is summarised in Section 18.11.2.

18.4 Wash up provisions

Under the 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.

18.4.1. HS1's proposed amendments

The large and uncertain changes in train volumes during Covid-19 highlighted issues with the wash up provisions in the PAT. HS1 will make 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 the start of the year. Over the long run this could drive perverse incentives for operators to submit low FWTs to reduce costs. We will address this by amending the provisions to apply the wash up to the total OMRCC costs in the year, taking the domestic underpin contributions into account.
- **Wash up of other charges**: Changes to reflect the clarification for billing AIRC on spots bids (see Section 18.11) and minor amendments for general clarification and consistency.

18.4.2. Operators' proposal: annual Fixed cost wash up provision

The ORR FD has approved the implementation an annual wash up of fixed costs proposed by EIL and SETL so total costs for operators are calculated at the end of the year based on actual volumes operated.

HS1 did not agree with this and had fundamental concerns about implementing the wash up. There has been no justification or evidence shared with HS1 at any time to indicate that the existing mechanisms for charging and recovering OMRCA2 and OMRCB are not functioning as intended as set by the contractual framework that has been in place since the start of the Concession, and that this change in approach is a proportionate and reasonable response. Nor had the ORR indicated that they had taken into account the considerable legal expenditure incurred by HS1 for its implementation. Furthermore, the original proposal for the wash up approach as set out in the ORR DD was considerably disproportionate given it could have resulted in increased risk, costs and unintended consequences for HS1 and the HS1 system.

We provided detail on our concerns in HS1's response to the ORR's DD consultation. This built on our views provided in the May 2024 5YAMS supporting document 'PAT proposals by operators – HS1 response'. The ORR FD responded to our concerns, setting out a number of principles that should be part of the wash-up mechanism. Our key concerns and ORR's response were:

- Introducing new credit risk and under recovery risk which if not mitigated could have significant implications for HS1.

  The ORR approved a 'pay when paid' basis for settling payments and mechanism for HS1 to recover fixed costs for that year in the event of operators running no services.

- Creating uncertainty for train operators as the level of OMRCA2 and OMRCB payable (both in terms of a per train per minute level and at an aggregate level) until the end of year wash-up. In extreme circumstances, the operators could face significant cost increases at the end of the year as a consequence of the wash up. The ORR will wish to be mindful of its s.4 Railways Act 1993 duties in this respect as operators (or a potential new operator) might argue it is inconsistent with the proposed wash up approach.

  The ORR acknowledged the mechanism potentially introduces greater uncertainty to operators about costs, but is proceeding on the basis the operators accept this as a trade-off for benefits of bringing actual costs in line with traffic volumes. The ORR stated all its decisions are consistent with the relevant statutory requirements.

- Implications for HS1's resource and budget, as HS1's internal processes are not currently set up to manage such a recalculation of OMRCA2 and OMRCB in the manner proposed, and could have implications for HS1's other wash up and billing processes.

  The ORR approved a small £150k increase in HS1's internal budget for CP4 to operate the fixed cost wash up. This was lower than the amount HS1 had identified was needed, and indeed not sufficient to cover even the cost of legal analysis that had to be undertaken by HS1 to (i) support the ORR's determination analysis and (ii) draft the significant amendments to the Access Terms.

- The wash up as proposed by ORR in the DD would not be effective, efficient nor consistent with HS1's structure of charges.

  The ORR arranged workshops with HS1, EIL, SETL and DfT through which HS1 has developed and agreed a mechanism that is consistent with HS1's structure of charges. The mechanism also needs to be consistent with the interaction with the Domestic Underpinning Agreement.

The ORR also determined some other principles that should be part of the fixed cost wash up mechanism:

- Annual frequency with provision for one interim in-year wash up. This interim wash up would be triggered when the reallocation of costs for any one party reaches £10m (in February 2023 prices) or higher for a six-month period and it is unlikely to reduce over the remainder of the financial year.
- If there are no services run in a year, HS1 apportions the fixed costs based on the volumes given by the operators' FWT.

In the workshops, HS1 also agreed with the stakeholders that if the wash up mechanism was introduced, other elements should be included to ensure the wash up was effective. There are:

- HS1 provides an indicative quarterly statement of balance for Q2 and Q3 to keep operators informed of the likely amount owed or owing at the end of the year. The operators need to provide updated traffic forecasts to allow HS1 to do this effectively.
- A table in the FTAAs that sets out the annual amounts for which the wash up will be in reference to.
- Amendments to the VRO to:
  - (i) Amend the timing for when the revised OMRCA2 and OMRCB charges following a VRO will apply to be the start of the financial year (currently it applies at the start of the timetable year). This is to keep this consistent the timing of the fixed cost wash up (based on financial year) and reduce complexity in both processes.
  - (ii) Include a provision that the table in the FTAA with the reference annual wash up amounts will be updated to reflect the revisions that occur with a VRO.

HS1 is now finalising the amendments to the PAT to implement a fixed cost wash up. HS1 has highlighted throughout this process that implementing such a wash up is complex given the potential for unintended consequences or new risks could arise as the legal drafting is taken forward. If any new risks or issues arise, we will need to address these through engagement with the ORR. It is also important to note that, as these mechanisms have been developed under the time constraint of the Periodic Review process, the fixed cost wash up will need to be reviewed after it has had time to be embedded.

HS1 is not implementing the fixed cost wash up in the FAT. As we understand, it was not intended to apply to HS1 freight. HS1 also recognises that the fixed costs for freight relate to Ripple Lane charges (given the FD confirmed the reallocation of other freight fixed costs – see Section 12.4.3). Any implementation of a wash up for Ripple Lane would need to be discussed in detail with freight operators.

18.4.3. Operators' proposal: OMRCA1 wash up amendments

EIL and SETL also proposed amendments to the OMRCA1 wash up approach to use the actual volume of trains run at the end of the year. In the DD, the ORR was minded to approve this for implementation for passenger operators, where the wash up occurs on a same day basis (as currently done) and total volumes are above the FWT (such that the FWT acts as a volume floor). While HS1 has set OMRCA1 in accordance with the Railway Regulations, we accept this change based on the ORR's proposal. We provided more detail on this in HS1's response to the ORR's DD consultation on the approach proposed by the ORR in the DD, including our position on why the wash up should occur on a same day basis and not over a longer period. This builds on our views provided in the May 2024 5YAMS supporting document 'PAT proposals by operators – HS1 response'.

The ORR's FD changed its position on this amendment so that the OMRCA1 wash up occurs over a Railway Period (while still retaining the FWT as a volume floor) to allow operators, in circumstances of exception disruption, to replace disrupted services at a later time than just the day of disruption.

To implement this wash up, the PAT needs to be amended to introduce the concept of chargeable journey distance to reflect the Route Charging Model's conversion of direct costs into a per-km charge. This is consistent with the Commission Implementing Regulations (CIRs) 'Modalities CIR': 2015/909 on the modalities for the calculation of the cost that is directly incurred as a result of operating the train service (see Section 19.1).

In line with the ORR's DD, HS1 has not made these amendments to the FAT. It is not necessary as freight operators schedule trains on a spot bid basis (i.e. they do not submit FWTs) and are already billed through a wash up that aligns with this principle.

The other proposals by the operators are to give effect to their proposed changes to the VRO provisions (see Section 18.3), and the wash up of IRC, the latter which is outside the scope of PR24. HS1 does not agree with these proposals. Section 18.11.2 sets out the complete list of proposals from the operators, along with HS1's position. More detail is provided as supporting documents to this 5YAMS.

18.5 OMRC indexation floor

EIL proposed removing the floor to indexing OMRC by inflation which prevents deflation being applied to operators' charges.

We were very concerned by the ORR's DD conclusion to remove the floor to indexing OMRC on the basis that operators should benefit from reducing costs due to negative inflation. The amendment would result in significant financial implications for HS1 and was inconsistent with the HS1 regulatory and contractual framework. Our November 2024 5YAMS and our response to the ORR DD consultation set out our concerns in detail.

The ORR FD responded to our concerns and concluded that there was not sufficient justification to remove the indexation floor at this time. The ORR noted it will explore this issue further at the next Periodic Review if it is not address before then. HS1 intends to work with other stakeholders during CP4 to consider how charges should be fairly indexed and aligned across the contractual framework.

18.6 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. The passenger operators support this and we are consulting freight operators. We expect to make the necessary changes to the Access Terms to take effect at the start of CP4.

18.7 Capacity reservation charge

18.7.1. 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 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.

18.7.2. 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.

In the Draft 5YAMS we proposed to reactivate the Capacity Reservation Charge at the start of CP4 to ensure that operators hold only the capacity they intend to operate. The Draft 5YAMS served as a consultation process to gather views on reactivation of the Capacity Reservation Charge.

In their feedback stakeholders highlighted that entry of a new operator is uncertain and that the capacity on HS1 will remain unconstrained until new entry is confirmed. We have therefore decided to not reactivate the Capacity Reservation Charge at this time. We will keep this under review and continue to reserve the right to activate during CP4.

18.8 Pass through cost categories

18.8.1. 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 18.11).

There is no pass through cost element of OMRC for current freight traffic.

18.8.2. 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 will however 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.

We also proposed additional changes to the pass through costs defined in the PAT related to additional costs for the escrow investment project and to clarify the existing pass through cost definition of business rates to include success fees. These two amendments were not approved in the FD as the ORR considers these were uncertain costs that should be negotiated between HS1 and operators closer to the time these would be incurred.

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 will 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. The passenger operators supported this.

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. The passenger operators are in agreement with this.

Cost clarification changes

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 overspend. 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 will 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.

- **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 will amend the insurance pass through definition to include all such costs. This would ensure that the description of Insurance captures current practice.

- **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 will amend the definition

to clarify that all non-traction electricity related costs, including ERM and bill checking services, are included in OMRCC. Train operators are in agreement with this proposal.

- Non-traction energy: REGO costs

Clarify that the definition of non-traction energy costs in the Access Terms include the costs associated with Renewable Energy Guarantees of Origin (REGOs).[28] REGOs have become a material proportion of HS1 electricity costs and will likely increase as we increase the proportion of electricity obtained from renewable sources. HS1 has been recovering REGO costs intermittently since April 2020 on traction and non-traction charges. Therefore, we are proposing to expressly clarify that these form part of the non-traction energy costs. Train operators are in agreement with this proposal.

HS1's proposed changes not taken forward

- Escrow investment project

We proposed to include a pass through cost category for the DfT's project, if it goes ahead, to make changes to the Authorised Investments in the Concession Agreement and help enhance returns on escrow investments (see Section 20.1). This would allow HS1 to recover the external costs for HS1 of analysing and implementing these changes which would also include the legal costs of DfT and ORR. The estimated combined cost we put forward in our November 2024 5YAMS was c£200k, albeit further scoping of the project costs is needed closer to the project start date (which is not yet known). We considered this was the most appropriate mechanism to recover the costs; it should not be a fixed cost included in HS1's internal budget. This is because HS1 does not have control over the costs as it is a DfT-led project. Also, HS1 is supporting the project for the benefit of the operators with no direct benefit to HS1, so we should not face the cost risk, and there is no certainty on whether DfT will proceed with the project. We set these reasons out in detail in Section 20.1.

The FD concluded that there was too much uncertainty around this project for this to be treated as a pass through cost, and that the cost should be negotiated between HS1 and the operators nearer the time these will be incurred. HS1 will not be able to take forward any work on this project until a cost recovery agreement with the operators is in place as we are not funded for this work. In line with the FD outcomes, the £200k for this project has been excluded from total OMRCC costs (see Section 12.4.2).

- **Rates: Fees, including 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 proposed no change to this but we recognised 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

[28] This includes, but is not limited to, REGOs which are required as part of a Corporate PPA

business rates, which would flow through to the TOCs. HS1 proposed that the costs associated with obtaining a reduction in a live list should be recovered from the TOCs under OMRCC.

The FD concluded that there was too much uncertainty around costs being incurred for an appeal for this to be treated as a pass through cost, and that the cost should be negotiated between HS1 and the operators nearer the time these will be incurred. HS1 will not be funded for this as it would involve extraordinary costs beyond typical business rate fees. Therefore we will need a cost recovery agreement with the operators is in place before being able to undertake work.

Other

We did not propose any other changes 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. The operators have not supported this change. While we maintain this view, we are not pursuing this for CP4.

18.9 Outperformance regime

The Access Terms 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 by the operators who propose that this is changed. It has been suggested that it could create perverse incentives for NR(HS) to outperform in the years the sharing does not apply and delay works to the years it does, and should be changed so that more outperformance is shared used to finance NR(HS)'s upfront investments.

The Outperformance Regime is not within scope of PR24. There is also no clear evidence this creates a perverse incentive. When NR(HS) foresaw there could be outperformance driven by Covid in Year 1 and 2 of CP3 when there is no sharing mechanism, it looked to return part of its contract risk fee. However, operators did not agree to this. Furthermore, NR(HS) is subject to regular assurance of its work delivery and budgets by HS1 and the ORR. It is also unclear 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 or reinvesting outperformance could reduce incentives on NR(HS) to outperform.

We are not proposing to change the approach to the Outperformance Regime at this time.

We need to amend the relevant Outperformance provisions in the Access Terms to reflect the relevant dates for CP4. The passenger operators support these changes and we are consulting the freight operators. We expect to make the necessary changes to the Access Terms to take effect at the start of CP4.

18.10 St Pancras International station – contractual inconsistency

The ORR concluded that there are inconsistencies between the contractual arrangements for the St Pancras International station and the Thameslink Box (managed by NRIL), and in the charges between operators who run directly competitive services. The ORR recommends that these contractual inconsistencies are reviewed by the affected stakeholders (HS1, DfT, NRIL and operators) to propose alternatives.

The existing contractual arrangements relating to the Thameslink Box and St Pancras International station reflect the arrangements that were implemented prior to the sale of the HS1 Concession in 2010. NRIL and the DfT are counterparties to the agreement that includes the Thameslink Box so any changes to these contracts will require their consent. Govia Thameslink Railway (GTR) and DfT would also need to consent to GTR signing an agreement to contribute to station costs and potentially for GTR to enter into a Station Access Agreement.

We reviewed this during CP3, but following advice from the DfT, it was decided not to pursue the issue further as, at the time, the DfT did not contemplate allocating costs to GTR for the use of St Pancras International station.

We support revisiting these discussions, on the basis that a significant number of GTR passengers use St Pancras International and GTR should therefore contribute to station costs.

We commit to holding a working group with DfT, NRIL and, where relevant, operators to review the contractual arrangements for the Thameslink Box and St Pancras International in year 1 of CP4. The working group will consider if alternative contractual arrangements are possible to address inconsistencies in charges between operators that run directly competitive services. HS1 will report back on the outcome of this working group in the CP4 year 1 AMAS.

18.11 Other Access Terms changes

In addition to the changes outlined above, HS1 will change the Access Terms to:

- Clarify the billing of Additional IRC (AIRC) on spot bids. We have not previously had to rely on this as spot bid volumes before Covid were relatively small. We will bill AIRC for the ERTMS early works Specified Upgrade on spot bids to ensure fair allocation of these costs across the relevant operators.

  We will amend the PAT to expressly clarify our ability to do this. SETL supported this proposal in principle.

In the FAT, the current provisions are sufficient, however we will amend the term used for Additional IRC to align with the PAT.

- Amend the FAT for (i) N-1 Scheme under the Performance Regime; and (ii) On Train Metering in traction electricity charging. This will reflect the similar provisions implemented into the PAT in 2023 and ensure consistency between the Access Terms.
- Make amendments to reflect legislative changes since PR19. These are amendments to reflect:
  - Removal of references to EU licences which no longer apply since Brexit.
  - The Corporate Insolvency and Governance Act 2020.
- Some minor amendments to update dates, addresses, cross referencing clarification and correction of typos.

During the PR24 process both HS1 and operators made proposals for amendments to the Access Terms. Stakeholders had initially agreed to run a separate Access Terms Consultation in parallel with the PR24 process so that the outcomes would be provided to the ORR in time for its Final Determination. The ORR revised the process, and HS1 had to set out our proposed amendments within scope of PR24 in the Final 5YAMS in May 2024. The shorter timeframe meant HS1 was not able to consult stakeholders fully on our proposals, including the legal drafting. We reflected stakeholders' views where these were known. Some proposals reflected recent developments, such as the inclusion of provisions in the Performance Regime related to mid-control period recalibrations (see Section 18.1) and a new provision to reallocate freight fixed costs if there is no freight operating on HS1 (see Section 18.3). The DD set out the ORR's minded to position on the Access Terms.

We were concerned by the late change in the process. Because of the shorter timeframe, HS1 limited its proposed changes to focus on the most significant and necessary and which were discussed with other stakeholders at length during the PR24 process. In contrast, the operators' full range of proposals were shared late in the process and did not receive similar balanced discussion and consideration for how these affect the overall system and risk profiles ahead of the ORR DD publication. The ORR has since held further discussions with stakeholders on the proposals where there were concerns raised ahead of making its conclusions in the FD.

18.11.1. HS1's proposals

Table 68 outlines the changes HS1 proposed to the Access Terms. We note that:

- Some reflect a change in law so, in accordance with paragraphs 5.2 (c) and (d) of Section 9 of the Access Terms, we follow Part C of the HS1 Network Code for implementing these changes.
- Some are amendments to provisions outside of the scope for PR24. In accordance with paragraph 5.2(a) of Section 9 of the Access Terms, we consulted the operators on these changes in order to achieve agreement before submitting to the ORR for approval.

We ran these processes in parallel to the PR24 process to implement for the start of CP4.

Table 69: HS1 proposed changes to the Access Terms

Document	Area	Scope of Change	ORR FD position	HS1 comment
In scope of PR24				
PAT and FAT	Section 8 (Performance Regime)	Performance Regime: **Initial proposal** - Include a provision that gives HS1 the ability to invoice the operator for the external costs of a performance regime recalibration when they are the party that requests it (Section 18.1). **Revised proposal** - Include a provision that gives HS1 Ltd the ability to split the costs of a performance regime recalibration between parties (HS1 Ltd and operators).	Approve revised proposal.	Agree.
PAT and FAT	Section 8 (Performance Regime)	Performance Regime: Include a provision so HS1 may amend and reapportion the OMRCA2 and OMRCB to reflect the adjustment in performance risk costs from a recalibration (Section 18.1).	Approve proposal only for recalibration that has been deferred from PR24 to commence by September 2025.	Accepted.

Document	Area	Scope of Change	ORR FD position	HS1 comment
PAT and FAT	Section 8 (Performance Regime)	Performance Regime: Include a provision that allows for recalibration during CP4, commencing by September 2025 (Section 18.1).	Approve proposal.	Agree.
PAT and FAT	Section 4 (Compensation for Restriction of Use)	Possessions Regime: Update the Possessions Allowance definition to reflect the extended and standard possession allowance for CP4. (Section 18.2.2)	Approve proposal.	Agree.
PAT and FAT	Section 4 (Compensation for Restriction of Use)	Possessions Regime: Change the number of possessions within the Possessions Allowance (Section 18.2.2).	Approve proposal.	Agree.
PAT and FAT	Section 4 (Compensation for Restriction of Use)	Possessions Regime: Allow unused Extended Possessions Allowance to roll over between years (Section 18.2.2).	Approve proposal, subject to use of Engineering Access Statement as change control mechanism for rollover.	Agree.
PAT and FAT	Section 7 (Track Charges)	VRO: Update the definition of a subsequent Review Event threshold to refer to the volume forecast for the relevant year in the preceding VRO (Section 18.3).	Approve proposal.	Agree.

Document	Area	Scope of Change	ORR FD position	HS1 comment
PAT and FAT	Section 7 (Track Charges)	VRO: Changes to simplify the definition of a VRO and clarify approach (Section 18.3).	Approve proposal.	Agree.
PAT	Section 7 (Track Charges)	VRO: Include a provision that, if freight ceases operating on HS1, it triggers a reapportionment of remaining freight fixed costs across passenger operators (Section 18.3).	Approve proposal.	Agree.
PAT	Section 7 (Track Charges)	Pass through wash up: Change the definition of the pass through costs wash up term so the wash up applies to the total pass through costs in the year (Section 18.4).	Approve proposal.	Agree.
PAT and FAT	Section 7 (Track Charges)	Pass through cost definitions: update existing pass through cost categories to include additional items. These are: success fees in Rates; broking fees and professional costs in Insurance; and management and bill checking fees and REGOs in non-traction energy (Section 18.8.2).	Approve proposals for insurance broking fees and professional costs; management and bill-checking fees for non-traction energy; and REGOs in non-traction energy. Reject proposal for success fees in business rates.	Accepted, noting that HS1 will not be able to undertake work on success fees in rates without a cost recovery agreement in place as we are not funded for this extraordinary work.

Document	Area	Scope of Change	ORR FD position	HS1 comment
PAT and FAT	Section 7 (Track Charges)	Pass through cost definitions: Update to include the new pass through cost categories for the REACT scheme, N-1 scheme and the escrow investment project (Section 18.8.2).	Approve proposals for the REACT scheme and N-1 scheme. Reject proposal for the Escrow Investment Project.	Accepted, noting that HS1 will not be able to undertake work on escrow investment project without a cost recovery agreement in place as we are not funded for this work.
PAT	Section 7 (Track Charges)	AIRC: Include provisions to expressly clarify the billing of AIRC on spot bid services and consequential changes (Section 18.11).	Approve proposal.	Agree.
FAT	Section 7 (Track Charges)	AIRC: Amend the term 'Further IRC' to Additional IRC to be consistent with the PAT (Section 18.11).	Approve proposal.	Agree.
FAT	Section 8	Implement the N-1 Scheme for consistency with the PAT (Section 18.11).	Approve proposal.	Agree.
PAT and FAT	Various	Minor corrections for consistency and clarification in provisions within scope of PR24.	Approve proposal.	Agree.

Document	Area	Scope of Change	ORR FD position	HS1 comment
Change in Law				
PAT and FAT	Section 7 (Track Charges)	Carbon costs: Remove the provisions related to carbon costs and charges (Section 18.6).	This is to reflect a change in law. The amendments can be made following the process in paragraph 5.2 of Section 9 of the PAT.	Passenger operators approve this; we are consulting freight operators.
PAT and FAT	Various	Updates to reflect: • Removal of references to EU licences which no longer apply since Brexit. • The Corporate Insolvency and Governance Act 2020.(Section 18.11)	This is to reflect a change in law. The amendments can be made following the process in paragraph 5.2 of Section 9 of the PAT.	Passenger operators approve this; we are consulting freight operators.
General changes				
PAT and FAT	Section 7 (Track Changes)	Update to the Outperformance Sharing to reflect CP4 dates (Section 18.9).	This is out of scope. The amendments can be made following the process in paragraph 5.2 of Section 9 of the PAT.	Passenger operators approve this; we are consulting freight operators.

Document	Area	Scope of Change	ORR FD position	HS1 comment
FAT	Section 7 (Track Charges)	Implement On-train Metering for consistency with the PAT (Section 18.11).	This is out of scope. The amendments can be made following the process in paragraph 5.2 of Section 9 of the FAT.	We are consulting freight operators.
PAT and FAT	Various	Minor amendments to update dates and addresses and for clarifications, cross-referencing and typos.	The amendments can be made following the process in paragraph 5.2 of Section 9 of the PAT.	Passenger operators approve this; we are consulting freight operators.

18.11.2. Passenger operators' proposals

The passenger operators also proposed amendments to the PAT. These are summarised in Table 69 along with the ORR's DD position and HS1's position. Supporting documents 'PAT proposals – EIL' and 'PAT proposals – SETL' set out the full details the operators' proposals. Some of the proposals are outside the scope of PR24 but are included here for completeness. HS1 provided our initial response on these proposals in the May 2024 5YAMS supporting document 'PAT proposals by operators – HS1 response'. We have since provided additional information in the November 2024 5YAMS and our response to the ORR's DD consultation on its minded to decision on the Access Terms which contained more detail on the proposed approach and legal drafting amendments.

Table 70: Operator's proposed changes to the PAT

Area	Proposed by	Proposal	ORR FD position	HS1 position*
In scope of PR24				
Annual fixed cost wash up	EIL and SETL	A wash up of OMRCA2 and OMRCB to allocate fixed costs on actual train volumes. SETL suggests an annual wash up. EIL proposes this only occurs when actual volumes deviate by 10%.	Approve proposal with no annual trigger level.	HS1 did not support this as it was not a proportionate proposal. However, the ORR has determined principles for the wash up that mitigates potential new risks that would have been imposed on HS1.
APA_t term	EIL	The APA_t term in the wash up provisions is restricted to inflation indexation differences only.	Approve proposal.	HS1 accepts this on the basis that dedicated wash up terms for OMRCA2 and OMRCB are adequately included in the general wash up formula in the Access Terms.
VRO % trigger	EIL	Change the trigger for a VRO from 4% difference in train volumes to 10%.	Reject proposal.	HS1 is strongly opposed to the proposal. It would increase HS1's volume risk with significant financial implications.

Area	Proposed by	Proposal	ORR FD position	HS1 position*
VRO reapportion-ment	EIL SETL supports only if A2/B wash up introduced.	Operators should approve volume forecasts HS1 uses to execute a VRO if these are above the FWT.	Approve proposal.	HS1 accepts this outcome. We did not support this because it could create perverse incentives that could unfairly advantage the international operator.
Dedicated OMRCA2/B wash up terms	EIL	Include dedicated terms for OMRCA2 and OMRCB so these are not washed up through APA_t term. EIL proposes the wash up of OMRCA2/B occurs only when volumes deviate by 10%.	Approve proposal so OMRCA2 and OMRCB are not washed up, but with no deviation of 10%.	HS1 accepts this, but without any trigger level.
OMRCA1 wash up	EIL	The OMRCA1 wash up approach is changed so OMRCA1 applies to the ex-post volume of trains; that OMRCA1 is refunded if volumes are below FWT.	Approve proposal where difference between actual trains and FWT trains is positive - but not in cases below FWT. Wash up occurs over a railway period.	Accepted, noting that HS1 had set OMRCA1 in accordance with the Railway Regulations 2016.

Area	Proposed by	Proposal	ORR FD position	HS1 position*
OMRC indexation floor	EIL SETL supports this	Remove the floor to inflation indexation for OMRC so negative inflation (deflation) is passed on to the operators' charges.	Reject proposal.	HS1 does not support the proposal. This would create misalignment with the Operator Agreement (for which a floor is a reasonable approach). This would unreasonably expose HS1 to inflation risk and under-recovery with significant implications.
Delay Attribution Board (DAB)	EIL SETL supports this	The DAB is used as the relevant dispute resolution body for delay attribution disputes to improve the efficiency and effectiveness of dispute handling.	Reject proposal. Parties can undertake exploratory work on the usefulness of the proposal if there is system-wide agreement.	We do not support this proposal. It is not clear if a move to the DAB would result in more effective and efficient dispute resolution, nor if the DAB has the relevant expertise and experience to handle specific differences in the HS1 system. Implementing this change is not straight forward, involving amendments to a wide range of contracts and negotiation of an agreement with the DAB. Exploring this would require a detailed assessment of cost, benefits and risks and HS1 would need to be funded for external technical expertise and legal costs.

Area	Proposed by	Proposal	ORR FD position	HS1 position*
Allocation of perfor-mance incidents	SETL	The timeframes for reviewing performance incidents should be extended to allow reasonable time to review, and the governance for the process outlined.	Reject proposal.	HS1 does not agree with this change. The process, timeframes and governance for allocating and disputing performance incidents is long established. All parties are familiar and have clarity on the processes.
Outside scope of PR24				
Invoicing	EIL and SETL	Proposals so that: • An operators' payment period only starts after all necessary and accurate invoices and supporting documents are received, to allow reasonable time to review. • Operators' may withhold amounts of an invoice they dispute to incentivise HS1 to improve invoicing accuracy. Currently operators must pay the invoice in full and then dispute. • There is specific reference to accurate and timely invoicing in the general standard for performance for HS1 (EIL only).	Invoicing arrangements are out of scope of the review.	HS1 does not agree to these proposals. The first two proposals would cause uncertainty in payment of HS1's invoicing and impact HS1's cash flows and financial risk. HS1 fully shares the operators' desire for all invoicing information to be provided in an accurate and timely manner. This requires a constructive and collaborative approach as all parties have a role to play. Changing established payment terms is an

Area	Proposed by	Proposal	ORR FD position	HS1 position*
		• Reciprocal charging of interest applies on late payments by HS1 to operators (SETL only).		inappropriate and unreasonable step to improving the situation. A specific reference in the general standard for performance is not necessary as it applies across the PAT, including payment and invoicing terms. The PAT already provides for reciprocal charging of interest.
Outperformance	EIL and SETL	The current Outperformance Regime should be changed as it drives perverse incentives for NR(HS).	This is out of scope. The amendments can be made following the process in paragraph 5.2 of Section 9 of the PAT.	HS1 does not agree to a change. There is no clear evidence the current regime drives perverse incentives, or that changing the regime will deliver material net benefits.

Area	Proposed by	Proposal	ORR FD position	HS1 position*
IRC wash up	EIL	The IRC wash up approach is changed so IRC applies to the ex-post volume of trains run; that IRC is refunded if volumes are below FWT.	IRC is excluded from the scope of ORR's review by the concession agreement which takes precedence over the PAT.	HS1 does not agree. HS1's approach is consistent with the Concession Agreement and the Railway Regulations 2016. IRC is refunded under the conditions set out in the PAT. This proposal may also create perverse incentives for operators to 'block' capacity by overbooking slots then cancelling at short notice with no penalty, resulting in inefficient use of the HS1 infrastructure.
Interim Review trigger	EIL	Introduce a new trigger for an Interim Review when train volumes deviate by more than 25% from forecasts so the potential impact of large changes in train volumes on charges is subject to regulatory review.	The triggers for an Interim Review are set out in the concession agreement and are therefore out of scope of the review.	HS1 does not agree. As seen in Covid, there can be large changes in train volumes without a material impact on costs. This trigger could lead to burdensome Interim Reviews being unnecessarily triggered. We consider the existing provisions for an Interim Review sufficiently broad to capture the necessary circumstances.

* More detail on HS1's position is provided in the May 2024 5YAMS supporting document 'PAT proposals by operators – HS1 response'; HS1's response to the ORR's DD consultation submitted in November 2024; and HS1 November 2024 5YAMS.

18.12 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 FTAA is due to expire in August 2025. SETL FTAA will expire in December 2029.

We have just been through the process of agreeing and signing new FTAAs presents an opportunity to review the existing agreements. We engaged with stakeholders on how we can ensure all FTAAs 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. The ORR DD concluded that HS1's charging structure and methodology appear to continue to comply with legal requirements and are designed to send appropriate price signals. The ORR did not change this position in the FD.

The ORR DD also concluded that certain freight long term avoidable costs (OMRCA2) are better defined as common costs (OMRCB), as these costs are incurred even when there are no freight services (see Section 12.4.3). We have implemented this change in the route charging model.

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).

- OMRCB: the long term common costs. OMRCB includes, for example, head office costs, other fixed costs, mothballing 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.[29]

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

[29] The three publications related to our Structure of Charges Review are published on HS1's website: https://highspeed1.co.uk/regulatory/periodic-reviews

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.
- **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 70.

Table 71: Structure of Charges review - conclusions and next steps

Item	Conclusions and Next Steps
IRC	HS1 discount policy remains appropriate. HS1 will consider any discount proposals for new and underutilised routes in line with the current policy.
Renewals costs	At the start of the PR24 process, ORR intended that the long-term renewals annuity methodology used in PR19 is used for PR24 and that it is willing to explore profiling of the annuity within CP4 to support operators' affordability if needed. In the DD, the ORR was comfortable with our annuity modelling approach and made some further adjustments set out in Section 13.6.2. 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. 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 which, following some small adjustments identified in the DD, the ORR approves.
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.

Item	Conclusions and Next Steps
Other operators	HS1 cannot pursue the allocation of stations costs to Govia Thameslink Railway for use of St Pancras without DfT agreement. We asked ORR to consider this in its review of stations cost allocation. The ORR concluded there are contractual inconsistencies for the Thameslink Box so we have committed to revisiting this in Year 1 of CP4 (see Section 18.10).
Other incentives	HS1 will keep the reactivation of the Capacity Reservation Charge under review. 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. We will make contractual amendments to the Access Terms to incentivise the booking of realistic train volumes and fair allocation of costs across operators (see Section 18.11).
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. 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 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 to take steps 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. There is currently no certainty that a solution can be found which meets DfT's risk requirements. If the changes are taken forward, DfT and HS1 will need to recover the legal fees incurred, as well as ORR regulatory fees, from the operators which are the sole beneficiaries of this enhancement. The ORR FD confirmed that the efficient costs of implementing changes to the Concession Agreement and Station Leases should be borne by operators.

We initially estimated this cost 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 based on the costs, given the benefit of the changes to the Authorised Investments and returns current forecast. However, it should be noted that the project scope is likely to evolve from that on which this cost estimate is based.

The passenger operators support these projects. Given the support for the project to amend Authorised Investments in the Concession Agreement, HS1 proposed to incorporate this into our 5YAMS proposals so that we are ready to assist if DfT can proceed. We considered that

treating this as a pass through cost for CP4 is the most appropriate cost recovery mechanism. This is because:

- DfT and ORR legal costs account for a significant majority of the project costs. Furthermore, as this is a DfT-led project, HS1's costs will be largely dependent on how DfT runs the project. Therefore, HS1 will have little control over these costs.
- HS1 is supporting this project because of the benefit it will deliver to the operators. However, as there is no direct benefit to HS1 beyond reduction of costs to the operators, HS1 should not face the cost risk (primarily derived from DfT and ORR legal fees) for this project. Including this as part of HS1's fixed budget would put cost risk on HS1.
- It remains uncertain if DfT will proceed with the project and when. Using the pass through cost mechanism means HS1 is not unnecessarily holding operators' money over the full Control Period.

The ORR FD concluded that there was too much uncertainty around this project, and that these costs should be negotiated with operators nearer the time the costs are incurred. HS1 will not be able to take forward any work on this project until a cost recovery agreement with the operators is in place as we are not funded for this work.

In the FD, the ORR agrees it would be beneficial to change the Concession Agreement to allow HS1 Ltd to achieve better returns on the escrow accounts. It suggested a working group including HS1, DfT and operators be set up and are content to help facilitate this. HS1 welcomes this and would participate in a working group if DfT decides to this is appropriate.

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 71 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 72: Escrow account movements (£m, nominal)

	Route		Stations	
	CP3 outturn	CP4 forecast	CP3 outturn	CP4 forecast
Opening balance	91.3	189.2	52.7	84.7
Transfers in	154.5	160.9	54.0	48.4
Withdrawals	(67.6)	(242.5)	(27.5)	(57.4)
Interest	11.0	28.8	5.4	13.6
Closing balance	189.2	136.4	84.7	89.3

Part 5:

CONCLUSIONS AND NEXT STEPS

21 Conclusions

This 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 plans compared to previous periodic reviews. We have based our plans 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 are pleased to confirm these plans that provide a real terms reduction in charges for operators and we are confident that these plans provide a solid foundation for growth.

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 has driven a change in the LET renewals strategy to more frequent smaller scale operational interventions across the 40-year period, away from the larger full scale asset renewals in the 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 11% 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 a 6% 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 operators had a positive impact. Pass through costs for CP3 are forecast to be 0.4% 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. The ORR had access to more detailed information for its review and assurance of NR(HS) costs. Based on this, the ORR determined a further £11.5m reduction in NR(HS) costs for additional efficiency opportunities. This results in an overall reduction of 5% in O&M costs for the CP4 efficient budget compared with CP3. 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. The ORR also determined efficiencies in long term renewals costs from accelerated asset maturity and better base cost estimation.

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. We have also removed the annuity uplift (for underfunding of the escrow in CP1 and CP2) and allowed small negative balances in later years in the annuity modelling. The resulting route renewals annuity is £28.1 million per annum, a reduction from £34.0 million per annum in PR19. In response to concerns we raised on the ORR-driven adjustments to renewals costs and

annuity calculation, the ORR noted it is satisfied that any risk to future charges and renewals funding can be appropriately managed through future periodic reviews.

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. HS1 has reviewed the NR(HS) proposals and has applied the Cost Policy to stations with a similar approach as for route renewals. The ORR determined efficiencies in long term station renewals costs similar to route, which has resulted in an overall 40-year renewals cost of £475 million across the four stations. To calculate the LTC, similar to route, these renewals costs have been inflated by the CPI long term forecast, the annuity has been partially weighted by train volume forecasts, and we have allowed small negative balances in later years in the annuity modelling.

Overall, our plans deliver a net reduction of 10% 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 15% to 20% compared to current charges, which reflect the VRO reapportionment of fixed costs during CP3. Relative to the PR19 determined charges, there is a decrease of 2 to 3%. 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 charges for CP4 and comparisons with PR19 and current charges are shown in Table 72.

Table 73: CP4 OMRC per train variance to current and PR19 charges (February 2023 prices)

Service Group	PR24	Current*	% change	PR19	% change
International (all services)	£2,537	£3,168	(19.9%)	2,605	2.6%
Domestic					
Ashford - St Pancras (and vice versa)	£1,896	£2,234	(15.1%)	1,935	2.0%
Springhead Jn - St Pancras (and vice versa)	£988	£1,170	(15.6%)	1,011	2.3%
St Pancras – Ebbsfleet (Up)	£852	£1,005	(15.2%)	870	2.1%
St Pancras – Ebbsfleet (Down)	£906	£1,071	(15.4%)	927	2.2%

* These are the 2023 VRO charges issued in February 2024 and OMRCC as at January 2024.

We are forecasting zero freight on HS1 in CP4 but have used a shadow model with 200 trains per year to calculate an indicative charge in the event that freight resumes services on HS1 in CP4. We have also reallocated certain freight-specific fixed costs to common costs, which are funded by passenger operators, in response to the ORR DD. The indicative freight OMRC charge per train has decreased compared with the charges determined in PR19, reflecting the reallocation of costs. Table 73 shows the indicative 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 74: CP4 freight charges per train (February 2023 prices)

	PR24	Current*	% change	PR19	% change
Indicative Freight OMRC	£648	£1,424	(52%)	£981	(30%)
Ripple Lane (Domestic Sidings) charge	£77.82	n/a	n/a	£71.42	9%

* These are the FY2024/25 VRO charges issued in April 2024.

The LTC for all stations is £8.5 million per annum, a reduction from £11.6 million in PR19, as shown in Table 74. The LTC for each station has reduced compared to PR19.

Table 75: Stations Long Term Charge CP4 (£m pa, February 2023 prices)

Station	PR24	PR19	£ change	% change
St Pancras	5.32	7.55	(2.23)	(30%)
Ebbsfleet	1.35	1.62	(0.28)	(17%)
Stratford	1.24	1.54	(0.29)	(19%)
Ashford	0.56	0.87	(0.31)	(35%)
Total	**8.47**	**11.58**	**(3.11)**	**(27%)**

Combined costs for route OMRC and stations LTC and Qx are set out in Appendix A7.

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.

The ORR has approved 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 changes have arisen from our review of charges and terms during the PR24 process and the greater uncertainty in the system as well as proposals from the operators.

Stakeholders supported delaying the recalibration of the **performance regime** until CP4. We will begin the recalibration by September 2025 when there should be sufficient data. For this, the Access Terms needs to include 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 will 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 will make amendments and help clarify the VRO to address the issues identified, and include a provision for a reopener to reallocate Ripple Lane costs in the event there was no freight using the sidings.

We will 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 will also make the following changes to the Access Terms:

- Changes to the pass through costs **wash up** to address issues with the application of the provisions identified during Covid-19;
- Clarification of billing of Additional IRC on spot bids;
- Amendments to reflect the removal of **carbon costs**, which relate to a scheme which is now closed, and legislative changes; and
- Update the FAT for the N-1 Scheme and On-train Metering for consistency with the PAT.

We do not consider making changes to the **outperformance regime** would deliver material benefits to the system. The provisions in the Access Terms however need updating to reflect CP4 dates.

The ORR has also approved amendments to implement an annual wash up of fixed costs so total costs for operators are calculated at the end of the year based on actual volumes operated. This is significant change from the current approach of charging fixed costs based on FWT.

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 steps which would allow us to improve escrow returns. HS1 is ready to support this work. For some of this work to proceed, HS1 and DfT will need to recover external costs associated with amending the Concession Agreement from the operators. The ORR did not support us recovering these project costs as a pass through cost given too much uncertainty around the project. HS1 will need to have a cost recovery agreement in place with the operators to be able to take this work forward. 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). In accordance with the regulatory framework 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 operating on HS1 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 assume that the NR(HS) proposed cost envelope can cover the costs associated with a permanent asset resolution at the Thames Kent Portal following the recent flooding event. This is subject to conclusion of the asset redesign.

The submission of our 5YAMS is a significant milestone in the PR24 process. Our plans for CP4 which have implemented the ORR FD outcomes meet the asset stewardship obligations in our Concession Agreement and Station Leases, while delivering a good service at an efficient cost to operators.

22 Next steps

This 5YAMS has been submitted to ORR on 3 February 2025 in accordance with the requirements set out in the Concession Agreement and Station Leases, along with the supporting documentation listed in Appendix A4.

We will 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
DD	Draft determination
DfT	Department for Transport
DTN	Data Transmission Network
EAG	Energy Action Group
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
FD	Final determination
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
REACT	Route Energy Action & Carbon Reduction Team
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 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
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

Paragraph 5.4	Requirement	LCRs section reference
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:*	-
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

Paragraph 5.4	Requirement	LCRs section reference
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
5.4.6 (B)	the distribution of any Deferred Life Cycle Works Saving pursuant to paragraph 7.1;	None proposed
	which shall include:	-

Paragraph 5.4	Requirement	LCRs section reference
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
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*	-

Paragraph 5.4	Requirement	LCRs section reference
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 this 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. The "Supporting documentation" column highlights which documents are new and which documents have been updated since the May 2024 5YAMS submission. We also provide the slide pack presentations from the PR24 stakeholder bilateral meeting and workshops for easy reference. In addition to the supporting documentation listed below, we will share additional evidence of our progressive assurance activities with the ORR.

Route supporting documentation

Supporting documentation	ORR/DfT	Operators
HS1 SAMP Strategic Asset Management Plan (publicly available on HS1's website)	✓	✓
Summary of draft 5YAMS stakeholder feedback and HS1 responses – confidential (non-confidential version is available on HS1 website: https://highspeed1.co.uk/regulatory/periodic-reviews)	✓	✓
NR(HS) Route 5YAMS for Control Period 4 (and Appendix 1) - Updated, 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	✓	✓*

Supporting documentation	ORR/DfT	Operators
Appendix 7: Specific Asset Strategy: Overhead Contact System	✓	✓*
Appendix 8: Specific Asset Strategy: Traction Power Supply	✓	✓*
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 - Updated	✓	✓*
Impact of ER NIC on O&M AFP	✓	-
Note on NRHS Asset Management approach PR24	✓	✓
HS1 assurance of NR(HS) O&M costs	✓	-
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 (for November 2024 5YAMS)	✓	✓

Supporting documentation	ORR/DfT	Operators
Summary of Ballast Unit Rate Development	✓	-
NR(HS) Possession Allowance CP4 PATFAT Proposal	✓	✓
HS1 Security and Cyber Security Strategies	✓	-
HS1 Sustainability Strategy (publicly available on HS1's website)	✓	✓
HS1 Cost Policy	✓	✓
Cost Levers Scoring Report May 2024	✓	✓
OMR Effectiveness Study (Route benchmarking)	✓	✓
O&M Cost allocation – Updated	✓	✓
Renewals – Allocation to Structure of Charges - Updated	✓	✓
HS1 Route Charging Model PR24 v4.0 - Updated	✓	✓
HS1 PR24 Charging Model Audit Final Report	✓	✓
Long term train path forecasts - Updated	✓	✓
Revised train path forecasts explanatory note (provided with November 2024 submission)	✓	✓^
PR24 Route KM change note	✓	✓
PAT proposals by operators – HS1 response; PAT proposals – EIL; PAT proposals – SETL (May 2024)	✓	✓
OMRC cost changes - ER NIC and GSMR – overview	✓	✓*

Supporting documentation	ORR/DfT	Operators
PR24 HS1 costs – November 24 increases	✓	-
Fixed cost wash up – overview (for November 2024 5YAMS)	✓	✓
Cost of new fixed cost washup (for November 2024 5YAMS)	✓	-
Delay Attribution Board cost estimate	✓	-
Deflation risk management	✓	✓*

^ Redacted versions provided directly to the Passenger Operators.

Stations supporting documentation

Supporting documentation	ORR/DfT	Operators
PR24 Life Cycle Reports (4 reports: St Pancras, Stratford, Ebbsfleet and Ashford) – Updated	✓	✓
HS1 SAMP Strategic Asset Management Plan (publicly available on HS1's website)	✓	✓
Summary of draft 5YAMS stakeholder feedback and HS1 responses – confidential (non-confidential version is available on HS1 website: https://highspeed1.co.uk/regulatory/periodic-reviews)	✓	✓
NR(HS) Stations 5YAMS for Control Period 4 (and Appendix 1), including:	✓	✓
Appendix 2: NR(HS) Strategic Asset Management Plan	✓	✓
Appendix 3: Specific Asset Strategy: Stations Civils	✓	✓*
Appendix 4: Specific Asset Strategy: Data & Communication	✓	✓*

Supporting documentation	ORR/DfT	Operators
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)	✓	-^^
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 Cost Policy	✓	✓
Cost Levers Scoring Report (Stations)	✓	✓

Supporting documentation	ORR/DfT	Operators
HS1 Sustainability Policy	✓	✓
HS1 LTC Charging model PR24 v4.0 - Updated	✓	✓*

^ 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 receive.

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. 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: • Trials of automated inspection and video analytics. • Deploy Remote Condition Monitoring on points and switches, this may then be expanded to other assets whose failure significantly impact cost or performance. • Adopt risk-based maintenance approaches to identified assets. • 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. 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.	HS1 and NR(HS) to trial the implementation of streamlined governance on Routine 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. Outcome of trial to be incorporated into PR29 plans (if, appropriate).
8	HS1 to begin a performance regime recalibration exercise by 1 September 2025 to recalibrate updated parameters.	By 1 September 2025

	Commitment	Milestone
9	(a) HS1 will report on the progress of the improved LET monitoring plan outlined in the SAS in the AMAS throughout CP4.	(a) Each AMAS in CP4.
	(b) HS1 will review the MEP asset data monitoring plan for opportunities to improve it by Year 1 of CP4. HS1 will report on this in the HS1 AMAS.	(b) Year 1 AMAS.
10	HS1 will review the governance of stations renewals. This will focus on aligning governance of stations renewals to the governance of route renewals, for example, better use of leading indicators and better packaging of works.	Year 1 AMAS
11	HS1 will report on changes that have been made and benefits that are being realised by NR(HS) around managing recovery of the train services following an incident by the end of CP4 Year 1.	Year 1 AMAS
12	HS1 will report on any new initiatives or examples of safety by design in the AMAS on an ongoing basis.	Each AMAS in CP4
13	(a) HS1 will hold a working group with NR(HS) and DfT to discuss possible solutions for introducing charging infrastructure at Singlewell Depot. HS1 will report on progress in the Year 1 AMAS.	(a) Year 1 AMAS
	(b) HS1 will lead on progressing the delivery of the solar panel initiative. We will report back on progress in the Year 1 AMAS.	(b) Year 1 AMAS
	(c) HS1 and NR(HS) will explore options to integrate circular economy design principles and sustainable procurement into future projects, and expand our existing circular economy plan to reflect this. As the asset owner, HS1 will involve DfT in this workstream as required. HS1 will report progress in our annual ESG reports under the 'Resource Use and Waste Impacts' section, with key updates provided after year 2 of CP4 (2026-27 ESG report).	(c) Progress updates in annual EAS report. Key update in Year 3 ESG report.

	Commitment	Milestone
	(d) HS1 will undertake a biodiversity re-baseline survey and develop a management plan to achieve net gain by the end of Year 1 that allows HS1 and NR(HS) to make a business decision on implementation. The management plan will have regard to priorities set in Local Nature Recovery Strategies and the Government's Environmental Improvement Plan.	(d) Year 1 AMAS
14	HS1 will hold a working group with DfT, NRIL and, where relevant, operators to review the contractual arrangements between the Thameslink Box and St Pancras International in Year 1 of CP4. This will consider if alternative contractual arrangements are possible to address inconsistencies in charges between operators that run directly competitive services. HS1 will report back on the outcome of this working group in the Year 1 AMAS.	Year 1 AMAS.
15	HS1 will include a weather resilience strategy in each discipline SAS by the end of CP4.	End of CP4.
16	HS1 will develop "supplier engagement" targets in line with SBTi's updated target validation criteria by Year 1 of CP4 and liaise with key suppliers to monitor their progress on delivering these targets across CP4.	Targets by end of Year 1.
17	We will Incorporate supplier-specific data into our annual Carbon Footprint Analysis by the end of Year 2 of CP4 to develop an updated scope 3 emissions baseline. We will report on the progress for this commitment in our annual ESG reports.	Data by end of Year 2
18	During CP4 we will further develop Cost Policies for route and stations, evolving them into integrated cost models, linking volumes and HS1 outturn renewal costs, considering risk application/methodology improvements. We will report on the development of the Cost Policies in the HS1 AMAS.	During CP4. Ongoing progress reporting over CP4.
19	We commit to develop, socialise and implement a stakeholder engagement plan for the ballast campaign in Year 1 of CP4, continue the development works and update system stakeholders of progress towards delivery in accordance with the plan.	Year 1 of CP4

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 76. 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 76: 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 4% of recoveries 100% of tamping costs, grinding costs and infrastructure freight haulage costs 9.5% of contribution to national functions 13% of specialist contractors 19% of materials	100% of wear-related Track renewals 25% of non wear-related Civils renewals 50% of mostly wear-related Civils renewals 25% of mostly non wear-related Civils renewals 40% SC&C - equally wear and tear / non-wear and tear related 100% of the cost for the Overhead Catenary Contact Wire (within E&P assets)
Track dependent, traffic independent costs	65% of infrastructure staff costs 100% of operations staff costs 23% of recoveries 100% of plant and vehicle costs, track recording costs and security of infrastructure costs 79% specialist contractors 81% materials	100% of non wear-related Track renewals 75% of non wear-related Civils renewals 75% of mostly non wear-related Civils renewals 50% of mostly wear-related Civils renewals 60% SC&C - equally wear and tear / non-wear and tear related renewals 100% non wear and tear SC&C renewals 100% non wear and tear E&P renewals

Cost apportionment category	O&M costs	Renewal costs
Operator dependent costs	None	None
Fixed common costs	All remaining NR(HS) O&M costs NR(HS) management fee and Contract Risk HS1 costs R&D costs ORR determined O&M efficiencies	100% of SC&C fixed cost renewals 100% of E&P fixed cost renewals 100% of Rail Plant renewals NR(HS) management fee 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 is weighted by train volume forecasts over 40 years.

We had previously included an uplift for underfunding of the escrow account in CP2 and adjusted so there are no negative balances at any time during the 40 years; these have been removed in response to the ORR FD (see Section 13.6.2).

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 77.

Table 77: Allocation of costs between passenger train operators

Cost apportionment category	Basis of allocation between operators
Track and traffic dependent costs	Allocated between all operators (passenger and freight) on the basis of: No. of trains x EMGTPA weighting per train The uses the forecast number of trains for each operator
Track dependent, traffic independent costs (net of mothballing costs) • International track • Domestic track • Common track	• Train minutes on international track • Train minutes on domestic track • Train minutes on common track Where the domestic operator's forecast number of trains are below the domestic underpin level and the domestic underpin is triggered, we use the number of minutes given by the domestic underpin
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 Where the domestic operator's forecast number of trains are below the domestic underpin level and the domestic underpin is triggered, we use the number of minutes given by the domestic underpin.

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; where the domestic operator's forecast number of trains is below the domestic underpin level and the domestic underpin is triggered, we use the number of minutes given by the domestic underpin. 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) capture the Ripple Lane charge for HS1 freight. The ORR DD concluded that certain other freight-specific fixed costs were better defined as common costs and we have implemented this change (see section 12.4.3).

The cost of operating and maintaining Ripple Lane exchange sidings (net of mothballing costs) is split based on the number of trains forecast to be operated between the:

i) 'HS1 Freight' – those trains accessing Ripple Lane to travel to/from the HS1 network from/to the NRIL network; and

ii) 'Domestic Freight' – those 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 HS1 freight (those using the HS1 and domestic sidings) is recovered under OMRC. The cost for freight using the domestic sidings from the NRIL network only 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.

The **freight long-term avoidable costs** are the HS1 freight share of the Ripple Lane 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)

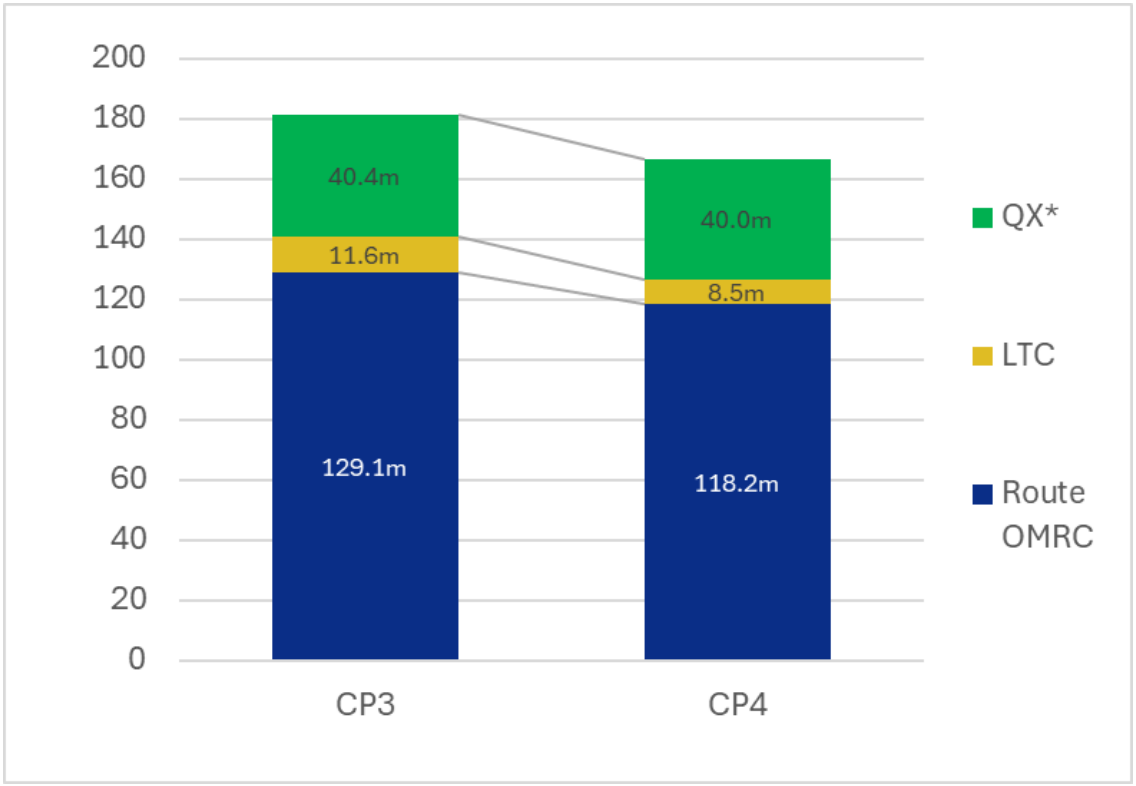
A charge per train is calculated by dividing the Ripple Lane (Domestic Sidings) costs by the forecast number of such trains; see Section 15.4.2.

A7 Combined costs

This section sets out the combined costs for route operations, maintenance and renewals (OMRC), stations operations and maintenance (Qx) and stations renewals (LTC) that the operators will pay in CP4 compared with CP3 as determined in PR19.

Figure 49 shows the average annual combined costs by cost area. The combined annual costs are £167 million in CP4 compared with £181 million in CP3. Costs have fallen across all three areas, with OMRC average annual costs lower by 8%, LTC lower by 27% and Qx lower by 1%.

Figure 49: Average annual cost by area (£million, February 2023 prices)



* Qx for CP3 is based on 2020/21 Best Estimates. Qx for CP4 is based on 2024/25 Best Estimates.

Table 78 shows the average annual combined costs by operator. The annual costs have decreased relative to CP3 as determined in PR19 for all operators except EMR where a higher share of Qx costs has offset the reduction in LTC.

Table 78: Combined OMRC, LTC and Qx (£m average pa cost, February 2023 prices)

	CP4	CP3	% change
EIL	62.7	67.7	(7.3%)
SETL	93.9	103.4	(9.1%)
EMR	10.1	9.7	4.0%
Freight	-	0.4	(100%)
Total	**166.7**	**181.1**	**(7.9%)**

A8 Zero freight scenario

In our Final May 5YAMS, HS1 analysed a scenario where there is zero freight on HS1 given this was a possibility at that time. We considered the impact on asset management plans and costs, how costs should be redistributed and the resulting OMRC for passenger operators and the Ripple Lane (Domestic Sidings) charge – all based on the Final May 5YAMS costs and charges. In this scenario we have assumed the removal of freight means only that freight services do not operate but HS1 still has responsibility for the freight-only assets, i.e. that these assets are not sold or removed. This analysis supported the ORR's conclusion to reallocate certain freight fixed costs into common costs funded by passenger operators (see Section 12.4.3).

A8.1 Impact on asset management plans and costs section

For the Final May 5YAMS, the asset management plans developed for PR24 were based on the likely traffic volume scenario at the time. This expected 200 freight trains per annum, within a total traffic volume of between 66,752 and 66,949 trains per annum. Freight's proportion of total system traffic was very small at less than 0.3%.

The reduction in freight from 200 trains per annum to zero had very little impact on the HS1 assets. The scenario resulted in less than one train per day being removed from traffic. This would not affect the maintenance and renewals plans for the HS1 system, nor the associated costs. The freight-specific assets are the two sidings connecting to Dollands Moor and Ripple Lane and the North London Line connection. These are very limited infrastructure (c12km in total) with low levels of traffic. The extent of inspection and maintenance in these areas was already at the minimum level to maintain safety requirements. Therefore, the zero freight scenario has no impact on the asset management approach needed to maintain this infrastructure. In summary, there was no change in the NR(HS) operations, maintenance and renewals plans and costs for CP4.

The other costs incurred by freight at the time we prepared this scenario analysis were HS1 costs and Ripple Lane costs.

Similar to the impact on asset management, there would have been negligible impact on HS1's internal and subcontract costs from the reduction of freight from 200 to zero. Given that freight accounts for a very small share of the overall requirements needed, HS1 could not partially adjust the staff required to deliver the services provided. Nor would our technical support or office costs change. The services we would need to procure under the NRIL, NGC, BTPA or our ORR regulatory fees would not change materially because freight accounts for a small proportion of the requirements, therefore there would be no impact HS1 subcontract costs.

NRIL costs for operating, maintaining and renewing Ripple Lane exchange sidings are shared between HS1 freight and domestic freight (that accesses and uses Ripple Lane from the NRIL network without entering HS1) after mothballing costs are subtracted. The costs for CP4

estimated by NRIL were not sensitive to the reduction in freight volumes between CP3 and CP4 as there is a certain level of work that needs to be undertaken to keep the asset maintained to the required standard. Furthermore, domestic freight accounts for the significant proportion of traffic at Ripple Lane, while the volume of HS1 freight is much smaller. Therefore, we do not expect the Ripple Lane costs to change.

It is important to note that this assessment of the cost impacts is considering a change in volume from an already small base. If there was a large increase in freight volumes this is likely to have a material impact on asset management plans and costs.

A8.2 Cost reallocation

As outlined above, overall operations, maintenance and renewals costs for CP4 are not expected to change in a zero HS1 freight scenario. Table 79 shows how the costs would be reallocated in the HS1 system based on the Final May 5YAMS costs.

Table 79: Reallocation of freight costs as per Final May 5YAMS (February 2023 prices)

Cost category	Cost p.a.	Reallocation
OMRC		
NR(HS) O&M and renewals costs that are directly incurred (Freight OMRCA1)	£125k	Total directly incurred costs are apportioned across passenger operators.
NR(HS) O&M and renewals costs that are long term avoidable (Freight OMRCA2)	£60k	Costs become additional mothballing costs*, transferred to OMRCB and apportioned across passenger operators.
HS1 costs	£60k	Total HS1 costs (including freight proportion) are fixed costs and apportioned across passenger operators.
Total OMRC reallocated	*c£245k*	*Allocated across to passenger operators.*
Other		
Ripple Lane costs	£18k	Total Ripple Lane costs (excluding mothballing costs) apportioned across domestic freight operators.

* This is in addition to the £18k pa freight track mothballing costs already transferred to OMRCB when freight is operating on HS1 (see Section 12.4.3).

Five Year Asset Management Statement for Control Period 4