OFFICE OF RAIL AND ROAD

ORR's annual report on HS1 Ltd 2017-2018

July 2018

Contents

Foreword

This report outlines the work we have done during 2017-18 under the terms of the HS1 Concession Agreement, the Railways Infrastructure (Access & Management) Regulations 2016 and relevant health and safety legislation. Separately, we commenced the periodic review of HS1's next control period in January 2018.

In summary, HS1 Ltd's performance remained positive in this reporting year, with only 0.34% of services (245 trains) being delayed by HS1 Ltd-attributable incidents. The overall average seconds delay per train in 2017-18 was 5.06, well above the performance floors set out in the Concession Agreement and better than HS1 Ltd's aim of lower than 10 seconds within the second control period (CP2, covering 2015-20) determination.

Billed train paths on the HS1 network fell by 1.5% overall, mostly due to a decrease in the number of timetabled international trains. As part of its periodic review completed in 2014 (PR14), ORR approved HS1's proposals for a volume re-opener for operations, maintenance and renewals charges subsequent to a +/-4% change. Following annual review in February, HS1 Ltd notified DfT and passenger train operators of its intention to trigger the re-opener for charges in 2018-19 and 2019-20 subsequent to an 8.9% fall in Eurostar services.

Overall performance of the assets on the HS1 network continues to meet the key asset performance metrics included in the CP2 determination. The delivery of the work in 2017-18 was on budget but with significant schedule slippage from the baseline established in last year's HS1 Ltd Asset Management Annual Statement (AMAS); around 60% of the work that was scheduled for completion in 2017-18 was delivered. ORR is working with HS1 Ltd to understand the implications of deferring this work until later in CP2.

HS1's regulated costs exceeded its regulated income by £1.5m in 2017-18. This represented £0.8m of financial underperformance relative to our CP2 determination. It received £70.0m of regulated income, £1.8m higher than assumed by our 2014 periodic review (PR14). It spent £71.9m operating, maintaining and renewing its rail infrastructure in the year, £2.9m higher than assumed in PR14.

The report also explains progress on our next periodic review of HS1 (PR19), and with regard to health and safety, including details of our proposed health and safety regulation activities for 2018-19.

Graham Richards

Director, Planning and Performance

July 2018

Background

This document is ORR's annual report on HS1 Ltd for 2017-18. Previous reports are available on our website.

HS1 Ltd has a 30-year concession from the Secretary of State to operate and manage the HS1 network. ORR is the health and safety regulator for HS1 Ltd, and has economic regulation responsibilities through the Concession Agreement and the Railways Infrastructure (Access and Management) Regulations 2016 ("the Regulations").

HS1 Ltd is responsible for the overall management and operation of the HS1 network, and subcontracts delivery of operations, maintenance and renewals to Network Rail (High Speed) Ltd. Network Rail (High Speed) is also the safety duty holder for the HS1 network and therefore responsible for compliance with regulatory requirements relating to the management of safety on the HS1 network.

Under the terms of the Concession Agreement, ORR has an important role to play in ensuring the long term sustainability of the asset, while also making sure that HS1 Ltd is provided with incentives to reduce the costs of provision of infrastructure and access charges.

This report focuses on the following key areas:

- performance and data monitoring;
- asset management;
- finance and efficiency;
- the 2019 periodic review of HS1 (PR19); and
- health and safety.

We monitor train service performance through data provided by HS1 against key performance metrics. Asset management is monitored through delivery of HS1 Ltd's Asset Management Strategy. The Asset Management Annual Statement, along with asset stewardship key performance indicators, is used to assess HS1 Ltd's performance in maintaining its assets.

Further questions or comments on this report should be directed to:

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1. Performance and data monitoring

Overview

HS1 Ltd's performance during 2017-18 has been good, with only 0.34% of services (245 trains) being delayed by HS1-attributable incidents; this does however represent a 26% increase on last year. Nearly 70% of these delays were attributable to non-track assets, such as signal and power supply failures, and points failures which affected 104 trains. Billed train paths on the HS1 network fell by 1.5% in 2017-18, mostly due to the decrease in the number of timetabled international trains.

Performance

1.1 We monitor HS1 Ltd's operational performance against the performance floor measures set out in the Concession Agreement. The performance floor threshold sets out the minimum operational standards for HS1 Ltd. For an asset the age of the HS1 network, we would expect performance to be at a much higher level than the performance floor measures, which state that the proportion of services delayed by HS1 Ltd in a quarter should not exceed 15% and in a year must not exceed 13%. HS1 Ltd sets Network Rail (High Speed) a separate target of 5.5 average seconds delay per train. A summary of performance for the financial year ending 31 March 2018 is provided here:

Figure 1 – HS1 performance in 2017-18[1]

	Total number of trains timetabled	Total number of services delayed	Total number of services delayed (attributable to HS1)	Percentage of services delayed (attributable to HS1)	Total number of services delayed (unknown incident)
Domestic (St Pancras - NKL via Ebbsfleet)	26,538	2,585	66	0.25%	5
Domestic (St Pancras - Ashford)	28,810	2,855	108	0.37%	1
International	17,203	3,757	68	0.40%	2
Freight	444	101	3	0.68%	1
Total	**72,995**	**9,298**	**245**	**0.34%**	**9**

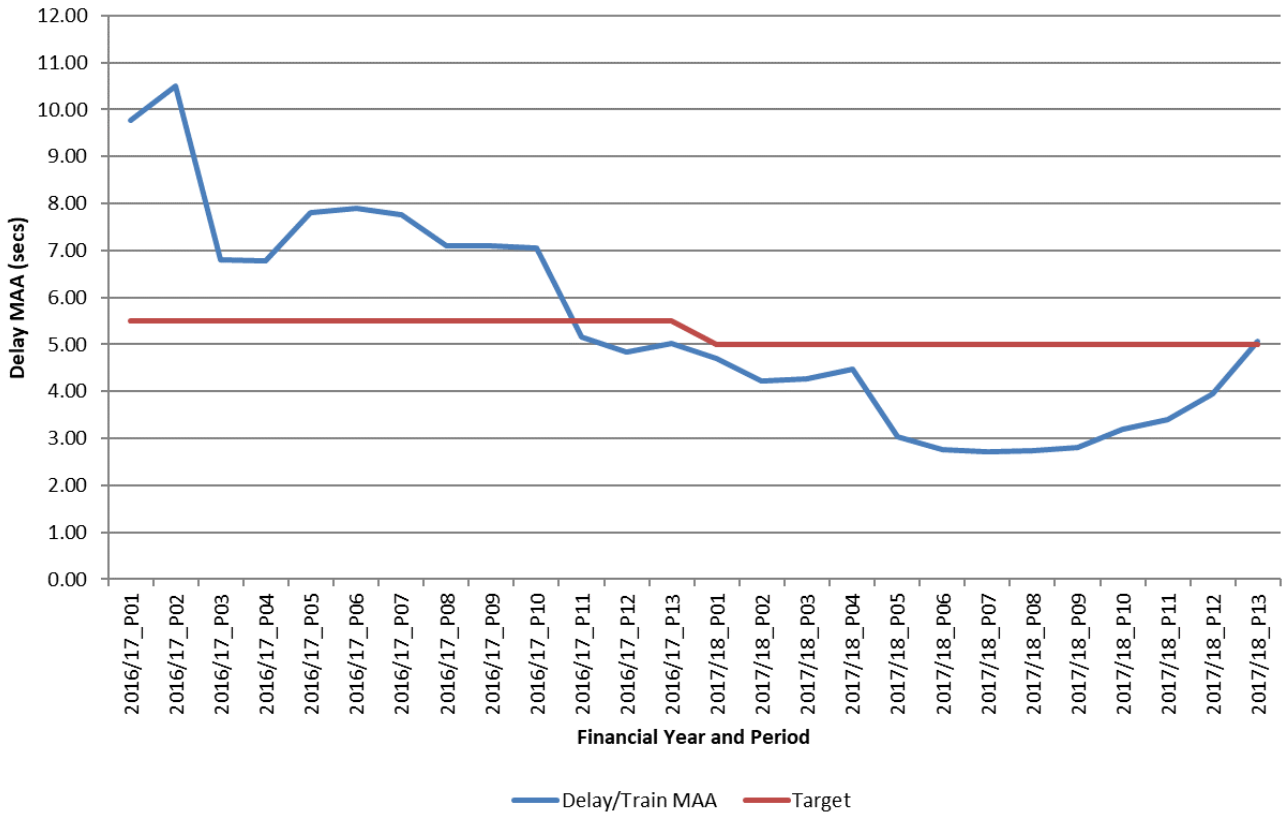
1.2 The proportion of trains delayed by HS1 Ltd-attributable incidents in 2017-18 was 0.34%, which is an increase from the improved percentage (0.26%) achieved last year. This was mainly due to a decline in performance towards the end of the year; in the last quarter two separate points failures resulted in a combined 1,358 minutes of

[1] Some of the figures included in this chapter are subject to revision due to various factors including the re-classification of some delay incidents.

delay. This led to a review of maintenance standards, specifically focused on aligning track and signalling tolerances.

1.3 As can be seen in Figure 2, by the end of 2017-18 average seconds delay per train was 5.06, beating the internal stretch target of 5.5 seconds.

Figure 2 – Moving annual average seconds delay per train on the HS1 network (delays attributed to HS1 Ltd), by period 2016-17 to 2017-18



Source: Network Rail (High Speed)

1.4 Further information on how asset performance and condition affected average seconds delay per train can be found in chapter 2 of this report.

Figure 3 - Delayed trains broken down by causes for which HS1 Ltd are wholly or mainly responsible, 2012-13 to 2017-18

Category	Incident description	Total number of services delayed (attributable to HS1)					
		2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Track	TSRs due to condition of track	0	0	0	0	0	0
	Track Faults including Broken Rails	1	60	0	0	0	11
	Reactionary delay to P-coded TSRs					1	0
	Track (total)	1	60	0	0	1	11
Non-track assets	Points failures	115	13	25	95	70	104
	OLE/Third Rail faults	6	50	5	52	2	40
	Signal Failures	19	1	0	14	9	1
	Track Circuit Failures	17	5	27	41	41	16
	Signalling System & Power Supply Failures	6	0	4	35	14	3
	Other Signal Equipment Failures	0	2	3	15	5	0
	Telecoms failures	4	0	0	1	4	3
	Non-track assets (total)	167	71	64	253	145	167
Network management	Problems with trackside signs including TSR boards	2	0	0	0	0	0
	Other infrastructure	0	0	6	3	0	5
	Track Patrols & related possessions	1	1	0	0	1	0
	Possession overrun & related faults	4	4	3	5	8	2
	Other possession related delay	0	39	0	0	8	0
	Network Rail Operations - signalling	65	36	32	36	20	26
	Network Rail Operations - control	4	1	0	18	1	4
	Network Rail Operations - other	15	6	5	11	1	14
	Timetable Planning	10	0	6	6	7	11
	Network Rail commercial takeback/other	0	0	0	0	0	0
	Uninvestigated delay	0	0	0	0	0	0
	Network management (total)	101	87	52	79	46	62
Severe weather	Civil Engineering structures, earthworks & buildings	0	0	0	0	1	4
	Wheel slip due to leaf fall	0	0	0	0	1	0
	Other weather	0	2	0	0	0	1
	Severe weather (total)	0	2	0	0	2	5
External fires	External fires	0	0	0	0	0	0
	External (total)	0	0	0	0	0	0
All	**Grand total**	**269**	**220**	**116**	**332**	**194**	**245**

Note: Please see caveat on revisions of figures.

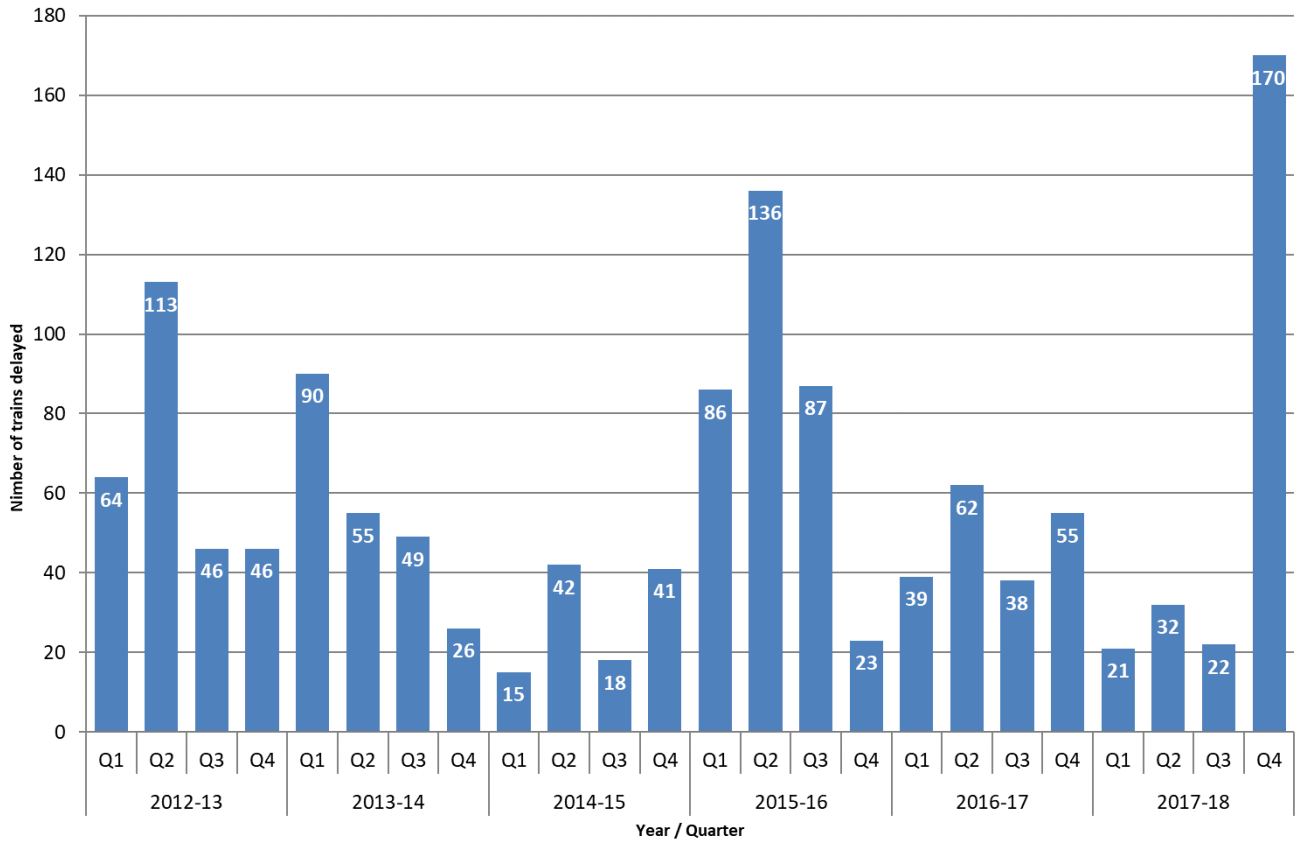
1.5 Figure 3 above shows the number of trains delayed by an incident wholly or mainly attributable to HS1 Ltd, displayed by cause. There were a total of 245 trains delayed in 2017-18, a 26% increase on last year.

1.6 Nearly 70% of the delays were attributable to non-track assets, such as signal and power supply failures and point failures which affected 104 trains. The majority of the delayed trains occurred in Quarter 4 (10 December 2017 - 31 March 2018) which accounted for 86 delayed trains. A points failure incident on 19 March 2018 at Stratford International caused delays to 50 domestic and international services and accumulated 921 delay minutes. A second points failure incident on 28 March 2018 between Nashenden Crossover and Crismill Crossover resulted in 437 delay minutes and affected 22 trains.

1.7 The number of trains delayed by network management issues, such as possession overruns and timetable issues, increased to 62 in 2017-18, accounting for a quarter

of the total delays. Around half of these (26 trains) were due to signal operations during the year.

Figure 4 - Number of trains delayed wholly or partly due to HS1 Ltd, 2012-13 Q1 to 2017-18 Q4



Note: Please see caveat on revisions of figures.

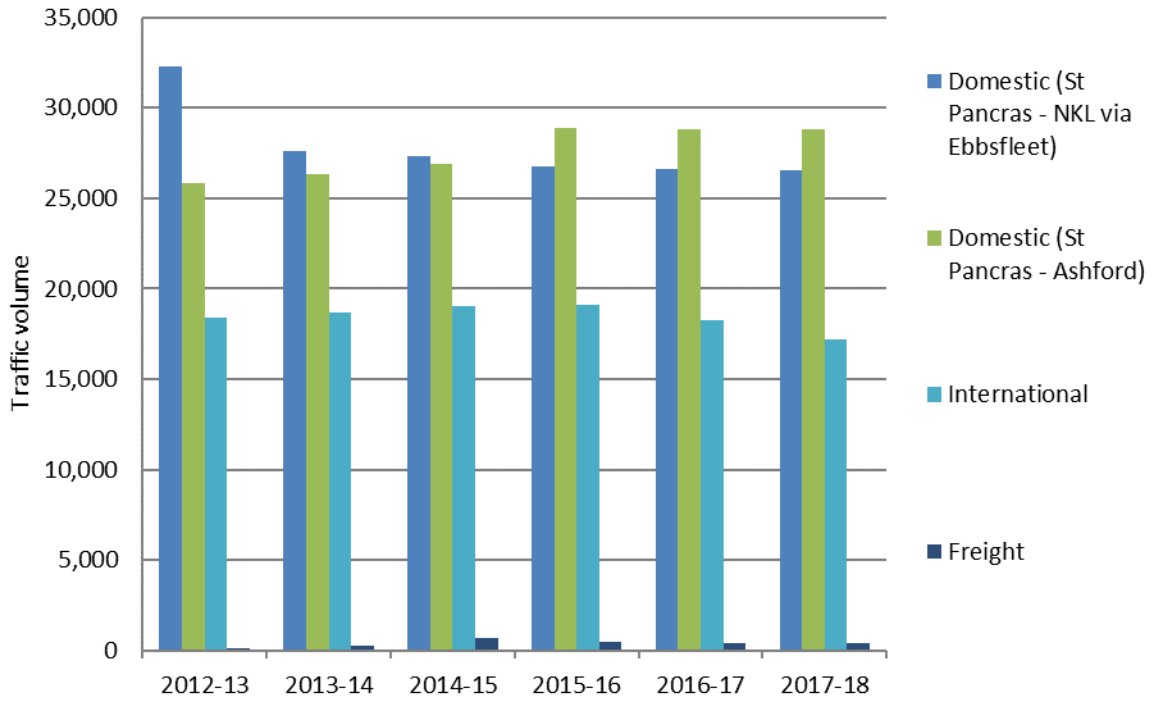
1.8 Figure 4 shows the number of trains delayed by HS1 Ltd by quarter. Quarters 1 to 3 showed improved performance, with Q2 recording the lowest value of delayed trains (32) in a corresponding quarter since the time series began in 2010-11, albeit based on a lower overall volume of trains than in previous periods. On the other hand, overall performance in 2017-18 deteriorated due to the worsening trend in Q4. It had the highest number of delayed trains (170) ever recorded, which was due to two points failures occurring at Stratford and Crismill in March 2018. As mentioned in Paragraph 2.11 below, HS1 is moving from a reactive strategy to one based on planned interventions. ORR will monitor this approach through the remainder of this control period to see if it has a positive impact on performance.

Traffic volume

1.9 The total number of trains timetabled to run on the HS1 network fell since last year, to 72,995 in 2017-18. This represents a fall of 1.5% on 2016-17. This is mostly

attributed to the reduction in the number of timetabled international trains (down 1,030) compared to 2016-17.

Figure 5 – HS1 traffic volume, 2012-13 to 2017-18



	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Domestic (St Pancras - North Kent Line via Ebbsfleet)	32,291	27,591	27,333	26,759	26,645	26,538
Domestic (St Pancras - Ashford)	25,857	26,326	26,874	28,885	28,814	28,810
International	18,408	18,707	19,011	19,117	18,233	17,203
Freight	137	286	704	509	439	444
Total	**76,693**	**72,910**	**73,922**	**75,270**	**74,131**	**72,995**

Note: Please see caveat on revisions of figures

Data assurance

1.10 The most recent 2016 data review was carried out by DNV GL. It incorporated a high-level review of the performance and asset management measures and a review of HS1 Ltd's asset register. The overall outcome of the review was positive, and included an assessment of all the key indicators, an identification of what progress has been made since the 2014 review, and minor recommendations for further improvements. All HS1 Ltd data assurance reviews are available on our website.

2. Asset management

Overview

The Concession Agreement requires HS1 Ltd to secure the operation, maintenance, renewal, replacement, planning and carrying out of upgrades in accordance with best practice and in a timely, efficient and economical manner, to the greatest extent reasonably practicable having regard to all circumstances.

Overall performance of the assets continues broadly to meet the key asset performance metrics included in the CP2 determination. The delivery of work in 2017-18 was on budget but with significant schedule slippage from the baseline established in last year's HS1 Ltd Asset Management Annual Statement (AMAS); around 60% of the work that was scheduled for completion in 2017-18 was delivered.

HS1 Ltd asset management maturity has continued to develop with Network Rail (High Speed) gaining ISO 55001 certification. In 2017-18 new asset availability measures have been developed, coupled with a shift from maintenance and renewal interventions based on fixed time intervals, to reliability-based intervals informed by asset utilisation and asset condition.

Work has continued on the preparation for the periodic review for the third control period (CP3). Stakeholder events have been held and HSL Ltd has appointed engineering consultants Bechtel to look at deliverability of the long term plan of route renewals.

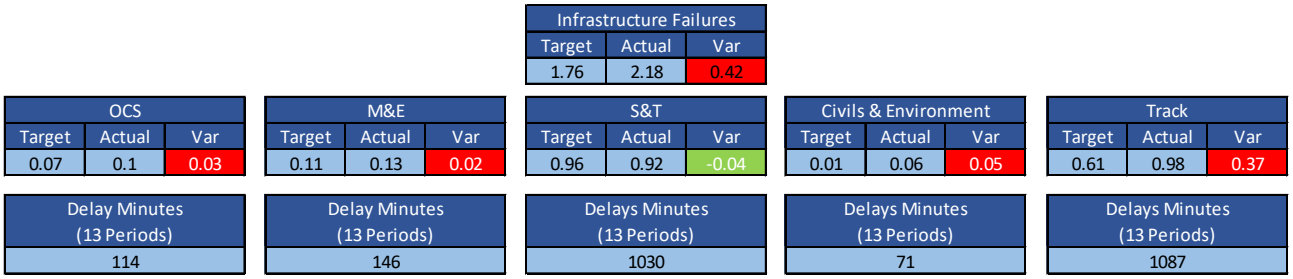
Asset performance and condition

Asset Performance

2.1 HS1 Ltd uses a Key Performance Indicator (KPI) of average seconds delay per train to measure its performance. Overall performance has continued to improve in the last 2 years, and in 2017-18 HS1 and Network Rail (High Speed) beat the stretch targets agreed. These targets, and current performance, exceed the requirements of the concession agreement.

2.2 HS1 has agreed several stretch targets with Network Rail (High Speed) for delay per train by type of HS1 infrastructure failure. These targets exceed the requirements of the concession agreement. Figure 6, known as the "line of sight", maps these out for the Overhead Catenary System (OCS), Mechanical & Engineering (M&E), Signalling & Telecoms (S&T), Civils & Environment and Track. As indicated by the sole green box, these stretch targets were only exceeded in one area (S&T) in 2017-18.

Figure 6 – Moving Annual Average of seconds delay per train on the HS1 network caused by infrastructure failures (Period 13, 2017/18) Source HS1



Note – Values are rounded to 2 decimal places; consequently a summed actual may differ by +/-0.01 to the stated aggregated Network Rail (High Speed) Actual.

2.3 When comparing actual performance to the internal targets set by HS1 Ltd for CP2 for the number of faults by asset group (Figure 7), the targets have all been met with the exception of Signalling. Overall this represents a slight worsening on the performance attained last year.

Figure 7 – Asset group performance against HS1 Ltd's internal CP2 targets

		CP2 Target	*2014-15 Actual*	*2015-16 Actual*	*2016-17 Actual*	*2017-18 Actual*
Asset Group		Ave/Period	Ave/Period	Ave/Period	Ave/Period	Ave/Period
Signalling	Number of faults	18	9	12.31	12.46	10.23
	Services affected	1	4	10.77	1.46	1.54
Telecoms	Number of faults	4	0.92	1.15	0.92	0.54
	Services affected	1	0.85	1.08	0	0
M&E	Number of faults	9	5.92	4.46	2.31	1.77
	Services affected	1	5.92	4.38	0	0.08
OCS	Number of faults	2	0.38	0.31	0	0
	Services affected	1	0.08	0	0	0
Track	Number of faults	0.2	0	0	0.08	1.23
	Services affected	0.1	0	0	0	0.08
Civil	Number of faults	2	0	0	0.23	1.3
	Services affected	0	0	0	0.08	0.08

2.4 New availability measures have been developed in 2017-18, for implementation in 2018-19 and to inform PR19. These are:

- Asset Availability
  - Operational Availability: defined as the percentage of time that a specific asset group or system is available for operational use excluding planned maintenance.
  - Engineering Access Statement Availability: defined as the number of nights per week that the level in the engineering access statement is

achieved. Specifically, to provide “A single line route for at least 160km/h running to be available between St Pancras International and the CTRL/Eurotunnel Boundary on Monday to Friday nights.”

- Plan/Attainment
  - Effectiveness of the Network Rail (High Speed) works planning capability: defined as “The percentage of work completed in the week it was planned.” The new plan/attainment measure will be implemented in 2018-19 and used to inform PR19.
- Maximum achievable train paths
  - The theoretical maximum number of achievable train paths that the signalling system can deliver has remained at 20 trains per hour, based on three minute signalling headways. HS1 currently operates a mid-morning weekly peak of 11 trains per hour.

Route Asset condition

2.5 HS1 Ltd continues to refine its approach to the condition assessment of assets through improving understanding of failure mechanisms and improved condition data capture in its management systems.

2.6 The HS1 route asset portfolio is generally in a good condition, with asset degradation broadly in line with expectations. Renewals interventions in 2017-18 resulted in a small proportion of assets seeing a year on year improvement in condition.

2.7 The current condition profile for the core asset groups is shown in Figure 8. This also compares the current profile based on the condition scores within the Network Rail (High Speed) electronic Asset Management System (eAMS) against the condition profile established in 2013 contained within the CP2 Five Year Asset Management Statement (5YAMS).

Figure 8 – Comparison of current assessment of asset condition against the position stated in the CP2 5YAMS - Source HS1

Condition Band			CIVILS	M&E	OCS	SIGNALLING	TELECOMS	TRACK
Percentage of assets in each condition band	1 (New)	CP2 5YAMS	0.00%	0.00%	0.00%	0.00%	0.00%	12.80%
		2017	0.16%	0.09%	0.00%	0.00%	1.64%	14.02%
		2018	0.22%	0.09%	0.00%	0.00%	1.62%	14.16%
	2	CP2 5YAMS	40.68%	0.00%	0.00%	96.85%	7.87%	78.49%
		2017	40.56%	0.00%	0.00%	97.28%	8.46%	76.14%
		2018	40.58%	0.03%	0.00%	97.21%	10.79%	75.97%
	3	CP2 5YAMS	59.30%	100.00%	100.00%	1.20%	62.62%	8.71%
		2017	59.25%	99.91%	100.00%	0.77%	58.74%	9.74%
		2018	59.17%	99.91%	100.00%	0.80%	57.72%	9.77%
	4	CP2 5YAMS	0.02%	0.00%	0.00%	1.95%	29.51%	0.00%
		2017	0.03%	0.00%	0.00%	1.94%	31.16%	0.10%
		2018	0.03%	0.00%	0.00%	2.00%	29.87%	0.10%
	5	CP2 5YAMS	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
		2017	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
		2018	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Not Scored	CP2 5YAMS	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
		2017	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
		2018	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Station Asset Condition

2.8 The HS1 international station assets have been categorised to form an asset hierarchy using the standardised Building Cost Information Service of the Royal Institution of Chartered Surveyors (BCIS) hierarchy.

2.9 HS1 has engaged with the Department for Transport to complete a stations asset renewal 'triggers' model. The 'triggers' model specifies precursors to asset failure and defines agreed intervention thresholds that will lead to the renewal of each station asset group or system.

2.10 A draft condition review has been undertaken for the structural elements of the HS1 stations, which is aligned to the stations asset hierarchy. This agreed hierarchy, asset

'triggers' model and condition information will be used to support the long term charges and asset handback processes at the end of the HS1 concession in 2040.

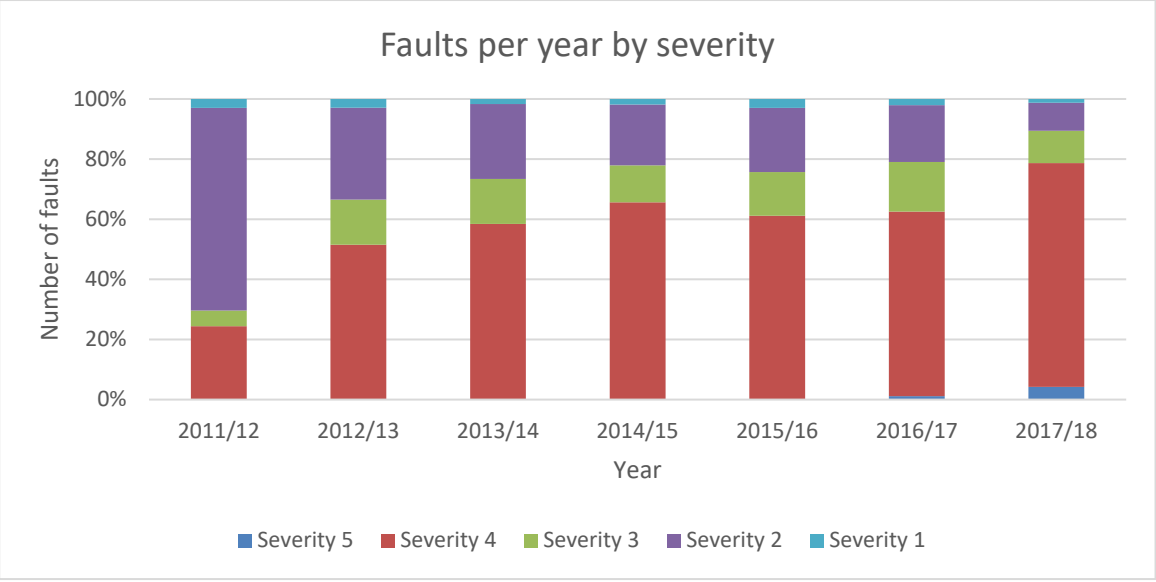
Maintenance Interventions

2.11 HS1 is moving from a 'find and fix' reactive strategy to one based on planned interventions, with faults categorised into 5 groups:

- **Severity 1** asset fault causes operational delay;
- **Severity 2** asset fault with potential to cause operational delay;
- **Severity 3/4** asset fault identified and rectified prior to potential to cause operational delay; and
- **Severity 5** asset fault identified through remote condition monitoring and rectified prior to potential to cause operational delay (as linked to CP2 commitments around remote condition monitoring).

2.12 In 2017-18 there was a continuation of the movement of maintenance interventions proportionately from reactive (severity 1 and 2 faults) to planned (severity 3, 4, and 5 faults) as shown in Figure 9. This is indicative of an improving maintenance effectiveness.

Figure 9 – Faults per year by severity - Source HS1



2.13 One power outage occurred in June 2017 causing disruption to station services. During the recovery works it was found to have been caused by a wiring fault within one of the control panels. This fault was corrected and all other panels were reported as having been checked for similar issues.

2.14 HS1 and Network Rail (High Speed) have instigated a shift from maintenance and renewal interventions based on fixed time intervals, to reliability based intervals informed by asset utilisation and asset condition. Network Rail (High Speed) has prioritised implementation of this change on the higher criticality assets.

Asset Data

2.15 Accurate asset information is fundamental to providing best in class infrastructure stewardship. The HS1 asset information currently collected, stored and shared has to date been sufficient for the effective operation and maintenance of the route infrastructure. HS1 needs to ensure that it continues to be so.

2.16 Route asset condition information is held by Network Rail (High Speed) within its eAMS. Asset condition information is relayed from eAMS into HS1's whole life cost model: the asset decision support tool (ADST). Additional information such as asset utilisation and predicted asset degradation behaviour is also entered into the ADST. The ADST is used to support the development of the specific asset strategies, which describe how the assets will be operated, maintained and renewed to deliver the asset management objectives.

Asset planning

Asset management capability improvement

2.17 HS1 and Network Rail (High Speed) have been working together to develop the maturity of the HS1 Asset Management System.

2.18 HS1 has refreshed its Asset Management Policy and created a new set of HS1 Asset Management Objectives. In line with HS1's harmonised approach to asset management, the asset management objectives are applied to both route and stations, categorised as:

2.19 In March 2018 ahead of the original schedule, Network Rail (High Speed) successfully obtained 'Certification to ISO 55001 Asset Management'.

2.20 Network Rail (High Speed) has now taken ownership of the asset management system for the route infrastructure. This include development of 'Specific Asset Strategies' which have replaced the 'Asset Specific Policies' developed during CP1. Whereas the ASPs were developed by external consultants, the SASs are written and owned by the Network Rail (High Speed) professional heads. The professional

heads also accountable for the asset management plans and Network Rail (High Speed) standards.

2.21 Network Rail (High Speed) has developed a 'single view of the plan' document, which details all the projected volumes of work in 10-year and 40-year time windows. These plans will need to be updated to reflect change in asset renewal timing from one based on fixed intervals to one reflective of predicated condition.

2.22 UK Power Network Services (UKPNS), a power network distribution operator, has shared with HS1 its asset management system and asset knowledge system. Additionally, UKPNS has provided an early draft of its 5 and 40 year operations, maintenance and renewals plans to HS1. UKPNS has committed to HS1 to gaining ISO 55000 certification in December 2018.

2.23 It would be expected that both Network Rail (High Speed) and UKPNS would use the same planning horizons going forward.

Progress with CP2 key outputs & initiatives

2.24 HS1 Ltd has progressed a number of route innovation, research and development projects, covering two key areas:

- Inspection and Monitoring
  - The use of Reliability Centred Maintenance methodologies being explored to drive maintenance frequencies. This is being trialled with a High Performance Switch System at St. Pancras.
  - Feasibility study for the adoption of strain gauge technology to reduce intrusive rail test works.
  - Use of Ballast Core Sampling to understand ballast condition.
  - Use of Remote Condition Monitoring systems to monitor Jet Fan performance.
  - Development of automatic Wire Drop Detection systems on Overhead Line Platforms.
  - Use of Pandas II Train Based Pantograph Monitoring to understand the interaction between the pantograph and overhead equipment.
  - Use of new systems for the measurement and scanning of tunnels. Tunnel scanning trial to provide repeatable and quantifiable data collection using less plant/possessions/isolations and reduce foot patrols for safety to allow risk based inspection and maintenance strategies to be developed for tunnels.

- Use of Track Recording Systems installed onto HS1 Multi-Purpose Vehicles.
- Use of Holographic Augment Reality and 'Digital Twining' for Critical Point operating equipment asset.

- Maintenance
  - Use of Google Maps to improve Network Rail (High Speed) staff route knowledge.
  - Use of Battery Powered Rail Drills.
  - Use of Automatic Rail Cutter/Saws.
  - Modifications to the Point Heating systems.
  - Use of Bar-coding in stores.
  - Use of Insulating Block Joint Magnets.

2.25 HS1 Ltd has continued to work on the key initiatives and improvements it identified in its CP2 submission against the key asset areas. The status of this work is summarised in Figure 10.

Figure 10 – Progress against key initiative identified in HS1 Ltd's CP2 submission Source HS1

Asset Group	Completed / on schedule	Behind schedule / at risk	Cancelled
Track	3	1	1
Signal Control & Commmunications	3	0	0
Electrical & Plant (E&P)	1	3	1
Civils	2	1	0

2.26 The items behind schedule / at risk are:

- Track - Plain line pattern recognition software to reduce resource and improve information. Estimated Time of Arrival 2020.
- E&P - Pantograph mounted CCTV to help with OCS inspection. Estimated Time of Arrival 2020+.
- E&P - Review proposals to undertake isolations more quickly without any change in safety. Estimated Time of Arrival 2018.
- E&P- Life extension of contact wire from 15-20 years to 25-30 years based on observed minimal degradation. Estimated Time of Arrival 2019.
- Civils - Verify move to decreased inspection frequencies for earthworks. Estimated Time of Arrival 2019.

2.27 Two initiatives cancelled were as a result of more detailed assessment identifying that the technology is not ready for implementation or that there is no business case for the proposed change.

2.28 We will make it a focus of our monitoring for the remainder of the control period to understand the knock-on effects of any late delivery of these projects.

2.29 We will also wish to understand the implications of these changes to the schedule of delivery on charges for operators.

Preparation for CP3

2.30 A series of stakeholder CP3 engagement workshops have been held by HS1 Ltd. Key content in these workshop was looking at how HS1 is approaching asset condition and asset deterioration rates as part of the asset management activity, and how this (and other information) is being used to drive the CP3 renewal plans as well as the 40 year renewal plan.

2.31 For CP3 new scenarios have been developed that use evidence based degradation and intervention strategies to inform the CP3 submission rather than scenarios described by the Network Rail (High Speed) professional heads as used for CP2. Outputs are being modelled within HS1's ADST.

2.32 HS1 commissioned Bechtel to look at the deliverability of the long term plan of route renewals. The first phase of this work has been completed, and HS1 has defined the HS1 renewals delivery strategy, which includes the following key aspects:

- The prioritisation of revenue service.

- Routine, predictable and timetabled engineering access periods for renewals work.
- Safe working methods for efficient single line working.
- High productivity rates during engineering periods.
- Early planning for any works that require multiple access periods or complete closure of the line.
- Integration of works with the potential line closure of other infrastructure managers (Eurotunnel, SNCF, UKPNS etc.).

2.33 In 2018-19, HS1 Ltd will deliver the final phases of the route renewals deliverability study, which will include the development of specific work execution methodologies (labour and plant requirements), unit rates for work, an integrated plan for CP4 and a high-level master plan for CP5 onwards.

2.34 ORR will continue to be closely involved in the development of the CP3 submission as part our duties under the Concession Agreement

Route Renewals programme

Project governance

2.35 HS1 Ltd has been developing its project management capability to improve management and reporting on the growing number of projects in the portfolio.

2.36 A core part of these improvements is associated with implementing revised governance and reporting arrangements for the work bank and improvements in the authorisation process involving HS1 Ltd, DfT and ORR.

2.37 In addition, the definition of renewal vs maintenance will need to be considered as part of the next periodic review.

Summary of 2017-18

2.38 HS1 Ltd has completed 4 schemes during 2017-18:

- MCEM91 point operating equipment
- Stratford box drainage pumps
- Phase 1 of the route control Centre
- Electrical Mechanical Management Information system (RCCS/EMMIS

2.39 Emergency renewals of some sections of the acoustic barriers were also authorised to proceed.

2.40 The renewal of the Digital Transmission Network (DTN) is the most costly and complex project in CP2. We have reviewed and agreed the strategy for its renewal.

2.41 The delivery of work in 2017-18 has been on budget but with significant schedule slippage from the baseline established in last year's AMAS; Around 60% of the work that was scheduled for completion in 2017-18 has been delivered.

Deliverables for 2018-19

2.42 The following schemes (previously identified in the 5YAMS) have been initiated for development/delivery:

- Drainage sump-pumps
- VCS control system
- Medway River Headwall
- Air conditioning in all Section 1 signalling rooms
- Renewal of the DTN & PABX including TSMMI (brought forward from CP3)
- CCTV Cameras
- UTS Power supply
- Radio Propagation
- Signalling interlocking ITCS system replacement
- Wheel load impact detector

2.43 In addition there are three projects that are planned to commence in CP2 that were not in the original CP2 renewals plan:

- The renewal of the fibre optic signals at St Pancras - equipment is obsolete and no longer supported.
- Replacement of track on the Temple Mills depot connection - increased wear due to the introduction of the new Velaro trains.
- Replacement of some of the switches outside St Pancras - significant wear.

2.44 Power supply points at Singlewell, Crismill, Lenham and Cheriton provide resilience to signalling rooms if their primary supplies are compromised. UKPNS has identified that for the transformers to be maintained, they need to be isolated. Their current design does not provide a compliant means of isolation and hence requires

modification to allow maintenance to be carried out. HS1 will need to bring forward a formal proposal as to how these safety driven works are to be progressed and funding agreed, once it has completed its investigation into why these isolators were not fitted before.

Stations Renewals Programme

Governance

2.45 Reporting obligations for stations renewals are not described in the Concession Agreement, HS1 being required to deliver the renewals against an agreed Long Term Charge model set out in the HS1 Lease with the Secretary of State.

Summary of 2017-18

2.46 The main station renewal focus in 2017-18 was on the progression of the station communications systems renewal (SCSR) project. Several other renewals were also initiated and are progressing: St Pancras UPS, Ashford Air Handling Units and Fire Compartmentation (All Stations). The replacement of Ashford Smoke Curtain, Ashford External Lighting and Lift renewal were all completed

2.47 Two new projects have been initiated through the approved change process. The first being a project looking at renewing East Midland Trains customer information system equipment at St Pancras. The second is the accelerated renewal of the Stratford escalator due to this asset regularly failing, causing operational issues for the train operating companies' customers.

Deliverables for 2018-19

2.48 Smaller value renewals involving water and heating systems and internal/external walls and doors will commence and pre-approved funding sought in the annual station renewals funding paper, as well as the continuation of the projects initiated in 2017-18

3. Finance and efficiency

Overview

HS1's regulated costs exceeded its regulated income by £1.5m in 2017-18[2]. This represented £0.8m of financial underperformance relative to our PR14 determination. It received £70.0m of regulated income, £1.8m higher than assumed in PR14. It spent £71.9m operating, maintaining and renewing its rail infrastructure in the year, £2.9m higher than assumed in PR14. These variances are examined below.

Figure 11 – Summary of HS1's regulated income and expenditure in 2017-18

£m (2017-18 prices)	Actual	PR14	Difference Better / (worse)	2016-17
Income				
OMR charge	53.1	53.0	0.1	55.6
Pass through income	17.1	15.2	1.8	15.2
Performance regime	0.1	0.0	0.1	0.0
Total income	**70.0**	**68.2**	**1.8**	**70.7**
Controlled track costs				
Network Rail (High Speed) Ltd	40.9	40.9	0.0	42.3
HS1 Ltd	11.5	10.0	(1.5)	10.1
Network Rail Infrastructure Limited	1.4	1.7	0.3	1.4
Total controlled track costs	**53.8**	**52.5**	**(1.3)**	**53.7**
Pass through costs				
Rates	7.0	5.0	(2.0)	5.2
Electrical infrastructure (traction)	5.1	5.1	0.0	5.2
Insurance	3.2	3.8	0.6	3.2
Power – non traction	1.5	1.3	(0.2)	1.6
Total pass through costs	**16.9**	**15.3**	**(1.6)**	**15.2**
Freight costs				
Network Rail (High Speed) Ltd	0.3	0.3	0.0	0.3
Network Rail Infrastructure Limited	0.2	0.2	0.0	0.2
HS1 Ltd	0.1	0.1	0.0	0.1
Total freight costs	**0.6**	**0.6**	**0.0**	**0.6**
Opex-funded upgrades	**0.5**	**0.6**	**0.1**	**0.5**
Performance related payments	**0.0**	**0.0**	**0.0**	**0.1**
Total costs	**71.9**	**69.0**	**-2.9**	**70.1**
Net Income / (Expenditure)	**(1.5)**	**(0.7)**	**(0.8)**	**0.6**

[2] Our analysis excludes unregulated income and expenditure. Unregulated income includes the 'Investment Recovery Charge' (IRC) and income from commercial property. Unregulated expenditure includes financing costs. HS1's statutory financial statements provide more information about these items. Some figures in this section may not sum due to rounding.

Income

3.1 The majority of HS1's regulated income (£53.1m) was from charges to train operators for operating, maintaining and renewing its network. This income was £0.1m higher than assumed in PR14. HS1 receives pass through income (£17.1m) from train operators to recover costs that are largely uncontrollable by HS1. These include non-traction electricity, electrical infrastructure costs, insurance and business rates. Pass through income was £1.8m higher than assumed in PR14.

3.2 Income was higher than assumed in PR14 largely due to increased use of the network by Southeastern's domestic passenger services, partly offset by lower than assumed use by Eurostar.

Costs

Operating, maintenance and renewals costs

3.3 The majority of HS1's regulated costs (£40.9m) were incurred in operating, maintaining and renewing its network. This work is undertaken through a long-term, fixed price contract with Network Rail (High Speed) Limited[3]. This expenditure was the same as assumed in PR14. Figure 12 provides a breakdown of Network Rail (High Speed)'s costs.

3.4 Staff costs were £1.8m higher than assumed in PR14 due to the recruitment of additional asset management posts, the introduction of the apprentice levy and increased holiday pay costs following a recent employment appeal tribunal ruling that voluntary overtime should be taken into account when calculating holiday pay. The risk premium expenditure category was £1.8m lower than assumed in PR14. This is because PR14 did not allocate risk funding to expenditure categories, whereas, cost increases that have materialised are reported in the relevant expenditure categories. Network Rail (High Speed) has attributed the overall favourable variance (shown as Outperformance) to spending less than we assumed in our PR14 determination.

3.5 HS1 is required to pay train operators if Network Rail (High Speed) outperforms our PR14 financial assumptions, in accordance with the calculation in the Operator Agreement for year 3 of the control period. HS1 and Network Rail (High Speed) have both stated that no outperformance payments are due for year 3 as there is no outperformance, after taking account of the way outperformance is calculated under the agreement, which is different to the way we have shown in Figure 12.

[3] Network Rail (High Speed) Limited is a wholly owned subsidiary of Network Rail.

Figure 12 - Network Rail (High Speed) costs 2017-18

£m, 2017-18 prices	Actual	PR14	Difference better / (worse)	2016-17
Staff costs	18.5	16.7	(1.8)	17.2
Agency costs	0.2	0.1	(0.1)	0.1
Consultancy costs	1.3	0.2	(1.1)	0.4
Corporate functions & Network Rail Infrastructure Ltd Services	4.9	4.4	(0.5)	5.2
Plant & Materials	5.0	5.7	0.7	4.4
Sub-Contractors	5.1	6.4	1.3	5.7
Research & Development	0.4	0.2	(0.2)	0.8
Overheads	2.5	2.8	0.3	2.3
Operating costs	**37.8**	**36.5**	**(1.3)**	**36.4**
Management fee	2.9	2.9	0.0	3.0
Risk premium	0.0	1.8	1.8	0.0
Outperformance	0.5	0.0	(0.5)	3.1
Total Network Rail (High Speed) costs[4]	**41.2**	**41.2**	**0.0**	**42.6**

HS1 internal costs

3.6 HS1's internal costs were £11.5m, £1.5m higher than assumed in PR14. Figure 13 provides a breakdown of HS1's internal costs. HS1 has attributed the majority of this increase to costs associated with its office move during the year.

Figure 13 – HS1's internal costs in 2017-18

£m, 2017-18 prices	Actual	PR14	Difference Better / (worse)	2016-17
Staff costs	4.1	3.8	-0.3	4.2
Technical support / Consultants	12.0	2.0	0.0	1.7
Office running costs	1.3	1.1	-0.2	1.1
Regulatory costs and Safety levy	0.3	0.6	0.3	0.2
Other costs	3.8	2.5	-1.3	3.0
Total HS1 Ltd Costs	**11.5**	**10.0**	**-1.5**	**10.1**

Pass through costs

3.7 Some of HS1's costs are passed straight through to train operators with equal and offsetting pass through income. These costs are largely uncontrollable by HS1 and

[4] This is presented as £40.9m in Figure [1] and £41.2m above as £0.3m of freight related costs are shown separately in Figure [1].

include traction electricity costs, business rates and insurance. Pass through costs were £16.9m, which was £1.6m higher than assumed in PR14 due to increased business rates following a review of the rateable value of its properties.

Freight costs

3.8 HS1 incurs costs relating to freight traffic including maintaining freight specific infrastructure. Freight costs were £0.6m, which is in-line with PR14. This is because the costs of freight assets operated and maintained by HS1 are largely fixed even though the number of freight trains using the network was significantly lower than assumed in PR14.

Upgrades to the network

3.9 In addition to the day-to-day operation of its rail network, HS1 makes upgrades to ensure that its network continues to meet the needs of customers. HS1 spent £0.5m on GSM-R (telecommunications) upgrades in 2017-18 compared to £0.6m assumed in PR14.

Efficiency

3.10 HS1 does not currently report on its efficiency changes over time. However, it is important that we understand how it is performing compared to the efficiency challenge that we set in our 2014 periodic review and to inform our next review of its charges. In this report, we assess HS1's efficiency by comparing its own costs and those of Network Rail (High Speed) to those incurred in 2014-15, the final year of CP1. We exclude pass through costs as HS1 has less control over these.

3.11 The costs in 2017-18 are shown in Figure 11. Adjusted for inflation, they have been reduced by £7.9m (13.1%) compared to 2014-15. Network Rail (High Speed)'s costs have decreased by 19.4% and HS1's costs have increased by 20.5%. HS1 has attributed the increase to its own costs to recruiting additional engineers (which HS1 considers increases costs in the short-term but reduces them in the longer term by developing its own asset management expertise) and to costs relating to its office move.

3.12 In preparation for our next periodic review (PR19), we will continue to work with HS1 to develop its Cost Efficiency Plan over the next year. We will develop the way that we assess and report on the company's efficiency accordingly.

Route escrow account

3.13 Some of HS1's access charges are paid into an escrow account to fund current and future renewals. This fulfils a similar function to the Regulated Asset Base (RAB) in Network Rail and other infrastructure providers to spread these costs over the long term.

3.14 The balance on the route escrow account at 31 March 2018 was £66.5m an increase of £10.1m in the year due to:

- £12.0m of payments into the escrow account. This was £0.1m lower than our determination assumption largely because of lower inflation[5];
- £2.0m withdrawn to pay for renewals undertaken in the year. PR14 assumed £5.7m due to a different phasing of work; and
- £0.1m of interest earned.

Financial overview of HS1 statutory financial statements

3.15 As reported in HS1's annual report and financial statements, earnings before interest, tax, depreciation and amortisation (EBITDA) was £191.3m. After deducting for these items, HS1 made an accounting loss of £55.8m in 2017-18. As at 31 March 2018 HS1's net liabilities were £186.0m.

3.16 In analysing HS1's financial position to understand the risks it is exposed to, we recognise that it is important to consider the position of the wider group of companies of which it is part. For example, debt for HS1 Ltd is raised at the group level by High Speed Rail Finance (1) Plc and High Speed Rail Finance Plc (subsidiaries of HS1's immediate parent company, Helix Acquisition Ltd). High Speed Rail Finance (1) Plc and High Speed Rail Finance Plc provide finance to HS1 Ltd, which then pays finance charges to them.

3.17 Recent credit rating agency reports on High Speed Rail Finance 1 Plc, have confirmed its A-/Stable rating, confirming that it has an affordable and sustainable capital structure. HS1's debt service cover ratio for 2017-18 was 2.2x. This means the company generated sufficient earnings to service its interest costs, which is a useful indicator of short-term debt affordability.

Change of ownership

3.18 HS1 ownership changed during the year. It was sold by Borealis and Ontario Teachers' Pension Fund to HICL Infrastructure, Equitix and the South Korea's National Pension Service. Information about the change in ownership is available on HS1's website[6].

[5] Unlike in the rest of our report, where we report HS1 Ltd's financial performance in a consistent price base, we report the value of the escrow account in cash prices. This means we do not update our PR14 assumption for differences in inflation compared to our PR14 determination assumptions.

[6] See https://highspeed1.co.uk/investors/investor-related-documents/reports-results-and-presentations.

4. The 2019 Periodic Review of HS1 (PR19)

Overview

Under regulation 15 of The Railways (Access, Management and Licensing of Railway Undertakings) Regulations 2016, we have to ensure that HS1 Ltd is provided with incentives to reduce the cost of allowing access to its infrastructure and the level of access charges. We perform this function through periodic reviews as set out in the Concession Agreement between the Secretary of State and HS1 Ltd.

The next periodic review will be the 2019 Periodic Review of HS1 (PR19) that will set track access charges for HS1's third control period (CP3) between 1 April 2020 and 31 March 2025.

Concession Agreement

4.1 Building on lessons learnt from PR14, during 2017 DfT and HS1 Ltd, with our input, proposed changes to the Concession Agreement in order to improve the process of future periodic reviews. These changes came into force in December 2017, and reflect an improved process that allows for active stakeholder engagement, as well as giving ORR more time to scrutinise HS1 Ltd's proposals for CP3.

Our Approach to PR19

4.2 We consulted on our proposed approach to the next periodic review during September-November 2017. Further to that initial consultation, we published our Approach to PR19 in January 2018, initiating the new periodic review process.

4.3 In accordance with the new process, HS1 Ltd has demonstrated engagement with its stakeholders on its plans for the next control period, in particular through a series of quarterly workshops to gauge views.

5. Health & Safety

Overview

Under the Railways and Other Guided Transport Systems (Safety) Regulations 2006, the infrastructure manager, Network Rail (High Speed), has duties to establish and maintain a safety management system as set out in the Regulations. Network Rail (High Speed) was issued with a safety authorisation in accordance with the Regulations in October 2009, which was renewed in May 2017 for a period of five years.

Health & Safety activities during 2017-18

5.1 During 2017-18 we carried out the following supervision activities;

- ORR carried out an inspection of Network Rail (High Speed)'s arrangements for the inspection and monitoring of track condition with the support of ORR's specialist track inspection team;
- ORR worked with Network Rail (High Speed) and HS1 Ltd railway undertakings to issue two exemptions from the Railway Safety Regulations 1999 during autumn 2017, relating to low speed movements of rolling stock not fitted with HS1-compatible train protection systems in the St Pancras station area, and advised on how to improve on and revise their approach for the future;
- ORR has held routine liaison meetings with Network Rail (High Speed)'s Head of Safety during the year; and
- The ORR Inspector for HS1 has also attended quarterly HS1 Ltd-ORR liaison meetings to discuss safety performance with HS1 Ltd's Head of Safety.

5.2 We have continued to encourage HS1 Ltd and Network Rail (High Speed) to adopt the ORR risk management maturity model (RM3) as a tool to improve the capability of health and safety management on the HS1 network. ORR notes Network Rail (High Speed)'s work to adopt RM3. Further information on RM3 can be found on the ORR website.

5.3 Further information on health and safety performance on all of Britain's railways can be found in ORR's health and safety annual report, and on the mainline railway (which includes the HS1 network) can be found in the Rail Safety and Standards Board (RSSB) Annual Safety Performance Report.

5.4 During a planned routine maintenance inspection by Network Rail (High Speed) track patrollers in January 2018, two loose bolts were found on a front-facing swing-nose crossing. While additional inspections to monitor the condition of these points were planned in and the internal track standard was revised, in March, during one of these

additional inspections, track patrollers found conditions at the crossing had deteriorated and identified that four bolts were loose. This was the first event of its kind on the HS1 network and had the potential to derail a train. Appropriate action was taken to protect traffic, effect a temporary repair and plan a permanent repair. Network Rail (High Speed) launched a formal, independent investigation.

5.5 ORR has since met with Network Rail (High Speed) senior managers to understand the actions they have taken in response to this incident; seek assurance on how they are making wider improvements across the business to deal with what is now an ageing asset; and to explore the issues behind the swing-nose crossing defect.

5.6 Further information on our approach to regulating health and safety risks created and managed by businesses in the railway industry can be found in the strategic risk priorities section of our website.

Proposed health and safety regulation activities for 2018-19

5.5 The following health and safety regulation activities are proposed for 2018-19:

- An inspection of Network Rail (High Speed)'s arrangements for its Track team competence, to assess the effectiveness of the existing framework and how it has evolved in order to provide the level of competency required to maintain what is now considered an ageing asset.
- Assessment of Mitie Technical Facilities Management's application for a renewal of its safety authorisation to operate Ashford International Station on HS1;
- Consideration of an application for an exemption from the Railway Safety Regulations, relating to low speed movements of rolling stock not fitted with HS1-compatible train protection systems;
- Contributing to PR19;
- Regular liaison meetings with Network Rail (High Speed) throughout the year; and
- The investigation of incidents in accordance with ORR's processes.