National Audit Office

Report
by the Comptroller
and Auditor General

Department for Transport and High Speed Two Ltd

High Speed Two: A progress update

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Department for Transport and High Speed Two Ltd

High Speed Two: A progress update

Report by the Comptroller and Auditor General

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This report examines whether the Department for Transport and High Speed Two Limited have protected value for money so far in their stewardship of the High Speed Two programme. It also examines the risks to value for money on the programme going forward.

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Contents

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Key facts

2036 to 2040

High Speed Two Limited's (HS2 Ltd's) current forecast opening date for the start of passenger services on the full High Speed Two network from London to Leeds and Manchester, via the West Midlands, although there is significant uncertainty regarding these dates

£65bn to £88bn

the Department for Transport's emerging estimate of the cost of the High Speed Two programme (in 2015 prices) as at December 2019. At the time of publishing this report, it is not possible to say with certainty what the final programme cost may be

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number of trains an hour that are planned to run to and from London on the new railway, compared with typically between two and six trains an hour on European high-speed railways

£27.1 billion	available funding for High Speed Two Phase One to the West Midlands (2015 prices), excluding VAT. Available funding for the whole programme is £55.7 billion (2015 prices), excluding VAT
£31 billion to £40 billion	the Department and HS2 Ltd's range estimate in November 2019 of the cost of Phase One (2015 prices). The Department proposes setting HS2 Ltd a target of delivering Phase One for £36 billion
March 2020	date by which construction must start on Phase One of the railway to avoid further delays to the start of passenger services
2029 to 2033	partial start of Phase One passenger services between Old Oak Common and Birmingham Curzon Street. Full Phase One services from Euston are forecast to start between 2031 and 2036
£6.3 billion	the Department and HS2 Ltd's spend on Phase One to 31 March 2019, excluding VAT. In total, they had spent £7.4 billion on the programme to 31 March 2019, excluding VAT

Summary

The High Speed Two programme

1 The High Speed Two programme (the programme) aims to construct a new high-speed, high-capacity railway between London, Leeds and Manchester, via the West Midlands. The new railway will join with the existing rail network to enable journeys to Liverpool, Newcastle, Edinburgh and Glasgow. It is the government's largest infrastructure programme by value and many of its component parts, such as works at Euston station, construction of the railway infrastructure and purchase of land and property for the route, are large and complex projects in their own right.

2 The Department for Transport (the Department) is the programme's sponsor, responsible for funding and overseeing delivery. High Speed Two (HS2) Limited (HS2 Ltd), an arm's-length body of the Department, is responsible for delivering an operational railway. Network Rail is undertaking work for HS2 Ltd to make changes to the existing railway to facilitate the construction of, and link to, the planned new high-speed service.

3 The Department has split the programme into three phases:

- Phase One (London to the West Midlands). The Department expects to take the final investment decision on whether to proceed with Phase One and to start main civil construction in early 2020.
- Phase 2a (West Midlands to Crewe). The Department expects Parliament to approve the Phase 2a enabling legislation (hybrid bill) in early 2020.
- Phase 2b (Crewe to Manchester and West Midlands to Leeds) is at a much earlier stage. The Department has been planning on introducing a hybrid bill to Parliament in June 2020.

4 The Department's objectives for the programme are to:

- provide sufficient capacity to meet long-term rail demand and to improve resilience and reliability on the rail network;
- improve connectivity by making journeys faster and easier; and
- boost economic growth across the UK.

5 In March 2019, HS2 Ltd formally advised the Department that it would not be able to deliver Phase One of the programme on time or within available funding. Since then, HS2 Ltd has continued to develop cost and schedule estimates for the programme, which indicate that the programme will cost more than the available funding and be completed later than planned.

6 The total forecast cost for the programme is not yet clear. The Department's emerging estimate, as at December 2019, gives a potential cost of between £65 billion and £88 billion (2015 prices), between 17% and 58% more than the available funding of £55.7 billion (2015 prices) agreed with HM Treasury. However, Phase Two is at an early stage of development, and given the reasons for cost increases on Phase One, we do not think that it is possible, as yet, to estimate with certainty what the final cost could be. The Department and HS2 Ltd are continuing to develop the cost estimates.

7 The Department and HS2 Ltd expect partial Phase One services from Old Oak Common to Birmingham Curzon Street to start between 2029 and 2033, with full services from Euston starting between 2031 and 2036. It is not clear when services on the full High Speed Two network to Leeds and Manchester will commence; HS2 Ltd estimates these will open between 2036 and 2040.

8 In August 2019, the government announced an independent review of the programme to provide advice on whether, and if so, how to proceed with the programme.[1] The review is wide-ranging in scope and is due to report in early 2020.

9 We have reported three times on the programme.[2] Each of our previous reports highlighted significant cost and schedule pressures; the potential effect of any increases in these on the scope and benefits of the programme to passengers, communities, businesses and the economy; and areas of risk going forward.

Scope of the report

10 This report examines whether the Department and HS2 Ltd have protected value for money in their stewardship of the programme so far, and the risks to value for money going forward. We assess:

- the progress of the programme since we last reported in 2016;
- why the schedule is delayed and forecast costs have increased; and
- the risks that the Department and HS2 Ltd must manage.

1 The review is chaired by Douglas Oakervee, who was the previous chairperson of both HS2 Ltd and Crossrail Limited.

2 Comptroller and Auditor General, Department for Transport, *High Speed 2: A review of early programme preparation*, Session 2013-14, HC 124, National Audit Office, May 2013. Comptroller and Auditor General, Department for Transport and HS2 Ltd, *Progress with preparations for High Speed 2*, Session 2016-17, HC 235, National Audit Office, June 2016. Comptroller and Auditor General, Department for Transport and HS2 Ltd, *Investigation into land and property acquisition for Phase One (London – West Midlands) of the High Speed 2 programme*, Session 2017–2019, HC 1531, National Audit Office, September 2018.

11 Given it is still at an early stage, we do not seek to conclude on whether the programme is ultimately likely to be value for money. We focus our analysis on Phase One, because HS2 Ltd has made more progress on the cost and schedule estimate in advance of the Department's plan to take the final investment decision on that phase.

12 We conducted fieldwork between July and December 2019. At the time of publishing this report, the latest forecast cost and schedule estimates for the programme were not yet complete and subject to change. We plan to continue to look at the programme regularly, reporting on progress and the Department's actions to address recommendations for improvement.

Key findings

Progress since our 2016 report

13 Since we last reported, the Department and HS2 Ltd have focused on getting ready to start construction on Phase One. HS2 Ltd has focused on working with its main civil construction contractors to design how the civil construction elements will be built and agree the cost and schedule. HS2 Ltd has purchased 66% of the land required to build Phase One, let design contracts for new stations and started other procurements needed for an operational railway, including railway systems. It has also undertaken preparatory work, such as demolitions, moving utility pipes and cables, and archaeological programmes at 250 locations. Across the whole programme, the Department and HS2 Ltd have spent £7.4 billion to March 2019 (paragraphs 1.7, 1.8 and 1.12 to 1.16).[3]

Why the schedule is delayed and forecast costs have increased

14 The 2026 target opening date for Phase One was ambitious. The Department set a 2026 opening date with reference to other infrastructure programmes. It did not take into account sufficiently that High Speed Two was a significantly larger programme with many more interrelated elements than the comparators. In 2013, we reported that it would be difficult for HS2 Ltd to complete all activities in the time available. In 2016 we, and others, warned that the 2026 opening date was at risk. In April 2017, the Department agreed that HS2 Ltd should work towards a partial opening of Phase One passenger services from 2026, and full opening by the end of 2027. It also asked HS2 Ltd to look at ways of achieving a full opening in 2026. In October 2018, HS2 Ltd notified the Department that there were significant challenges to achieving the partial opening date of 2026. Since April 2019, HS2 Ltd has been planning on the basis of a more realistic schedule for the programme. The Department and HS2 Ltd now expect partial Phase One services to start between 2029 and 2033, with full services from Euston starting between 2031 and 2036, at least five years later than planned (paragraphs 2.4 to 2.6, 2.8 and 2.9).

3 Excluding £0.6 billion of VAT which HS2 Ltd has told us that HM Treasury has agreed to fund.

15 **The Department and HS2 Ltd underestimated the complexity of the programme, and Phase One is now forecast to cost between £31 billion and £40 billion, £3.9 billion to £12.9 billion (14% to 47%) more than its available funding.** High Speed Two is a highly ambitious programme intended to be world-leading in its specification, including features such as a service frequency of 18 trains an hour to and from London compared with between a typical two to six trains an hour on European high-speed railways. The programme is constructing a new railway through city centres where site logistics are more challenging, and the UK's high population density means a large number of roads, utility pipes and cables must be moved. The Department set the available funding in 2013 when the programme was at an early stage, based on a basic design, and uplifted this for inflation in the Spending Review 2015. Since then, forecast costs have increased on all elements of Phase One except the purchase of new trains (paragraphs 2.2, 2.10 to 2.12, and Figures 5, 7, 8, 11 and 12).

16 **HS2 Ltd did not account for the level of uncertainty and risk in the programme when previously estimating the costs of Phase One.** HS2 Ltd's previous cost estimate was agreed in April 2017, when Phase One was still at a relatively early stage of design maturity. At this stage, it was not possible to know what the specific requirements of the programme meant for the design or the costs of the railway. HS2 Ltd used existing international high-speed rail programmes as a basis for its costs, but these programmes have significant differences to High Speed Two. HS2 Ltd also had to make assumptions about elements such as ground conditions, as it did not yet have the legal powers to undertake detailed surveys. Despite these uncertainties, HS2 Ltd adopted a detailed method for calculating contingency appropriate for a programme at a much greater stage of development and certainty. This method resulted in £7 billion of contingency being set, 37% of forecast future Phase One costs. The amount of contingency was not enough to address the significant increases in cost that emerged as the design became more detailed, and issues such as poor ground conditions came to light (paragraphs 2.14 to 2.16, 2.19, 2.22, and Figures 11 to 13).

17 **The Department and HS2 Ltd underestimated the impact on costs of changes made to the design and construction of the railway by the hybrid bill.** To gain the legal powers to build the railway, in 2013 the Department and HS2 Ltd deposited a hybrid bill in Parliament. As part of this process, the Department and HS2 Ltd committed to meeting certain requirements during the construction and operation of the railway. Some of these commitments were requested by people affected by the programme and were added through additional provisions to the bill, or through commitments known as 'undertakings and assurances'. Some of these requirements made High Speed Two different from the international comparators on which HS2 Ltd based its April 2017 cost estimate, although it is difficult to isolate the impact of these commitments from other design choices and legal requirements. HS2 Ltd commissioned analysis which suggested that environmental and visual impact measures, such as lowering the railway beneath ground level, have made High Speed Two's main civil construction around £1 billion more expensive than international comparators. Although there is some overlap with the measures above, indicative analysis by HS2 Ltd also suggests that its previous estimate of £245 million for meeting undertakings and assurances may have also been underestimated, and that the impact on costs may be £1.2 billion. Not all commitments have an impact on cost, although some of the commitments made can restrict contractors' ability to avoid costs and create interdependencies that add to the challenge of delivering the programme (paragraphs 2.16 to 2.18).

18 **HS2 Ltd included ambitious savings targets in its forecast costs to get within the available funding on Phase One but did not change its approach in order to deliver them.** To make Phase One affordable, HS2 Ltd incorporated £4.9 billion of efficiency savings, changes to the design and scope of the programme and price estimate reductions within its April 2017 estimate. These were based on internal scrutiny of the estimate, the benchmarking approach it used to cost the programme and reviews by the Cabinet Secretary. For example, HS2 Ltd assumed it could make savings by encouraging UK industry to work closer together, as is common in European countries, to reduce administrative costs. When we last reported, HS2 Ltd had plans identifying where the savings might be found but did not develop these further into a programme of activity to achieve them. The elements that had the most assumed savings have seen significant cost increases. Had HS2 Ltd assumed no savings and applied a more appropriate amount of contingency, it would have forecast a cost comparable with the current estimate for Phase One (paragraphs 2.20 to 2.22, and Figure 13).

Actions taken by HS2 Ltd and the Department

19 **HS2 Ltd and the Department tried to reduce forecast costs.** In June 2018 HS2 Ltd's main civil construction contractors warned that early estimates for Phase One construction were indicating significant cost increases. HS2 Ltd undertook a number of actions to reduce costs, including further detailed technical design work on how features of the infrastructure could be built more efficiently. However, these actions did not bring forecast costs within the available funding, or achieve a schedule that enabled passenger services to start on time. The Department also explored changes to the scope of the programme to make it affordable. It assessed that significant changes were needed that would require the support of Parliament and wider government stakeholders. In July 2019, the Department concluded that the programme was not affordable within available funding (paragraphs 1.12 to 1.17 and Figure 6).

20 **HS2 Ltd has undertaken a significant and unforeseen amount of work to agree a new cost and schedule for Phase One.** HS2 Ltd and its contractors underestimated the amount of time they thought it would take to develop and assess a robust revised cost and schedule for Phase One. HS2 Ltd has repeatedly moved its internal targets for agreeing the estimate and then approving the start of main construction, and the unanticipated volumes of work have increased pressures on HS2 Ltd's staff. In order to maintain the schedule and protect future value for money of the programme while it agreed a new cost and schedule, the Department concluded that it should continue to spend money on the programme and authorised some spending on main civil construction activities in advance of taking the main investment decision on the programme. HS2 Ltd considers that the additional time taken to develop the 2019 cost estimate has helped to protect the scheme's overall value for money by giving it more time for scrutiny and applying lessons learned from contracting for main civil construction on Phase One to other areas, such as the design and build of new stations and Phase Two (paragraphs 2.28 and 2.29).

Risks that the Department and HS2 Ltd must manage going forward

21 **Compared with 2016, HS2 Ltd now has greater confidence in its cost estimate for Phase One but it will need to manage risks that could cause costs to increase further as the programme progresses.** The Department and HS2 Ltd have undertaken a substantial programme of activity to ensure the current Phase One cost estimate is robust, but there are risks that costs could change further. Unexpected site conditions and poor weather could increase construction costs; final cost estimates from contractors for nearly 50% of the cost of the current estimate could be more or less than assumed; and potential efficiencies may not be achieved, increasing costs. Euston station will need to be extended to accommodate high-speed services and there is uncertainty as to how this will be done and the likely cost. The Department and HS2 Ltd based the £31 billion to £40 billion (2015 prices) estimate for Phase One on a detailed assessment of programme risks and analysis of comparator schemes. The range includes £9.9 billion of contingency (2015 prices). The lower bound of the range assumes few risks materialise, whereas the upper end assumes the majority of modelled risks occur. Given the scale, complexity and early stage of the programme, the Department and HS2 Ltd will need to consider going forward how to monitor whether the level of contingency is sufficient for future risks materialising and when it is appropriate to narrow the range of estimated costs (paragraphs 3.5 to 3.6).

22 **HS2 Ltd's revisions to its commercial approach for the Phase One main civil construction works are sensible but carry risks that it must manage.** In July 2017, HS2 Ltd let seven multi-million pound contracts for Phase One main civil construction to four joint venture companies. HS2 Ltd intended that agreeing fewer, larger contracts would create economies of scale and reduce the risks from, and costs of, managing many different contractors. HS2 Ltd considers that once the cost of building the railway became clear, the terms of the contract combined with worsening conditions in the construction industry, resulted in designs which were less efficient and contractors increasing their forecast prices further. In order to ensure an affordable programme, HS2 Ltd is currently finalising revised terms with its contractors. Contractors will no longer be liable for cost increases above a fixed target price. Instead, HS2 Ltd has developed an estimated cost for the works with its contractors. HS2 Ltd will be responsible for funding increases above the estimated cost and contractors will lose a proportion of their fee for building the railway if they do not meet performance indicators on cost and schedule. HS2 Ltd will need to ensure that it has a detailed understanding of contractors' costs and that it incentivises contractors to deliver throughout the contract (paragraphs 2.23 to 2.27, 3.7 and Appendix Three).

23 **Delays to the start of construction beyond March 2020 will put the expected opening date of Phase One at risk.** The Department and HS2 Ltd currently expect a phased opening of Phase One of the railway between 2029 and 2033. If work does not begin by the end of March 2020, the schedule may be delayed or compressed further because some of the construction work can only be done at certain times of the year. Delays may also reduce the amount of time allocated for the latter stages of a programme, such as integrating the signalling and systems which control the railway, and testing the intended operation of the railway, which are complex and risky parts of delivering a project on time and budget (paragraphs 1.11 and 3.2).

24 **HS2 Ltd must develop its capability to manage the programme as it progresses.** The programme is a vast, interrelated set of projects all at different stages, which need to be managed concurrently over decades. HS2 Ltd will need to continue to develop its existing capabilities, as well as new ones, as the programme progresses into construction, and eventually into integrating the systems used to control the railway and operations. This includes effectively managing revised arrangements with its contractors and ensuring that it can assure itself that the programme is on track (paragraphs 1.4, 1.5, 3.8 and 3.9).

25 **On current plans Phase Two is forecast to cost more than its available funding and take longer than expected.** Phases 2a and 2b are at much earlier stages of development than Phase One and their scope, costs and schedule are less certain. HS2 Ltd's current forecast for when passenger services would run on Phase 2a is between 2030 and 2031, and for Phase 2b is between 2036 and 2040, three to seven years later than planned. The Department estimates the cost of Phase 2a could increase to £6.5 billion (87% higher than the available funding of £3.5 billion) and Phase 2b to £41 billion (63% higher than the available funding of £25.1 billion). However, both phases will require legislation to be agreed by Parliament, which may affect both the cost and schedule, and are at such an early stage of development that it is currently difficult to estimate the potential costs with certainty. The Department will need to carefully balance decisions on the scope and costs of Phase Two as changes will impact on the benefits of the overall scheme, given the majority of benefits are delivered by this phase (paragraphs 1.11, 3.11 to 3.18 and Figure 5).

Conclusion on value for money

26 High Speed Two is an ambitious national programme, the construction of which will take decades. The Department, HS2 Ltd and government more widely underestimated the task, leading to optimistic estimates being used to set budgets and delivery dates. In not fully and openly recognising the programme's risks from the outset, the Department and HS2 Ltd have not adequately managed the risks to value for money. If these risks had been recognised and managed earlier, then the significant activity in a pressured environment over the past year trying to understand and contain cost increases may not have been necessary. There are lessons to be learned from the experience of High Speed Two for other major infrastructure programmes.

27 We welcome the increased realism on the estimated cost and schedule for the programme. However, significant risks remain. While the estimated cost and schedule for Phase One are now on a stronger footing, the challenge of getting Phase One into construction, and of monitoring and managing the programme as it progresses, is considerable. Phase Two is at a far earlier stage of development with many important decisions to be made before HS2 Ltd and the Department can improve cost and schedule estimates. Completing High Speed Two will require sustained focus and support from the Department and across government to ensure the programme is re-established on a sound basis, balancing cost, time and benefits, and delivered in a way that achieves long-term value for money.

Recommendations

28 On the High Speed Two programme:

a the Department should periodically assure itself about the feasibility of completing the programme to agreed revised opening dates and the likely success of actions to improve delivery confidence, and whether any delays against schedule are reducing the time allocated for the critical stages of systems integration and testing of the railway;

b the Department and HS2 Ltd should develop a common set of management information, so that they can clearly and consistently track performance on the programme and identify when risks are emerging. The management information should use consistent terminology and definitions and include the rationale for any changes. It should also be clear about what the Department and HS2 Ltd are measuring the programme costs and schedule against, for example the difference between the forecast cost of the programme, the budget and the target cost;

c while we support the use of cost and schedule ranges in major programmes, the Department and HS2 Ltd should have a plan to narrow the range as the programme goes on. This plan should reflect the level of risk remaining in the programme;

d the Department should assure itself that HS2 Ltd has the capabilities it needs to deliver the programme, including the capability needed to manage the revised commercial approach for main civil construction. This assessment should recognise that HS2 Ltd will need a range of skills because the phases of the programme will be at different stages of maturity;

e following its review of sponsorship arrangements for major projects, the Department should ensure that it has appropriate arrangements to gain assurance on programme delivery, while also providing HS2 Ltd with sufficient freedom to deliver the programme; and

f HM Treasury, the Department and HS2 Ltd should take decisions on the scope and available funding for the programme, taking into account the trade-offs between cost and benefits. It should reflect a realistic assessment of the full cost of the programme and include appropriate contingency. It should also include the potential impact on cost, schedule and benefits of decisions made during parliamentary scrutiny of the Phase Two hybrid bills and provide this information to Parliament.

29 On programme management the government should:

a ensure that it takes appropriate account of the limitations of cost benchmarking information when using this approach to estimate costs. It should also use other available sources of information on costs;

b be realistic about the cost of complex and ambitious programmes and not assume arbitrary efficiency savings to make them affordable within available funding. Targets should be based on a realistic assessment of how robust cost control and different approaches to delivery can lower costs; and

c throughout the life of a programme, consider setting ranges for cost estimates and completion dates to reflect uncertainty, with a point estimate within this range set to help delivery bodies and programme sponsors closely manage performance.

Part One

Progress on the High Speed Two programme

1.1 This part examines what progress the Department for Transport (the Department) and High Speed Two Limited (HS2 Ltd) have made on the High Speed Two programme (the programme) since we last reported in 2016. It examines:

- background information and roles and responsibilities; and
- activity since we last reported, the current status of programme cost and schedule and the actions of the Department and HS2 Ltd in addressing the emerging cost increases and schedule delays.

Background

1.2 The programme aims to construct a new high-speed, high-capacity railway to improve rail connections between London, the West Midlands, Leeds and Manchester. The new railway will join with the existing rail network to enable passengers to make journeys to Liverpool, Newcastle, Edinburgh and Glasgow (**Figure 1** overleaf).

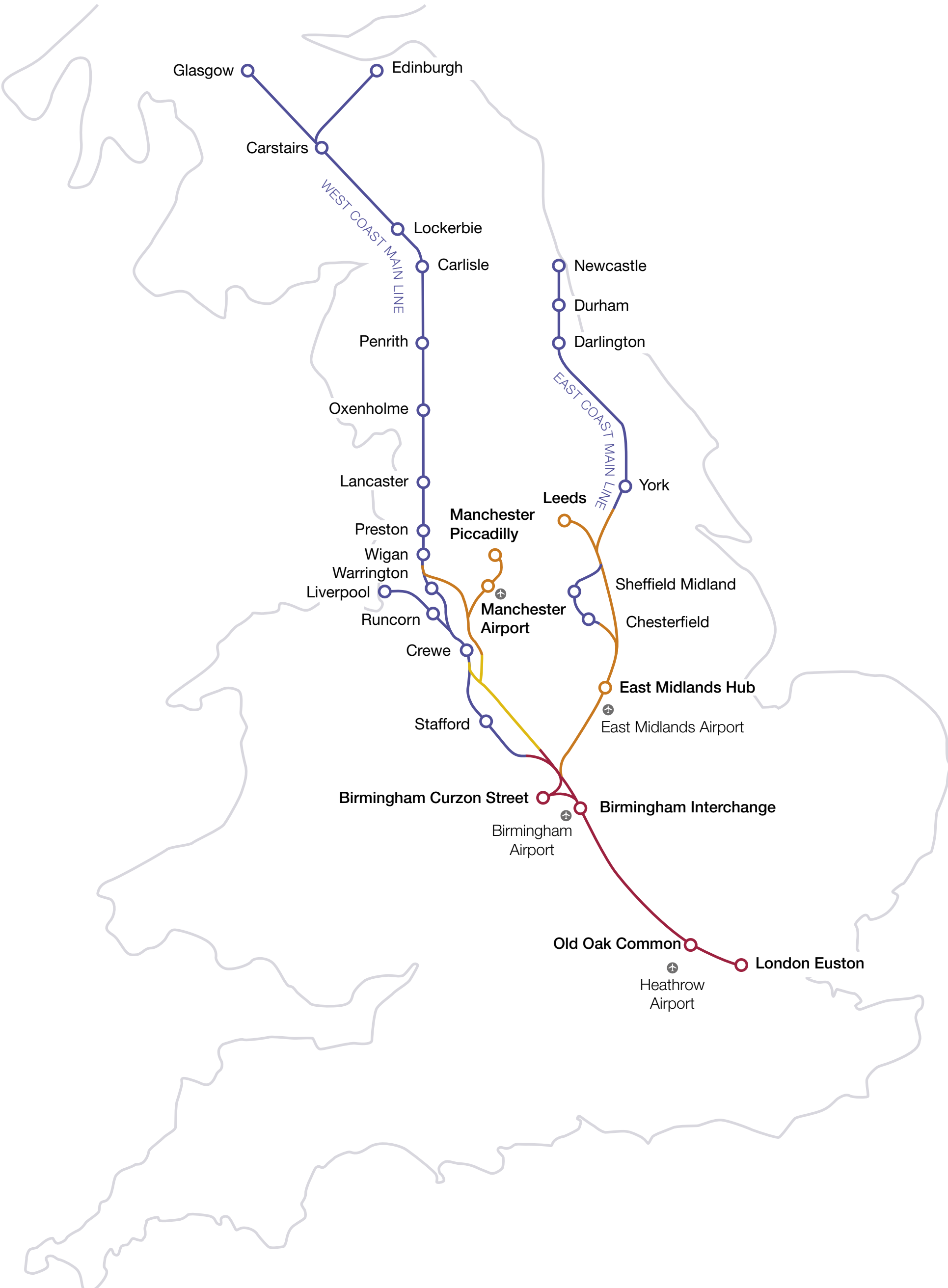
1.3 The Department has split delivery of the programme into three staggered phases, each requiring their own parliamentary approval. Phase One will run between London and the West Midlands. Phase 2a will connect the West Midlands and Crewe and Phase 2b will complete the full network to Leeds and Manchester. Currently, available funding for the whole programme is £55.7 billion (2015 prices).[4] Of this, £27.1 billion (49%) is allocated for Phase One of the programme, with the remaining £28.6 billion (51%) for Phase Two. The programme is the largest infrastructure project by value within the government's major programme portfolio, 85% larger than the second largest project, the Prison Estate Transformation Programme. **Figure 2** on pages 17 and 18 sets out a timeline of key points in the development of the programme from 2009.

4 This excludes VAT and the works to enable the development of commercial space above Euston station.

Figure 1
Current proposed High Speed Two route

High Speed Two will provide a new dedicated high-speed railway between London, the West Midlands, Leeds and Manchester, connected to the existing rail network

- New station (Phase One)
- New station (Phase 2b)
- Destinations served by HS2 services on existing network
- HS2 line (Phase One)
- HS2 line (Phase 2a)
- HS2 line (Phase 2b)
- HS2 services on existing network



Source: Department for Transport

Figure 2

Development of the High Speed Two programme between 2009 and 2020

There have been a number of key points in the development of the High Speed Two programme

Date		Event
2009	Jan	The Department for Transport (the Department) establishes High Speed Two Limited (HS2 Ltd) to advise and develop proposals for high-speed rail services.
2010	Mar	The Department sets out proposals for a Y-shaped high-speed rail network connecting London and cities in the North, opening in 2026.
2011	Feb	The Department launches a public consultation on high-speed rail proposals.
2012	Jan	Public consultation concludes and the government decides to proceed with a Y-shaped High Speed Two network, in two phases. The Department estimates that Phase One between London and the West Midlands would cost £16.3 billion (2011 prices).[1]
2013	Jun	Spending Review 2013 sets funding for programme of £50.1 billion (2011 prices), based on a basic schedule and designs for the railway supporting an updated cost estimate.
	Nov	The government deposits a hybrid bill in Parliament to enable construction of Phase One.
2014	Mar	The Department decides to remove the connection with High Speed One, and carry out a more comprehensive redevelopment of Euston Station in response to a review of the programme by David Higgins (then HS2 Ltd chairperson).
2015	Sep to Nov	Spending Review 2015 uplifts funding for the programme set in 2013 by inflation to £55.7 billion (2015 prices). HS2 Ltd estimates that, based on emerging work, the cost of Phase One is £4.9 billion above this funding envelope.[2] HS2 Ltd launches work to develop a more detailed cost and schedule for Phase One. The Department decides to split Phase Two into Phase 2a (West Midlands to Crewe) and Phase 2b (Crewe to Manchester and West Midlands to Leeds) in order to accelerate the delivery of Phase 2a in line with a recommendation from the Higgins Review.
2016	May	HS2 Ltd presents the Department with the cost and schedule estimate for Phase One. Costs are now £0.2 billion above available funding (2015 prices).[2] HS2 Ltd has a relatively low level of confidence that it can start passenger services by 2026. The Department tasks HS2 Ltd with making the programme affordable and improving confidence that it will open on time.
	Jun	Cabinet Secretary completes reviews of the costs and schedule of the programme and identifies possible cost savings of between £875 million and £1.05 billion for Phase One and more than £6 billion of potential savings on Phase Two.

Figure 2 *continued*

Development of the High Speed Two programme between 2009 and 2020

Date		Event
2017	Feb	Royal Assent of hybrid bill to enable construction of Phase One, setting the route and key features of the railway. The Department and HS2 Ltd originally planned for Royal Assent by March 2015. Changes during parliamentary scrutiny of the bill affect the design, construction and operation of the railway.
	Apr	HS2 Ltd presents the Department with a revised cost and schedule estimate for Phase One. Costs are now forecast to be £0.4 billion below available funding (2015 prices).[2] To increase its level of confidence that it can start services on time, HS2 Ltd plans on the basis of a partial opening of passenger services in December 2026 and full opening in December 2027. The Department approves the cost and schedule estimate but acknowledges that better information on the cost and schedule of Phase One will be provided from engaging with industry to agree the design and cost of building the railway. On that basis, contracting for Phase One main civil construction is finalised.
	Jul	HS2 Ltd awards main civil construction design and construction preparation contracts to four joint venture companies, following approval from the Department, HM Treasury and Cabinet Office.
2017 to 2019	Sep ↓ Jul	Figure 6 details the key events during this period, which include HS2 Ltd and its contractors developing cost and schedule estimates; HS2 Ltd's October 2018 formal early warning notice to the Department that there are significant challenges with delivering Phase One on time and within the available funding; and HS2 Ltd's formal notification to the Department in March 2019 that it has breached the terms of the development agreement (Figure 3) because it cannot deliver Phase One on time or within available funding.
2019	Jul	The Department concludes that it has sufficient evidence that Phase One is not affordable within available funding and that it is no longer feasible to open in 2026.
	Aug	The government announces an independent review of the programme.
	Oct and Nov	HS2 Ltd and the Department approve a revised cost and schedule estimate for Phase One.
Early 2020		Independent review of programme expected to report its findings to the government. The Department expects to take the final investment decision on whether to proceed with Phase One and to start main civil construction.

Notes

1 This estimate of the cost of Phase One excluded the cost of track renewal and new trains.

2 At a 95% confidence level.

3 Selected dates and events shown.

Source: National Audit Office analysis of Department for Transport and High Speed Two Ltd information

1.4 The programme is highly ambitious in its scale and involves many interrelated, complex elements, including:

- buying land and property on and around the route and compensating those affected;[5]
- designing and building new high-speed rail infrastructure (such as signalling, safety and communications systems) capable of working with the existing rail network;
- constructing a new railway, including more than 300 bridges and 70 viaducts for Phase One alone;
- building six new stations, extending Euston and redeveloping Manchester Piccadilly; and
- introducing passenger services, including 18 trains an hour running in each direction to and from London and an additional six trains per hour in each direction to and from Birmingham. Typically, between two and six trains an hour, up to a maximum of 14, run on European high-speed railways.

1.5 HS2 Ltd will be managing concurrently, over decades, parts of the programme that will be at different stages of development: design, approval, construction, systems integration and readying for operations. For example, HS2 Ltd will be managing Phase One construction alongside the hybrid bill process for Phase 2b. Also, the length of proposed tunnelling across the country and the integration of the new infrastructure with existing systems represent significant engineering challenges.

Roles and responsibilities

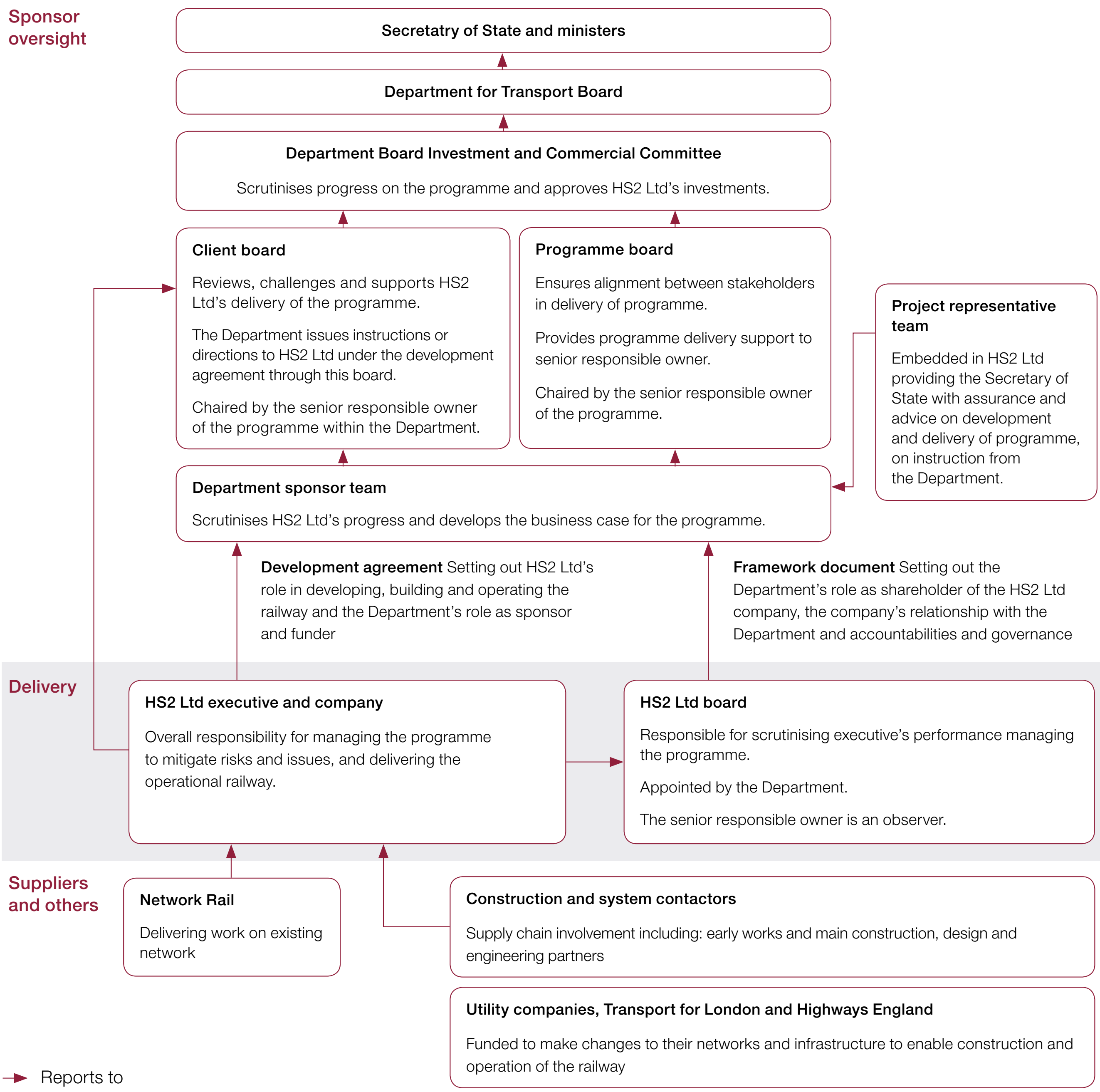
1.6 The Department is the programme sponsor and main funder, accountable for successful delivery of the programme. HS2 Ltd is an arm's-length body of the Department, created to deliver the programme as well as to maintain and manage the railway infrastructure when the railway is open (**Figure 3** overleaf). Since our 2016 report, HS2 Ltd has more than doubled its number of staff to more than 1,250.[6]

5 For Phase One, the government will need to acquire approximately 70 square kilometres of land along the route of the railway. HS2 Ltd estimates that it will have to compensate between 6,000 and 10,000 claimants who have land and property interests affected by the route and issue and process up to 50,000 compulsory purchase notices between 2017 and 2023.

6 Average number of whole-time equivalent persons directly employed by HS2 Ltd during 2018-19.

Figure 3
Roles and responsibilities for delivering High Speed Two

The Department for Transport is accountable for successful delivery of the programme



Notes

1 This is a simplified overview of the organisational responsibilities and structure for High Speed Two. Intermediate boards, groups and all relationships are not shown.

2 The Department for Transport also has organisational oversight responsibilities for Network Rail, monitoring Network Rail's performance in delivering a portfolio of rail infrastructure projects, including its works for HS2 Ltd. HS2 Ltd directly manages its contracts with Network Rail for the works on the existing railway needed for High Speed Two.

Source: National Audit Office analysis of Department for Transport and High Speed Two Ltd information

Progress since we last reported

1.7 Since we last reported on the programme in 2016, HS2 Ltd has focused on preparations to make the final investment decision to proceed with Phase One, including the start of construction. The Department and HS2 Ltd have spent £7.4 billion across the whole programme up to 31 March 2019 (**Figure 4** overleaf), of which £6.3 billion has been on Phase One.[7] Around 44% (£3,287 million) has been spent on the acquisition of land and property.

1.8 The Department and HS2 Ltd's progress on Phase One since we last reported includes:

- completing the legislation needed to permit construction of Phase One in February 2017;[8]
- awarding two-stage design and build contracts for main civil construction work to build the tunnels, bridges, embankments, viaducts and railway to four joint venture companies;
- completing significant preparatory works, including building demolitions, land clearances, moving utility pipes and cables and archaeological programmes at 250 locations;
- purchasing 66% of the land required to build Phase One;[9]
- awarding contracts for construction partners to oversee the construction of the works to extend Euston station and construction of Old Oak Common station; and
- started other procurements needed for an operational railway, including railway systems.

1.9 The Department and HS2 Ltd have also made progress on Phase Two, although this remains at a much earlier stage: In particular:

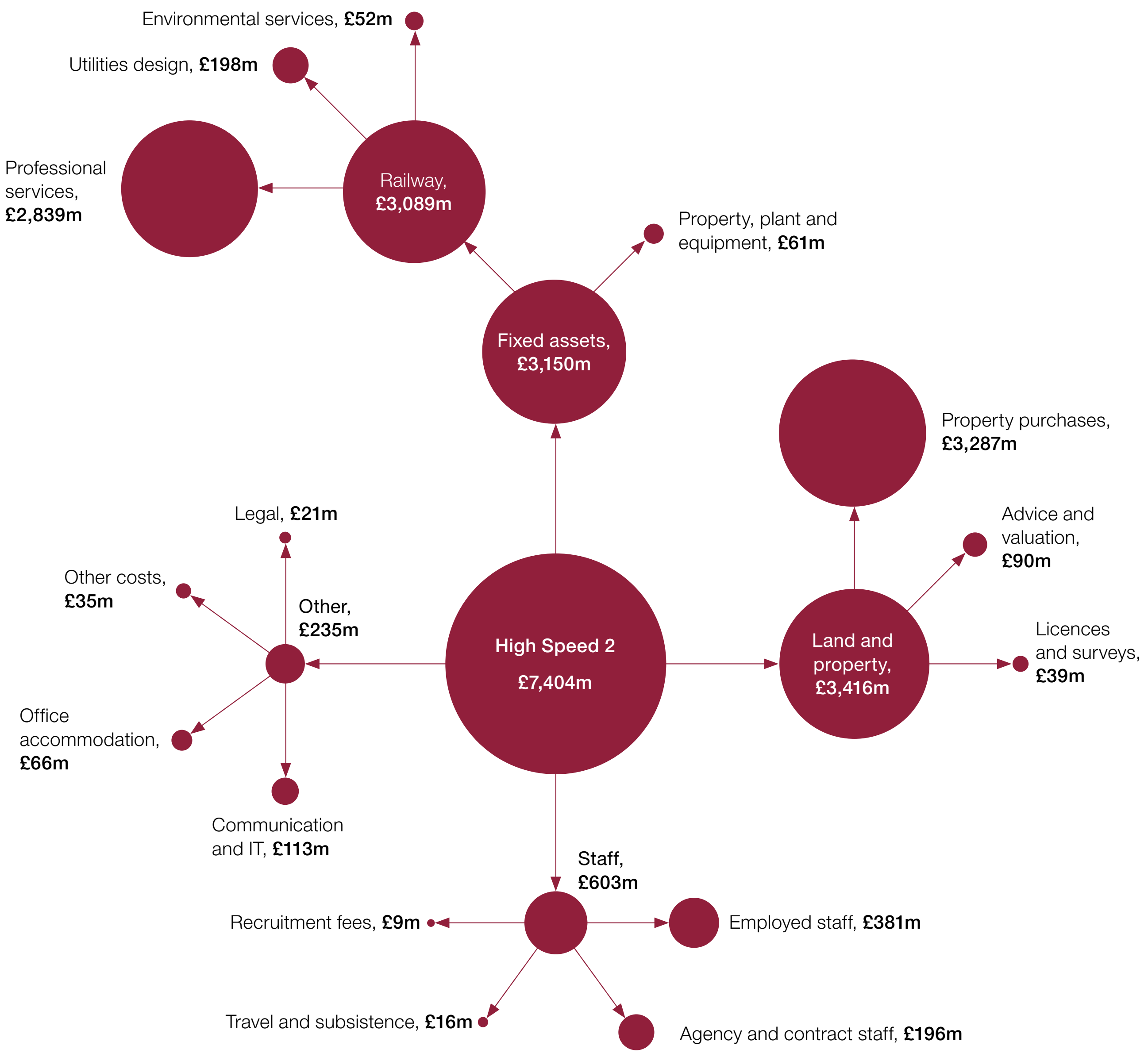
- Legislation for Phase 2a is currently being scrutinised by Parliament, and the Department is planning on the basis that Royal Assent can be achieved in early 2020.
- In 2017, the Department set out its preferred route for Phase 2b, including Sheffield being accessed via a spur from the High Speed Two route, served by High Speed Two trains that can use the existing Midland Main Line railway.
- HS2 Ltd is developing outline designs and costings for Phase 2b, in advance of the Department's plan to introduce primary legislation in June 2020 to enable construction from 2026.

7 In current prices. Excluding £0.6 billion of VAT, which HS2 Ltd has told us that HM Treasury has agreed to fund.
8 High Speed Rail (London–West Midlands) Act 2017.
9 As at October 2019.

Figure 4

Spend by the Department for Transport and HS2 Ltd to 31 March 2019 on the High Speed Two programme

The greatest proportion of programme spend to 31 March 2019 has been on the acquisition of land and property



Notes

1 Since the second reading of the Phase One hybrid bill, HS2 Ltd has included some of the costs of developing the railway as an asset in its accounts, when it judged that it was probable that Phase One will be completed.

2 Professional services includes engineering, environmental services and design costs.

3 Land and property purchases are reported in the Department for Transport's accounts.

4 In current prices. Does not include £0.6 billion of VAT paid by HS2 Ltd. HS2 Ltd told us that HM Treasury has agreed to fund VAT on the programme. Payment of VAT was not included when the available funding of £55.7 billion was set.

5 Figures may not sum due to rounding.

Source: National Audit Office analysis of Department for Transport and High Speed Two Ltd Department information

Current programme cost and schedule

1.10 We have reported three times on the programme:

- In 2013 we reported on early programme preparations and found that cost estimates were at an early stage, there was a gap in funding and that scheduling for the programme was overambitious.[10]
- In 2016 we reviewed progress with preparations. We found that the target opening date of 2026 was at risk and that the forecast cost for the programme was above the available funding. We also found that the available funding for the programme did not cover all of the activity needed to deliver the planned growth and regeneration benefits from the new railway.[11]
- In 2018 we reported on the land and property acquisition programme for Phase One. We found that the land and property cost estimate had increased significantly since the start of the programme and that cost estimates were inherently uncertain and subject to change as information improved on the railway and land and property required.[12]

1.11 At the time of publishing this fourth report, the total forecast cost for the programme is not yet clear. Since our previous reports, HS2 Ltd has developed cost and schedule estimates for the programme which indicate that the programme will cost more than the available funding and be completed later than the current target opening dates. The Department's emerging estimate, as at December 2019, gives a potential cost of between £65 billion and £88 billion (2015 prices), between 17% and 58% more than the available funding of £55.7 billion agreed with HM Treasury (**Figure 5** overleaf). However, Phase Two is at an early stage of development, and given the reasons for cost increases on Phase One, we do not think that it is possible as yet to estimate with certainty what the final cost could be. The Department and HS2 Ltd expect partial Phase One services from Old Oak Common to Birmingham Curzon Street to start between 2029 and 2033, with full services from Euston starting between 2031 and 2036. It is not clear when full services to Leeds and Manchester will commence; HS2 Ltd estimates between 2036 and 2040. The Department and HS2 Ltd are continuing to develop cost and schedule estimates.

10 Comptroller and Auditor General, Department for Transport, *High Speed 2: A review of early programme preparation*, Session 2013-14, HC 124, National Audit Office, May 2013.
11 Comptroller and Auditor General, Department for Transport and HS2 Ltd, *Progress with preparations for High Speed 2*, Session 2016-17, HC 235, National Audit Office, June 2016.
12 Comptroller and Auditor General, Department for Transport and HS2 Ltd, *Investigation into land and property acquisition for Phase One (London – West Midlands) of the High Speed 2 programme*, Session 2017–2019, HC 1531, National Audit Office, September 2018.

Figure 5

Available funding and current forecast cost and schedule estimates for High Speed Two

The current forecast cost to complete the programme is significantly above the available funding and the programme will not open on time

	Approved by the Department for Transport in November 2019	The Department's emerging estimates as at December 2019		
Cost (£ billion in 2015 prices)	Phase One	Phase 2a	Phase 2b	Full programme
Available funding[1]	27.1	3.5	25.1	55.7
Estimate range	31.0 to 40.0 [2,3,4]	4.5 to 6.5[5]	29.0 to 41.0[5]	65.0 to 88.0[7]
Variance between cost estimate and available funding	+3.9 to 12.9 (14% to 47%)	+1.0 to 3.0 (+29% to 87%)	+3.9 to 15.9 (+15% to 63%)	+9.3 to 32.3 (+17% to 58%)
Opening date				
Original target	2026	2027	2033	2033
Current estimate	2029 to 2033 (partial) 2031 to 2036 (full)	2030 to 2031	2036 to 2040	2036 to 2040
Delay	+3 years to +10 years	+3 years to +4 years	+3 years to +7 years	+3 years to +7 years

Notes

1 The current available funding for the programme was established at the 2015 Spending Review. The available funding figures used above reflect budget movements between phases since our last report and the Spending Review.

2 HS2 Ltd's point estimate is £30.1 billion. The range of the estimated Phase One costs is a judgement by the Department on the basis of detailed estimates from HS2 Ltd. The Department proposes setting HS2 Ltd a target cost for Phase One of £36 billion.

3 The figures shown are taken from Department and HS2 Ltd information. They include the estimated cost for the over-site enabling work at Euston station. The over-site enabling work is not included in the £55.7 billion available funding for the programme.

4 At the time of publishing this report, HS2 Ltd was finalising revised commercial terms with its main civil construction contractors.

5 The estimates for Phase 2a and Phase 2b are at a much earlier stage of development than Phase One and are subject to change.

6 All estimates include contingency. VAT is not included. The numbers may not sum due to rounding.

7 When setting the range for the full programme, the Department has rounded the total of the constituent phases to the nearest billion.

8 We have not audited the calculations and evidence underpinning these estimates. At the time of publishing this report, the Department had agreed with HS2 Ltd a revised cost and schedule for Phase One; however, these have not yet been approved by wider government stakeholders and were subject to change.

Source: National Audit Office analysis of Department for Transport and High Speed Two Ltd information

Actions of the Department and HS2 Ltd

1.12 Since its creation, HS2 Ltd has been developing cost and schedule estimates for Phase One. The maturity of these estimates has improved over time. In approving cost and schedule estimates, the Department recognised that it would get greater certainty on costs as preparatory construction activities were completed, the design developed, the scope of main civil construction works became clear, and through engagement with its contractors and the supply chain. **Figure 6** on pages 26, 27 and 28 sets out the key events in the programme and actions taken by the Department and HS2 Ltd. It includes events between April 2017, when the Department approved HS2 Ltd's revised cost and schedule estimate for Phase One as being sufficiently mature to start procurement activity, and November 2019, when the Department approved a finalised cost and schedule estimate for Phase One.

1.13 When the scale of possible cost increases and delays to Phase One became clear, the Department and HS2 Ltd decided to undertake further work to better understand the estimates and to identify ways of reducing forecast cost and schedule. In October 2018, HS2 Ltd's contractors estimated that main civil construction costs were 83% above the target price and HS2 Ltd formally notified the Department that there were significant challenges to the affordability of the programme. The Department decided to continue with the programme because it considered HS2 Ltd required more time to refine forecast costs and design and that it did not yet have enough information to conclude whether the programme was affordable. It approved HS2 Ltd's action plan to try to recover the programme.

1.14 While HS2 Ltd was continuing to develop its cost and schedule estimate, the Department reviewed how the scope of the programme could be changed to make it affordable within available funding. In November 2018, the Department and HS2 Ltd established a scope steering group to consider options for making changes to the programme, for example, removing the link to the West Coast Mainline at Handsacre Junction. After assessing the options, the steering group concluded that Phase One scope options alone would not make the programme affordable. It also assessed options to change the scope of Phase Two.

1.15 In February 2019, the Department's accounting officer concluded that it was appropriate to maintain spending on Phase One of the programme. Recognising that while the emerging scale of forecast cost increases and delays on Phase One was very significant and concerning, the Department considered that it needed more evidence on what a robust cost and schedule would be. In April 2019, when HS2 Ltd's action plan had not achieved an affordable programme, the Department and HS2 Ltd determined that HS2 Ltd required more time to try to reduce forecast costs and schedule delays.

Figure 6

Key actions taken by HS2 Ltd and the Department for Transport in addressing Phase One cost increases and schedule delays between April 2017 and November 2019

Date		Actions
Early cost and schedule estimates		
2017	Apr	• The Department approves HS2 Ltd's cost and schedule estimate for Phase One, which HS2 Ltd will develop and finalise to inform the main investment decision on Phase One.
	Jul	• **HS2 Ltd awards main civil construction design and construction preparation contracts to four joint venture companies, following approval from the Department, HM Treasury and Cabinet Office with a target price of £6.1 billion (excluding contingency).**
2018	Jan	• Main civil construction contractors report that the forecast cost of tunnels, earthworks and structures could exceed the target price.
	Mar	• Main civil construction contractors report poorer ground conditions than assumed, the need for further ground investigations and cost estimate increases. **Response: HS2 Ltd directs contractors to focus their work on the areas showing cost increases.** • **The Department Board Investment and Commercial Committee (BICC) approves a joint Department-HS2 Ltd plan for developing a revised cost and schedule estimate, capability development programme and full business case by February 2019, all for approval by the Department and HM Treasury prior to start of main civil construction.**
Understanding the scale of possible cost and schedule increases		
2018	May	• HS2 Ltd reviews main civil construction contractors' latest cost estimates and compares them with benchmarking information and previous estimates.
	Jun	• Main civil construction contractors warn that early construction estimates are 50% more than the target price for main civil construction and that the construction schedule could increase by 12 to 18 months. **Response: The HS2 Ltd board approves the extension of the expected start date of construction by three months to June 2019.**
	Jul	• HS2 Ltd engages consultants to help review and challenge emerging estimates from contractors where forecast costs exceed the target price and delays against schedule are forecast. • The Department approves £84 million of construction investments so that equipment is ready when needed to avoid delays to schedule, and further detailed design and ground investigations that were originally planned once construction had started, could be undertaken.
	Sep	• HS2 Ltd begins to develop its plan of actions for reducing forecast costs and schedule delays. • The Infrastructure and Projects Authority undertakes a review of HS2 Ltd's plan for developing a revised cost and schedule estimate. It finds HS2 Ltd's plan is appropriate, but not necessarily in the timescale set out in the plan.
	Oct	• **The first detailed cost estimate from main civil construction contractors is received which, following review and challenge from HS2 Ltd, indicates an estimated cost 83% higher than the target price for construction and schedule pressures of 12 to 18 months remain.** **Response: HS2 Ltd issues the Department with a formal notice as an early warning that there are significant challenges to meeting the terms of the development agreement (Figure 3) and delivering Phase One on time and within the available funding.** **Response: In November the Department responds that the formal notification was appropriate and that HS2 Ltd must set out a plan of actions for addressing the cost and schedule pressures, working with the Department.** • The Department informs the Secretary of State of the cost and schedule pressures on Phase One.

Figure 6 *continued*

Key actions taken by HS2 Ltd and the Department for Transport in addressing Phase One cost increases and schedule delays between April 2017 and November 2019

Date		Actions
Trying to recover the programme		
2018	Nov	• HS2 Ltd informs the Department that there are significant forecast cost increases and schedule delays on Phase One. • Endorsed by the BICC, the HS2 Ltd board choose to continue with the programme, rather than pause, so that HS2 Ltd can implement a plan of actions, which includes closer working with contractor teams to lower costs, further detailed technical design work on how features of the infrastructure could be built in different ways or to different specifications, examining reductions in the scope of the programme with the Department and revising the commercial arrangements. • The government sets up an independent review panel, led by Ian King the lead non-executive on the board of the Department for Transport, to look at HS2 Ltd's plan of actions. This panel raises concerns, including on whether reasons for cost and schedule issues are fully understood and the resourcing availability to support the cost and schedule estimate. • The Department establishes a scope steering group with HS2 Ltd input to look at options of reducing the scope of the programme to make it affordable. • Cabinet Office and HM Treasury undertake a review of Phase One progress and agree that the Department and HS2 Ltd should focus on seeing through the plan of actions.
	Dec	• HS2 Ltd delays the expected start of main civil construction by six months to December 2019.
Re-establishing the programme for decision-making		
2019	Feb	• HS2 Ltd informs the BICC that there are continued forecast cost increases and schedule delays on Phase One. HS2 Ltd provides the Department with a plan for how it expects to get approval from the Department to start construction in December 2019. • Officials provide advice to the accounting officer in line with HM Treasury guidance that states an accounting officer assessment should be prepared at any stage of a major project if there is potential for the project to exceed the schedule, risk, contingency or benefits parameters set for the project. This advice concludes that Phase One could still be value for money, but work has not yet finished to improve the cost and schedule estimate of Phase One.
	Mar	• **HS2 Ltd formally notifies the Department that it has breached the terms of the development agreement because it cannot deliver Phase One on time or within available funding.** **Response: The Department responds to HS2 Ltd's formal notification of a breach of the development agreement in April. It determines that HS2 Ltd requires more time to complete its plan of actions.** • The Secretary of State is advised that actions to make Phase One affordable within the available funding have not worked. • The Department commissions an external benchmarking study against which to compare current cost estimates and undertakes a review of the programme with HM Treasury.
	May	• HS2 Ltd estimates that forecast costs for Phase One have further increased. • The Department concludes that Phase One could be made affordable within the available funding with significant changes, including a combination of savings, scope reductions and alternative financing. • HM Treasury informs the Department that it agrees HS2 Ltd should be given six more weeks to scrutinise costs for savings opportunities. • The Secretary of State directs that preparations are made for a pre-summer parliamentary recess decision on whether, and if so, how to progress with the programme.

Figure 6 *continued*

Key actions taken by HS2 Ltd and the Department for Transport in addressing Phase One cost increases and schedule delays between April 2017 and November 2019

Date		Actions
Re-establishing the programme for decision-making *continued*		
2019	Jun	• Chairperson of HS2 Ltd informs the accounting officer that there is no prospect of HS2 Ltd being able to deliver Phase One within the available funding or on time and provides the Department with a draft report from their review of the programme. • The Infrastructure and Projects Authority undertakes a review and concludes that successful delivery is unachievable. HM Treasury undertakes a progress review suggesting further scrutiny of risks to the programme and contingency is needed. • Major Projects Review Group (MPRG) discusses programme options to present to ministers, with a preference to maintain work on Phase One while continuing to look at ways of making savings. It also recommends that the Department develops an overall rail strategy for the North to inform decisions on relevant schemes, including High Speed Two Phase 2b. • **The HS2 Ltd board approves £0.5 billion to fund equipment investments and further detailed design, maintain progress on construction activities to avoid higher costs from its contractors standing down their plans and resources and then starting up again at a higher overall cost, and for cost increases on preparatory works.**
	Jul	• **Officials provide the accounting officer and HS2 Ltd chief executive with updated advice, which concludes that Phase One is unaffordable but the value for money of the programme remains compelling.** • **The Department concludes that it has sufficient evidence on the revised cost forecast and schedule developed by HS2 Ltd to conclude that Phase One is not affordable within the available funding and scope requirements and that it was no longer feasible for Phase One to open in 2026.** • **Chairperson of HS2 Ltd provides the Department with their final report from their review of the programme.**
	Aug	• **The government announces an independent review of the programme. The new Secretary of State is briefed on the programme review by the HS2 Ltd chairperson.**
	Sep	• **The Department publishes HS2 Ltd chairperson's report on the programme.** • **HS2 Ltd and the Department continue to work on the cost and schedule estimate and commercial arrangements.**
	Oct	• The HS2 Ltd board approves the revised Phase One forecast cost and schedule estimate and provides to the Department for approval. The forecast cost range of £38.2 billion to £40.4 billion is £11.1 billion to £13.3 billion more than the available funding, and the opening date of full Phase One services from Euston between 2031 and 2036 is at least five years delayed.
	Nov	• The Infrastructure and Projects Authority undertakes a review and concludes that, until Phase One's schedule and budget are reset, successful delivery of the programme appears to be unachievable. • Based on HS2 Ltd's completed estimate, the Department approves a cost and schedule estimate for Phase One setting a range of between £31 billion and £40 billion, between £3.9 billion and £12.9 billion more than the available funding. HS2 Ltd's point estimate is £30.1 billion.

Notes

1 This figure sets out the key actions taken by the Department and HS2 Ltd. It is not an exhaustive list of all actions and work ongoing during the period.

2 References to 'target price' in this table exclude contingency and are in 2016 prices. All other values are in 2015 prices.

3 The figures shown are taken from Department and HS2 Ltd information. They include the estimated cost for the over-site enabling work at Euston station. The over-site enabling work is not included in the £55.7 billion available funding for the programme.

4 The MPRG is a group of experts from which HM Treasury and Cabinet Office convene panels to scrutinise the largest and most complex major government projects at key points in HM Treasury's programme approval process.

Source: National Audit Office analysis of Department for Transport and High Speed Two Ltd information

1.16 In May 2019, the Department recognised that it needed to prepare for a fundamental decision on how to proceed with the programme before the summer 2019 parliamentary recess. It assessed that Phase One could be made affordable with significant changes, including a combination of applying savings and scope reductions and securing alternative financing. The Department recognised that these changes carried risks, and would require the consent of Parliament and stakeholder support. For example, savings identified to date were based on estimates and may not be achieved and scope changes could adversely affect the value for money of the programme.

1.17 In July 2019, the Department assessed that it had sufficient evidence on the revised cost forecast and schedule developed by HS2 Ltd to conclude that Phase One was not affordable within the available funding and scope requirements and that it was no longer feasible for Phase One to open in 2026. The Department considered that work by HS2 Ltd with its contractors, and internal and external benchmarking, provided evidence that no further significant savings were likely: In particular:

- Work the Department had commissioned from consultants found that further efficiencies from the technical design of Phase One were unlikely to have a significant impact on cost.
- The Department commissioned consultants to benchmark the emerging forecast costs of Phase One against other 'similar' UK infrastructure projects, which concluded that HS2 Ltd's forecast estimate at that time was within the range of similar projects, although at the higher end of the range.
- HS2 Ltd also commissioned benchmarking of its cost estimate to similar international projects. This found that while the cost of High Speed Two per kilometre was three to four times the cost of comparable projects in Europe, detailed analysis of the reasons for this identified that only 8% (£3.2 billion) of the differences could not be explained.

1.18 In July 2019, the Department and HS2 Ltd updated advice to the accounting officer and HS2 Ltd chief executive to set out the basis for continued spend on the programme. This highlighted:

- Delivering the programme remains government policy.
- The Department had identified scope reductions and changes to the financing of the programme that could lead to a viable scheme.
- The value-for-money case for the High Speed Two programme remains compelling against other schemes.
- While continuing with the programme posed an increased risk to nugatory spend, slowing progress introduced a greater risk of total programme costs increasing by £350 million to £525 million, as main civil construction contractors would need to stand down their plans and resources and then put these back in place at extra cost.
- While, at the time, the revised benefit-cost ratio (BCR) for the overall programme is equivalent to low value for money, the Department had plans to reduce costs, which had the potential to improve the BCR.

1.19 In August 2019, the government announced an independent review of the programme, led by Douglas Oakervee. In September 2019, the Department published the chairperson of HS2 Ltd's review of the programme, with the findings having previously been discussed with the Secretary of State and the Department.

1.20 The remainder of this report examines:

- why the schedule is delayed and forecast costs have increased; and
- risks that the Department and HS2 Ltd must manage going forward.

Part Two

Why the schedule is delayed and forecast costs have increased

2.1 This part of the report examines the key factors that increased costs and delayed the schedule of Phase One, and the key points of learning for this programme and other future major programmes. Our analysis focuses primarily on main civil construction for Phase One, because this part of the High Speed Two programme (the programme) is the most advanced.

2.2 In June 2019, the chairperson of High Speed Two Limited (HS2 Ltd) reported to the Department for Transport (the Department) the provisional results of a review of the programme. He concluded that there was no prospect of HS2 Ltd being able to deliver Phase One within the available funding or opening on time. At the time of publishing our report, the Department and HS2 Ltd estimate the cost of Phase One at between £31 billion and £40 billion, between £3.9 billion and £12.9 billion (14% to 47%) more than the available funding, and that costs have increased on all elements except the purchase of trains.[13] We have not audited the calculations and evidence underpinning these estimates. **Figure 7** on pages 32 and 33 and **Figure 8** on pages 34 and 35 summarise the reasons why Phase One is now expected to cost more than the previous cost estimate in April 2017.

2.3 The rest of this part seeks to draw out the key learning points underlying the cost and schedule increases on Phase One.

Schedule

2.4 The Department set the 2026 opening date for Phase One in 2010, with reference to the time taken to design and complete other infrastructure programmes, but before it had a detailed schedule of the activities needed to deliver the railway. The Department recognised that achieving this date was subject to public consultation, parliamentary approval and a decision on funding. However, it did not sufficiently take into account that High Speed Two is a much larger programme with many more interrelated elements than comparator programmes.

13 Numbers drawn from Department and HS2 Ltd information. The point estimate is £30.1 billion. The estimated cost includes the cost of the over-site enabling work at Euston station. The over-site enabling work is not included in the £55.7 billion funding available for the programme.

Figure 7

Summary of High Speed Two Phase One forecast cost increases by element between April 2017 and October 2019

Every element of the Phase One forecast cost estimate has increased between April 2017 and October 2019, except for purchasing trains (rolling stock)

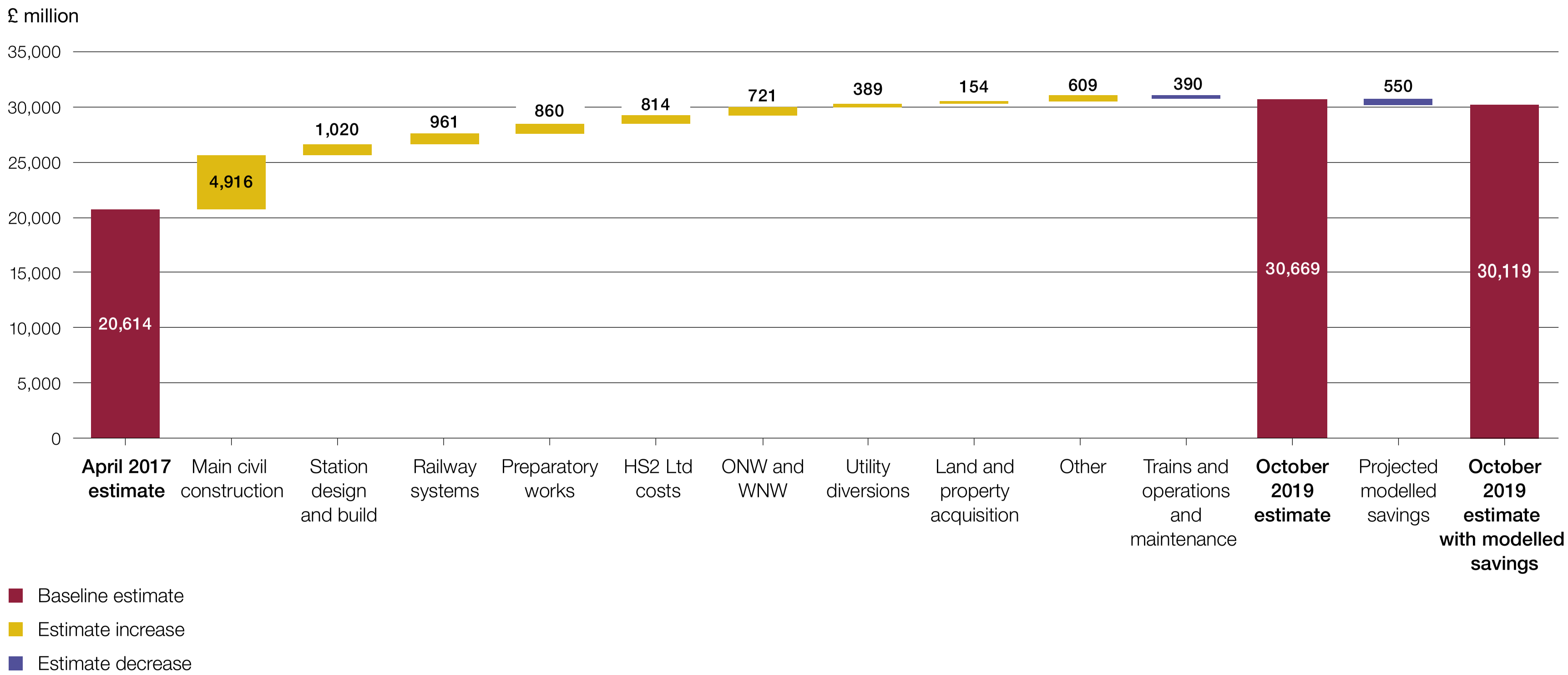


Figure 7 *continued*

Summary of High Speed Two Phase One cost increases by element between April 2017 and October 2019

Element of cost estimate	Cost change since April 2017 (£m)	Cost change since April 2017 (%)	Cost estimate in October 2019 (£m)
Main civil construction[3]	4,916	85	10,667
Station design and build	1,020	34	3,984
Railway systems	961	52	2,792
Preparatory works	860	124	1,552
HS2 Ltd costs: HS2 Ltd staff and administration	814	35	3,138
On network works (ONW) and wider network works (WNW): Works on the existing rail network	721	85	1,573
Utility diversions	389	81	869
Land and property acquisition	154	5	3,562
Other[4]	609	180	948
Trains (rolling stock) and operations and maintenance (O&M)	-390	-20	1,584
Total	**10,054**	**49**	**30,669**

Notes

1. All values are in 2015 prices and do not include contingency or VAT. The numbers may not sum due to rounding.
2. Numbers drawn from Department for Transport and HS2 Ltd information. The cost estimates at April 2017 and October 2019 include the cost of the over-site enabling work at Euston station. The over-site enabling work is not included in the £55.7 billion available funding for the programme.
3. Main civil construction includes savings negotiated with contractors of £230 million.
4. 'Other' includes third-party agreements, logistics and transport management, Department for Transport commissioned work and other Phase One contracts.
5. We have not audited the calculations and evidence underpinning these estimates. At the time of publishing this report, the Department had agreed with HS2 Ltd a revised cost and schedule for Phase One; however, these had not yet been approved by wider government stakeholders and were subject to change.

Source: National Audit Office analysis of Department for Transport and High Speed Two Ltd information

Figure 8

Factors leading to the change in forecast cost of High Speed Two Phase One between April 2017 and October 2019

The HS2 Ltd chairperson's review of the programme in 2019 identified a number of reasons why Phase One is forecast to cost more than the available funding

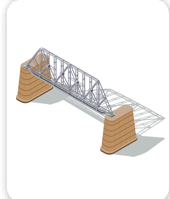
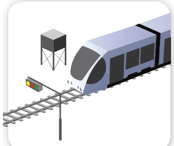
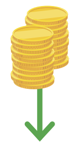
	Element of cost estimate	Reasons for change in forecast cost
	Main civil construction The building of the railway including earthworks, tunnels and bridges.	Additional costs of constructing bridges, tunnels and earthworks as the consequences of the Department's set requirements for High Speed Two became clear in the programme's design. Contractors' security, design and logistical costs were higher than anticipated.
	Station design and build Building, extending and redeveloping stations.	Previous estimates of contractor overheads and design costs were based on other programmes which underestimated the costs of High Speed Two stations. Additional requirements from the Department and third parties on the specification of the stations.
	Railway systems Systems such as power, signalling and communications fitted to built infrastructure.	Further development of the design has led to a better understanding of the work needed for systems. The need for specialist skills has increased labour costs.
	Preparatory works Preparatory work undertaken before main civil construction can begin. Includes site clearance, building demolitions and archaeological programmes.	Site complexity and the volume of work needed has been greater than anticipated as a result of issues, such as the presence of asbestos and archaeological remains.
	HS2 Ltd costs Administration costs – costs not directly related to the construction of High Speed Two.	The Department previously assumed that some of HS2 Ltd's operating costs would be paid for by the future operator. HS2 Ltd incorrectly assumed land and property professional fees were included in the land and property budget. The lengthened schedule means administrative costs will be spent over a longer period.
	Works on the existing rail network (ONW) and wider network works (WNW) Work to modify existing Network Rail assets to enable high-speed services.	Work at Euston and Old Oak Common is more complex than originally anticipated. Cost rates are now based on Network Rail contractor estimates which are higher than HS2 Ltd's original estimates.

Figure 8 *continued*

Factors leading to the change in forecast cost of High Speed Two Phase One between April 2017 and October 2019

	Element of cost estimate	Reasons for change in cost	
	**Utility diversions** Diversion of existing utilities on the route of the scheme, such as gas and power lines.	A greater volume of work needed than first anticipated, particularly for site preparation. Need for specialist skills increasing forecast labour costs.	
	**Land and property acquisition** Programme to acquire the land and property needed to build and operate High Speed Two.	Updated surveyor estimates of actual properties to be acquired.	
	**Other**	Mitigation measures better defined for the strategic road network and greater clarity on third-party agreements including service level agreements with local authorities. Works to enable operation of the High Speed Two service on the existing network (wider network works) decreased as cost savings identified.	
	**Trains (rolling stock) and operations and maintenance (O&M)** Purchasing of trains needed for the route and equipment and preparing people for operations.	Trains: Number of trains being bought has been reduced from 60 to 54. O&M has increased: Efficiencies assumed for the track in previous estimates have not been achieved.	

Notes

1 Descriptions of programme elements may be different from those used in the chairperson of HS2 Ltd's review.

2 This table includes the most significant reasons why HS2 Ltd's forecast cost and schedule have changed from earlier estimates. The full list is provided in the chairperson's review.

Source: National Audit Office analysis Department for Transport and High Speed Two Ltd information, *HS2 Ltd Chairman's Stocktake*, September 2019

2.5 In our 2013 report, we noted that the schedule for Phase One was overambitious, particularly given that High Speed Two is much larger than other programmes, such as Crossrail and High Speed One, and that it would be difficult for HS2 Ltd to complete all the activities in the time available. In 2016, we reported that the 2026 opening date was at risk. HS2 Ltd had missed 32% of its planning and development milestones and was only 60% confident it could meet the opening date. We also reported that it would be challenging for HS2 Ltd to deliver the programme at the same time as building the required organisational capabilities. In 2016, the Committee of Public Accounts, the Cabinet Secretary and the Major Projects Review Group (MPRG) all raised concerns about the schedule, which had also been recognised by the Department, and recommended revisiting or delaying it.[14] In May 2016, the MPRG concluded that the ambitious schedule had been a useful tool to drive progress to this point but that it was driving up costs. The amount of time allocated to construction had also reduced since 2010 (**Figure 9** on pages 38 and 39).

2.6 In 2017, the Department and HS2 Ltd considered how it could increase confidence in the opening date for Phase One. In April 2017, the Department approved a cost and schedule estimate for Phase One which assumed a partial start of train services of three trains an hour from Old Oak Common starting in 2026, rather than the 10 trains an hour operating from Euston station as originally planned. Services from Euston station were planned to start from December 2027. HS2 Ltd assessed that it was 80% confident that it could achieve this schedule and worked towards meeting these dates. However, the Department continued to set HS2 Ltd a target date for full opening from 2026 because it wanted HS2 Ltd to develop options to meet this date. It is not clear what work HS2 Ltd undertook to try to achieve a full opening in 2026.

2.7 HS2 Ltd has missed and delayed many of its programme milestones set in April 2017. It has required more time than anticipated to agree the detailed technical design and forecast cost of the main civil construction (building the railway, tunnels and viaducts) with its contractors because forecast costs have been significantly higher than expected. Also, HS2 Ltd's progress on the other elements needed for the railway, primarily stations and railway systems, has been delayed for a number of reasons, including time spent applying lessons learned from the commercial approach for main civil construction and evaluating feedback from potential bidders (**Figure 10** on pages 40 and 41). The delays to stations and railway systems have not impacted on the start of main civil construction because HS2 Ltd is delivering these elements in parallel.

14 The Major Projects Review Group is a group of experts from which HM Treasury and Cabinet Office convene panels to scrutinise the largest and most complex major government projects at key points in HM Treasury's programme approval process.

2.8 From July 2018, the project representative (Figure 3) reported consistently that Phase One was not deliverable within available funding and schedule, recommending that the Department reset the programme and examine its strategic case and value for money. In October 2018, HS2 Ltd formally notified the Department that there were “significant challenges” to the partial opening of Phase One services in 2026. In March 2019, HS2 Ltd notified the Department that it could not start any services in 2026. At that point, HS2 Ltd began planning on the basis of the earliest likely start of passenger services, forecast at the time to be between December 2028 and December 2029.

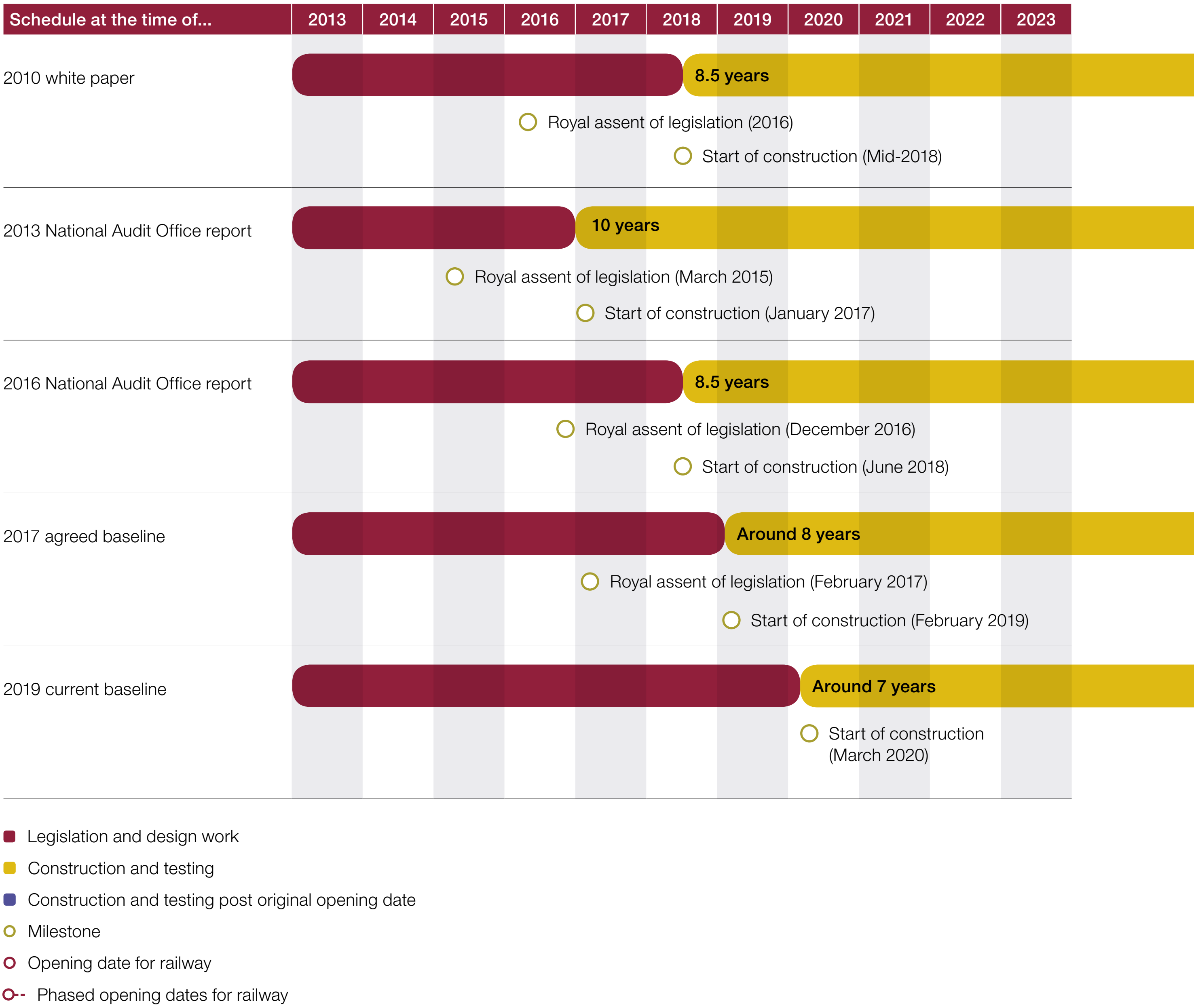
2.9 In October 2019, HS2 Ltd finalised its revised cost and schedule estimate for Phase One, reflecting delays against the milestones and difficult aspects of the programme requiring more time than originally anticipated. It now forecasts running three trains an hour between Old Oak Common and Birmingham Curzon Street between 2029 and 2033, with 10 trains an hour from Euston between 2031 and 2036, at least five years later than planned. The reasons for the delayed opening include:

- a 21-month delay to the start of construction, including an additional year spent developing a revised cost and schedule estimate for Phase One;
- an additional year being required as the ground needs more time to settle after earthworks than planned before contractors can complete other elements of construction;
- the delay to main civil construction has had a knock-on effect to when contractors can install railway systems, causing a year of delay;
- Granby Terrace Bridge at Euston station requires more structural works and works on the existing utility pipes and cables than anticipated. These works impact on the handover of the site to other works to complete Euston station, leading to a year’s delay to services from this location; and
- a revised amount of contingency to reflect an updated assessment of risk in the schedule.

Figure 9

The anticipated High Speed Two Phase One schedule at selected points in time

Delays to the programme have reduced the amount of time to complete the railway before the original target opening date of 2026



Source: National Audit Office analysis of Department for Transport and High Speed Two Ltd information

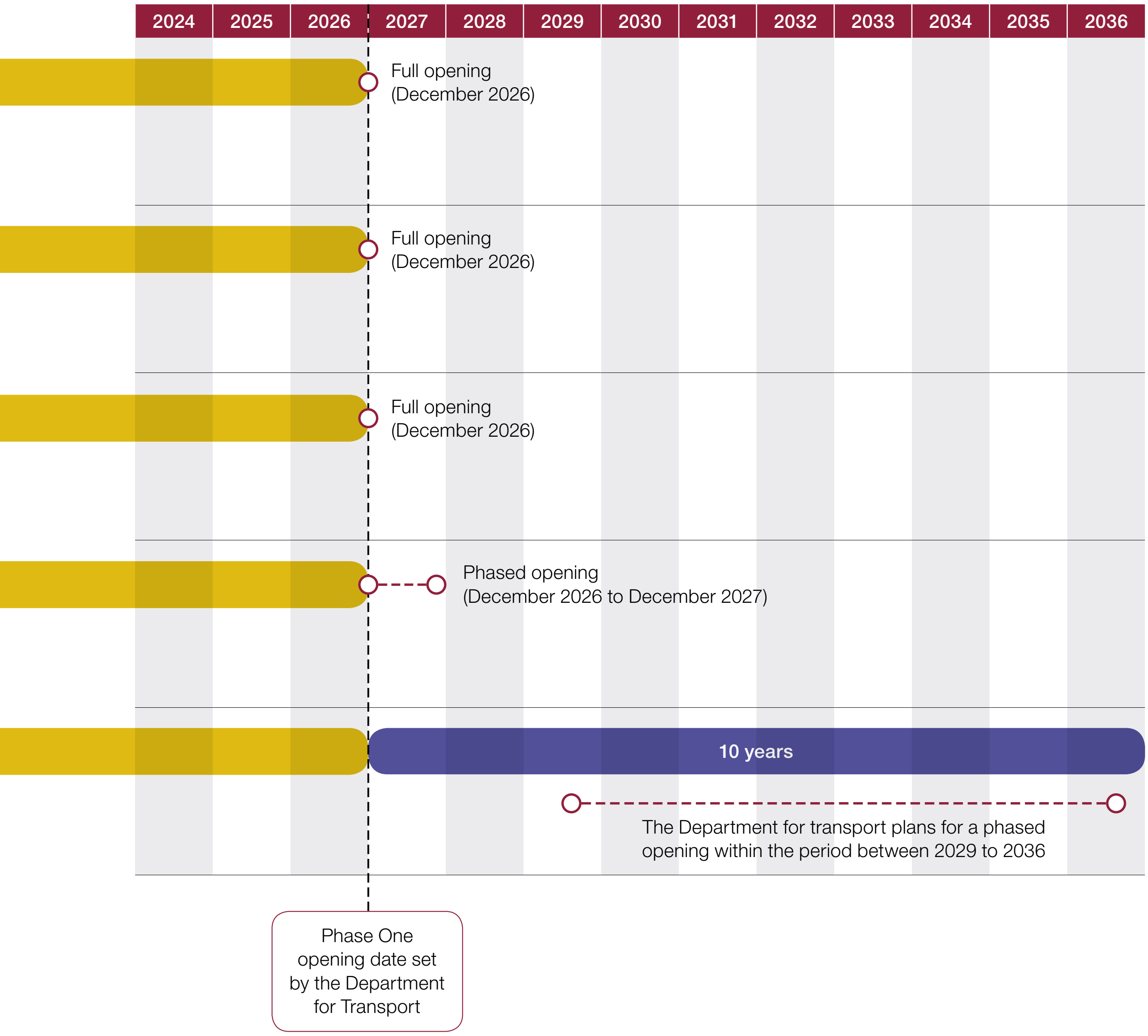
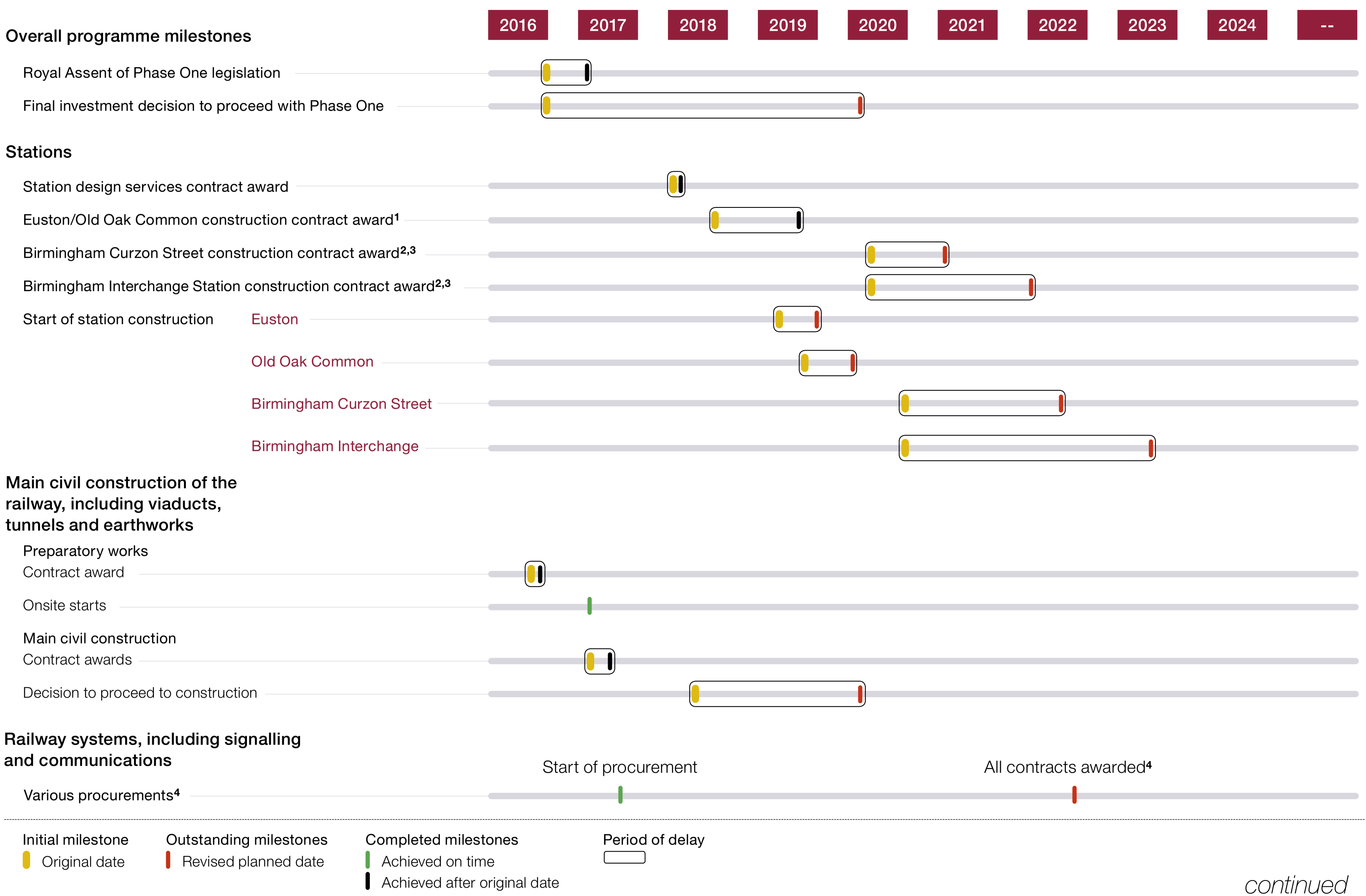

2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
Full opening (December 2026)
Full opening (December 2026)
Full opening (December 2026)
Phased opening (December 2026 to December 2027)
10 years
The Department for transport plans for a phased opening within the period between 2029 to 2036
Phase One opening date set by the Department for Transport

Figure 10

HS2 Ltd's performance against Phase One milestones as at October 2019

HS2 Ltd has not met many of its scheduled milestones to enable passenger services to start in 2026



continued

Figure 10 *continued*
HS2 Ltd's performance against Phase One milestones as at October 2019

Notes

1 HS2 Ltd let the construction contracts for Euston and Old Oak Common stations six and 12 months later than planned. HS2 Ltd required extra time for assessing market responses to contract proposals, securing approval from the Department and because of a legal challenge from a losing bidder on Old Oak Common station.

2 In May 2018, HS2 Ltd changed its procurement approach for the stations in Birmingham. Rather than contracting for Birmingham Interchange and Curzon Street stations through a single procurement process, HS2 Ltd re-phased and separated the procurement of the two stations.

3 The award of contracts for Curzon Street and Birmingham Interchange stations are up to 20 months delayed. HS2 Ltd decided to change how it was going to procure the design and build of these stations drawing on experience from main civil construction contracts about the size of, and incentive mechanisms within, the contracts. HS2 Ltd paused the procurement of the design and construction of Curzon Street station in March 2019, and at the time of publishing this report, HS2 Ltd was deciding when to contract for the design and build of the station.

4 HS2 Ltd has revised its procurement approach for railway systems twice. Both times it has increased the number of contracts to be let. This was in response to feedback from possible suppliers that contracts were too big and complex, and from learning from other parts of Phase One.

Source: National Audit Office analysis of High Speed Two Ltd information

Cost

Specification

2.10 High Speed Two is a highly ambitious programme, intended to be world-leading in its specification. The programme plans to:

- be the most environmentally sustainable high-speed railway in the world;
- support the largest archaeology programme ever undertaken in the UK;
- set new construction workforce standards for equality, diversity and inclusion; and
- run 18 trains an hour to and from London, and an additional six to and from Birmingham, comprising a mix of 200 metre- and 400 metre-long trains, at speeds of up 360 kilometres an hour.

2.11 During the passage of the hybrid bill in Parliament to approve Phase One, additional elements were added to account for stakeholders' needs, such as a longer tunnel through the Chilterns.

2.12 The Department set the budget for High Speed Two at an early point in the programme's development, before there was detailed information about how it would be built. When we reported in 2013, the Department forecast that Phase One would cost £16.3 billion to build (2011 prices), based on a basic outline of the programme design and a simple calculation using average cost rates multiplied by the kilometres of the scheme (**Figure 11**).[15] The Department developed this into a series of basic schedules and designs underpinning a new cost estimate made in late 2013. The 2013 Spending Review established funding for the whole programme of £50.1 billion (2011 prices), which was uplifted by inflation in 2015 to set the current available funding for the programme of £55.7 billion (2015 prices), of which £27.2 billion was allocated to Phase One.[16]

2.13 When we reported in 2016, HS2 Ltd estimated that Phase One would cost £27.4 billion, £0.2 billion above it's available funding.[17] The Department tasked HS2 Ltd with revising the cost and schedule (paragraph 2.6) so that it was within the available funding and had a greater level of confidence that it could start services on time.

2.14 In April 2017, HS2 Ltd updated the Phase One cost estimate we examined in our 2016 report. HS2 Ltd based the 2017 estimate on the May 2016 cost and schedule estimate with a series of cost savings and scope reduction decisions applied, informed by reviews of the costs and schedule of the programme led by the Cabinet Secretary (see paragraph 2.21). The design was still at a relatively early stage of development; approximately 13% of the design was complete. HS2 Ltd calculated that costs were £0.4 billion below the available funding.[18]

2.15 HS2 Ltd calculated the amount of contingency required for Phase One using a detailed analysis of its identified risks, resulting in £7 billion of contingency, equivalent to 37% of future costs at that time. This method is more appropriate for a programme at a later stage of development, with a detailed design to support a fuller understanding of a programme's risks. This detailed analysis did not take enough account of the uncertainty inherent in the programme at this stage, and the likelihood that unidentified risks would emerge. Analysis completed recently by consultants for HS2 Ltd found that the ranges HS2 Ltd applied to account for cost uncertainty were less than half that outlined in the Crossrail programme's guidance for estimates at a similar stage of development.

15 The estimate of the cost of Phase One excluded the cost of track renewal and new trains.
16 The available funding for Phase 2a was £3.7 billion and £24.8 billion for Phase 2b.
17 In 2016 we reported the Department and HS2 Ltd's estimate of Phase One costs based on a 95% confidence level. The upper end of the range of Phase One costs, as at November 2019, in this report corresponds to approximately a 95% confidence level.
18 In 2016 we reported the Department and HS2 Ltd's estimate of Phase One costs based on a 95% confidence level. The upper end of the range of Phase One costs, as at November 2019, in this report corresponds to approximately a 95% confidence level.

Figure 11

HS2 Ltd's development of the Phase One cost estimate between 2009 and 2019

HS2 Ltd's current cost and schedule estimate is its most detailed so far and uses more comprehensive designs and more accurate cost and schedule data

	Early stage (2009)	Preferred route and developing design (2009 to 2013)	Hybrid bill debated in Parliament (2013 to 2016)	Royal Assent to confirm final route (2016 to 2017)	Agreeing final costs before construction begins (2017 to 2019)
Maturity of route	Route represents a line on a map.	The expected route continues to mature although still a basic outline. HS2 Ltd discusses with construction specialists which sections are expected to be tunnels or viaducts. Government decides to proceed with Y-shaped route.	In order to submit the hybrid bill, HS2 Ltd develop drawings of the programme routes outlining the main works that would be undertaken and land affected. This includes a Book of Reference which lists all the land and property that will be on the safeguarded route.	Route is finalised following passage of the hybrid bill through Parliament and includes additions from parliamentary scrutiny of the bill. The design reaches 13% completion.	Detailed route design and schedules are developed with input from contractors 70%–80% of the scheme design complete.
Maturity of estimate	No cost estimate at this stage.	Cost estimate prepared for business case, which required a benefit-cost ratio. A simple calculation using average cost rates multiplied by the kilometres of the scheme. This estimate was reviewed by major projects officials with experience of Thameslink and Crossrail. Basic schedules exist.	An Estimate of Expense is submitted to Parliament; a statement of what the government considered it would cost to construct the railway. This includes costs based on estimates from an external professional adviser for land and property. The Estimate of Expense is revised as the hybrid bill made its way through Parliament.	Calculated with cost models. Only 3% of the data from the construction supply chain with the rest from estimates and comparable international infrastructure projects. A limited number of ground and site surveys were able to be carried out. Cost estimate comprised of 15,000 lines of data and 500 cost rates. Cost estimates used to let contracts to the market.	HS2 Ltd's most detailed cost and schedule estimate based on a mixture of: • detailed costs and schedules provided by contractors (49%); and • data from international benchmarking and some cost assumptions. Cost estimate comprised of 260,000 lines of data underpinned by 12,000 cost rates.
Budget		2013 Budget set (2011 prices)	2015 2013 budget increased by inflation (2015 prices)		

Increasing understanding of programme design, cost, schedule and risk

Source: National Audit Office analysis of High Speed Two Ltd information

2.16 In April 2017 it was not possible for HS2 Ltd to know in detail how the specific requirements of the railway would be met in its design. HS2 Ltd also had to make assumptions about elements such as ground conditions, as it did not have the legal powers to acquire land and undertake detailed ground surveys. HS2 Ltd developed its April 2017 cost estimate using existing international high-speed rail programmes as benchmarks, particularly those from Europe. However, High Speed Two's specification has significant differences to these comparators (**Figure 12**). The impact of these differences has meant the costs of main civil construction elements are higher than those estimated by the benchmarks.

2.17 The hybrid bill process introduced some of the requirements that made High Speed Two different from international comparator railways. To gain the legal powers to build Phase One, in 2013 the Department and HS2 Ltd deposited a hybrid bill in Parliament to be scrutinised before it became law in February 2017. As part of this process, they committed to meeting certain minimum requirements during the construction and operation of the railway. Some of these commitments arose from petitions by members of the public affected by the bill and were added through additional provisions to the bill, or through commitments known as 'undertakings and assurances'. These commitments cover a wide range of matters including ecology, equality, diversity and inclusion, protection of utilities, and community engagement. Addressing these commitments has required solutions such as lowering the railway beneath ground level, increasing the length of tunnelling and erecting noise barriers. The bill also established limits within which construction can occur. The Department and HS2 Ltd told us that they assessed the commitments before agreeing to them.

2.18 The overall impact on cost and schedule of the commitments entered into during scrutiny of the hybrid bill are hard to accurately estimate. This is because it is difficult to isolate them from other design choices made by the Department and HS2 Ltd, and other legal requirements the programme must meet, such as on wildlife preservation. HS2 Ltd commissioned analysis which suggested that environmental and visual impact measures, such as lowering the railway beneath ground level, account for around £1 billion of the explainable difference in cost between High Speed Two's main civil construction and international comparators. The costs of undertakings and assurances may have also been potentially underestimated. Although there is some overlap with the measures above, indicative analysis by HS2 Ltd suggests costs of £1.2 billion, compared with the allowance of £245 million it included in its April 2017 estimate. Not all commitments have an impact on cost, although some can restrict contractors' ability to avoid costs in construction and can create interdependencies that add to the challenge of delivering the programme. For example, HS2 Ltd has assured certain petitioners that parts of the land required for access to construct the railway will remain unused, which can constrain the ability of contractors to use particular construction methods.

Figure 12

Key differences between High Speed Two and European high-speed railways

Factor	High Speed Two	European high-speed Railways	Impact of difference on design and cost
Number of trains an hour	18 trains an hour to and from London	Typically, two to six trains an hour, 14 maximum	HS2 Ltd chose to use track held by concrete slabs (rather than ballast) because of the speed and weight of the trains and to reduce the maintenance costs of operating this many services. Slab track needs more foundations and is noisier, requiring more earthworks to mitigate the sound (see also depth). Bridges also need more foundations and to be longer and thicker to prevent the risk of trains derailing.
Depth	Route cut deeper into ground for environment and noise mitigations	Mostly surface route	A deeper railway requires more excavation and structures to hold the walls in place. More excavation also increases the time required for the ground to stabilise afterwards.
Population density	New railway going into centres of big cities	Mostly use existing rail into city centres	Increases the difficulty of site preparation and the logistics of moving materials and machinery. Greater numbers of road and utilities diversions are needed. Tunnels are needed for the route into London, and viaducts for Birmingham.
Overheads (such as design, security and transportation)	Tiered structure of construction industry increases overheads	More efficient supply chain and design techniques	The programme's scale and complexity, and the reporting requirements of HS2 Ltd and the hybrid bill, require double the staff estimated by HS2 Ltd. These staff also need to stay in post through a longer construction schedule. Overall, contractors' estimates were at 40% to 55% of direct construction costs, compared with HS2 Ltd's estimate of 29%.

Source: National Audit Office analysis of Department for Transport and High Speed Two Ltd information

2.19 HS2 Ltd also made assumptions about other elements of the programme which have subsequently increased in cost. Detailed surveys found ground conditions to be poorer than HS2 Ltd assumed, which has increased the time and cost of construction. This is because, for example, construction will require more structural reinforcement and a greater amount of time to leave the ground to stabilise after excavation than was originally anticipated. In addition, HS2 Ltd will need to treat or replace some excavated material intended to construct the railway because it is of poorer quality than expected.

Cost savings

2.20 HS2 Ltd had begun work on its April 2017 cost estimate when the spending review that set funding for the programme was being finalised in September 2015. In September 2015, HS2 Ltd estimated that the cost of Phase One was £4.9 billion more than the available funding. To make the programme affordable, HS2 Ltd incorporated £4.9 billion of efficiency savings, changes to the scope of the programme and price estimate reductions to the Phase One estimate between September 2015 and 2017. In our 2016 report, we identified that while it is good practice to identify efficiencies as a programme develops, it would be challenging for HS2 Ltd to realise them, and that if HS2 Ltd could not achieve them, it may have to find additional funding elsewhere, or remove scope from the programme.

2.21 The efficiency savings, scope changes and price estimate reductions were driven by a focus within the government to make the programme affordable within its available funding. HS2 Ltd's internal scrutiny of the estimate resulted in a number of price estimate reductions, scope and design changes. A review of international high-speed rail programmes indicated that UK infrastructure tends to be more expensive when compared with international schemes.[19] Using this benchmark cost data, HS2 Ltd incorporated efficiencies in a number of areas. For example, it assumed that it could make savings from adopting procurement methods which encourage closer working in the industry, and through revising the standards it had originally set for key parts of the railway, as these were higher than those used in some international comparators. These standards include the approach to mitigating the noise and visual impact of the railway. Reviews by the Cabinet Secretary recommended more extensive use of the benchmark cost data to drive efficiencies, and further scope and design changes.

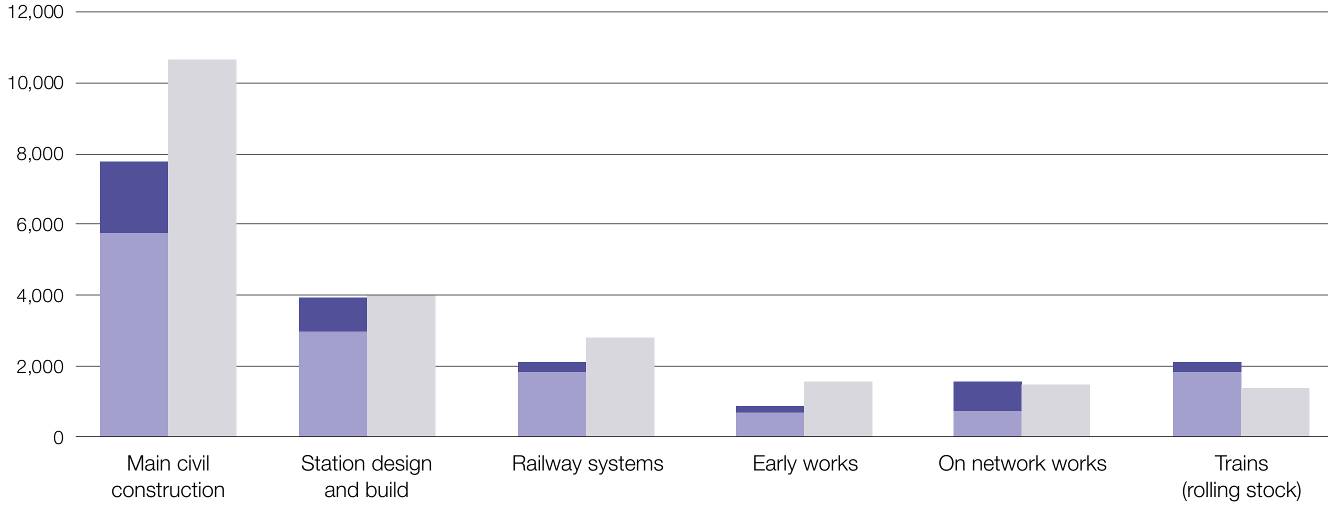
2.22 In 2016, HS2 Ltd had plans which identified where the savings might be found, but it did not develop these further into a programme of activity to achieve them. Analysis commissioned by the Department shows that elements assumed by HS2 Ltd to have the most efficiencies have seen some of the greatest cost increases. **Figure 13** shows where the majority of efficiencies were applied within the April 2017 estimate, and how the amounts in this estimate without assumed efficiencies are more similar to the current estimate. The analysis also showed that had HS2 Ltd assumed no efficiencies and calculated contingency using a risk allowance of 60%, in line with Network Rail guidance, the total forecast cost of Phase One would have been £40.3 billion, comparable with the upper end of its current estimate of between £31 billion and £40 billion.

19 *High speed rail international benchmarking study*, October 2016. Consultants were commissioned by the Chancellor of the Exchequer and Secretary of State for Transport to examine ways that experience from international high-speed schemes can be applied to deliver High Speed Two within budget. The report drew on technical data from 32 international high-speed rail schemes.

Figure 13

Cost estimates and efficiency savings of the main High Speed Two Phase One elements between April 2017 and October 2019

Elements of HS2 Ltd's April 2017 cost estimate without assumed efficiencies are more similar to its current estimate



	Main civil construction (£m)	Station design and build (£m)	Railway systems (£m)	Early works (£m)	On network works (£m)	Rolling stock (£m)
Cost estimate in 2017 when efficiency savings applied	5,751	2,964	1,831	692	760	1,826
Assumed efficiency savings in 2017 estimate	2,000	1,000	300	200	800	300
Cost estimate in 2017 without efficiency savings applied	7,751	3,964	2,131	892	1,560	2,126
Cost estimate in 2019	10,667	3,984	2,792	1,552	1,496	1,390

Notes

1 All values in 2015 prices.

2 Early works refers to preparatory works referenced as in Figure 8.

3 On network works (ONW) works are those needed for High Speed Two on the existing rail network, as in Figure 8.

4 We have not audited the calculations and evidence underpinning the October 2019 estimate. The 2019 cost estimate incorporates efficiency savings which we discuss in paragraph 3.5.

Source: National Audit Office analysis of High Speed Two Limited information

Commercial arrangements for main civil construction

2.23 HS2 Ltd's commercial approach had unintended consequences on forecast costs. In July 2017, HS2 Ltd let seven contracts, with a total target price of £6.1 billion, to four joint venture companies to construct the railway (including earthworks, tunnels and viaducts) (Appendix Three).[20] These contracts were two-stage design and build contracts used to involve industry early in the technical design of the railway and to incentivise contractors to deliver for less than the target price. HS2 Ltd thought fewer, larger contracts would create economies of scale and reduce the risks from, and costs of, integrating the work of many different contractors. HS2 Ltd told us that contracting with joint ventures made up of different companies would mean that the joint ventures would take on greater coordination, responsibility and oversight of the supply chain.

2.24 During the design stage of the contracts, contractors provided HS2 Ltd increasingly detailed construction designs and costings so that HS2 Ltd could review and challenge them. It planned to instruct contractors to begin construction, starting the build phase of the contracts, once it had agreed these prices and demonstrated that the plans were affordable within available funding.

2.25 HS2 Ltd considers one of the reasons for contractors' early cost estimates being higher than anticipated was because contractors had taken a more risk-averse approach to their designs and pricings. Under the original terms, contractors were subject to an incentive mechanism in their contracts, which held them liable for 60% of any cost increases above a target price.

2.26 As contractors developed their detailed designs, it became clear that the forecast cost of constructing the railway was significantly higher than anticipated (as a result of the reasons identified in paragraphs 2.10 to 2.19). The terms meant that if they priced the works incorrectly or unanticipated cost increases occurred, the contracts could put the financial health of their parent companies at risk. The condition of the construction market, particularly following the collapse of Carillion in January 2018, heightened contractors' concerns about the size and risk of the contracts relative to their financial resources. Contractors were also liable to make compensation payments to HS2 Ltd because of strict liability standards or if construction was delayed.

2.27 The combination of these factors meant that contractors created designs which were more conservative (and therefore less efficient) and increased their forecast prices to offset the financial risks of undertaking the works. At the time of publishing this report, HS2 Ltd was finalising revised terms with its contractors to address these issues (paragraph 3.7).

20 Excluding contingency, 2016 prices.

Consequences of schedule delays and costs increases

2.28 The significant, unforeseen amount of work HS2 Ltd has needed to complete to agree a new cost and schedule estimate for Phase One has had a number of consequences for the programme:

- **Planning:** Given the complexity of the cost estimate, HS2 Ltd and its main civil construction contractors underestimated the amount of time they thought it would take to determine a robust view of the cost and schedule of Phase One, and for HS2 Ltd to evaluate these were value for money.[21] In particular, not enough time was set aside to develop and assure the cost and schedule estimates, or address unanticipated issues. This has led to constantly moving internal targets for agreeing the estimate and rescheduling the date at which the start of main civil construction is to be approved.
- **Staff:** The project representative reported that the significant, unanticipated, volume of work required in a compressed amount of time has stretched HS2 Ltd's capacity and put staff under considerable pressure.
- **Spending:** The Department assessed that it needed to both continue spending on Phase One, and authorise some main civil construction activities, to maintain the schedule and protect future value for money while it agrees a revised cost and schedule for Phase One:
    - In July 2018, the Department approved £84 million of construction investments so that equipment would be ready when needed to avoid delays to the schedule, and further detailed design and ground investigations that were originally planned once construction had started, could be undertaken.[22,23]
    - In December 2018, the HS2 Ltd board approved £87 million of additional expenditure on main civil construction design and surveys to improve the robustness of cost and schedule estimates.

21 The revised cost estimate includes 260,000 cost lines and 12,000 cost rates, compared to 15,000 and 500 respectively in 2017.
22 The Department Board Investment and Commercial Committee was required to approve these investments because HS2 Ltd did not have delegated authority to fund main civil construction activity.
23 Including tunnel boring machines and a slurry treatment plant.

- In June 2019, the HS2 Ltd board approved £502 million to fund equipment investments and further detailed design, maintain progress on construction activities and avoid higher costs from its contractors standing down their plans and resources and then starting up again at a higher overall cost, and for cost increases on preparatory works.

In July 2019, while the accounting officer assessed that continuing spend on the programme increased the risk of nugatory spending, they concluded that because completing the programme was government policy, until the government reviewed and set a revised budget for the programme, continued investment in the programme was justified. The accounting officer stated that HM Treasury had been kept up to date with programme progress and spending plans, and this assessment would be reconsidered following any views from the new Prime Minister and Secretary of State.

2.29 HS2 Ltd considers that the additional time taken to develop the 2019 cost estimate has helped to protect the scheme's overall value for money, through allowing it to undertake more scrutiny and apply lessons learned from contracting for main civil construction on Phase One to other areas, such as the design and build of new stations and Phase Two.

Part Three

Risks that the Department for Transport and High Speed Two Limited must manage

3.1 This part of the report examines the main risks to the value for money of the High Speed Two programme (the programme) over the short to medium term, which arise from our findings in Part Two. It is not an exhaustive list of all the challenges on this programme.

Phase One

Schedule

3.2 To meet the current expected start of partial Phase One services between 2029 and 2033, High Speed Two Limited (HS2 Ltd) considers that main civil construction must start before the end of March 2020. This is because some of the construction work can only be done at certain times of the year. Delays may also reduce the amount of time allocated for the latter stages of a programme, such as integrating the signalling and systems which control the railway, and testing the intended operation of the railway, which are complex and risky parts of delivering a project on time and budget. The Department for Transport (the Department) and HS2 Ltd can only authorise the start of main civil construction when they have certainty on whether, and how, the programme will proceed, have assurance that the programme is affordable and value for money, and have secured approval from wider government stakeholders.

3.3 Our previous work on other major projects has found that managing and understanding a programme's interdependencies, such as the integration of different contractors' work during construction, is crucial to delivering a project on time and budget.[24] In our view, given the scale of the High Speed Two programme, the risks are even greater than is normal on other programmes. In producing a revised opening schedule and keeping it up-to-date, HS2 Ltd will need to be realistic about how much contingency it allows, informed by in an in-depth understanding of the most challenging and risky areas.

24 Comptroller and Auditor General, Department for Transport, *Completing Crossrail*, Session 2017–2019, HC 2106, National Audit Office, May 2019. Comptroller and Auditor General, Department for Transport and Network Rail, *Modernising the Great Western railway*, Session 2016-17, HC 781, National Audit Office, November 2016.

3.4 The Department and HS2 Ltd will need to consider the feasibility of the schedule regularly as the programme progresses. They will also need to closely manage the critical path using up-to-date and integrated programme plans to help identify and manage where the schedule is becoming compressed. HS2 Ltd should ensure that any delays at the start of construction do not reduce the amount of time allocated for the latter stages of the programme.

Cost

3.5 Since we reported in 2016, HS2 Ltd has undertaken a substantial amount of work to develop its estimate of the cost and schedule to complete Phase One. HS2 Ltd reports that it now has much greater confidence in the robustness of these compared with those made in 2016. However, the programme is a substantial undertaking over a long period of time and so risks remain that costs could go up or down, particularly in the following areas:

- **Main civil construction**: This includes significant tunnelling, earthworks and building works across a wide geographical area, including dense urban areas. Further unexpected site conditions and other unforeseen issues, such as poor weather, could delay construction and increase costs.
- **Other costs**: Approximately 50% of the costs, for elements such as trains and railway systems, in HS2 Ltd's current estimate are based on HS2 Ltd's estimates, consultant designs or benchmarking information, rather than costs agreed in contracts with industry. The potential cost of these elements is therefore less certain.
- **Extension of Euston station**: This is an important and complex part of the programme and involves building new platforms and ticket halls, extending bridges, building connections to the underground system and tunnelling in an operational railway within a central London location, while the station and conventional railway continues to operate.[25] There is uncertainty regarding the current design of the works. As a result, the Department has set a wide range of between 2031 and 2036 for the start of train services from Euston. The Department and HS2 Ltd will need to closely manage the risks to this part of the programme, balancing cost, schedule and intended benefits when taking decisions on how to proceed, and during construction.
- **Efficiency savings**: HS2 Ltd has incorporated £2.8 billion of savings within the cost estimate, including £1 billion from the revised commercial terms (see paragraph 3.7), which if not achieved will increase costs. HS2 Ltd must develop detailed plans for achieving these savings, and identify who is accountable for delivering them.

25 HS2 Ltd's work at Euston does not include the redevelopment of the existing station or the development of commercial space above the station.

3.6 HS2 Ltd's estimate of the cost of Phase One is £30.1 billion (2015 prices), excluding contingency (known as the 'point estimate'). To set an appropriate level of contingency on this point estimate, HS2 Ltd undertook detailed modelling of the impact of programme risks materialising including those above, and also commissioned analysis of the outturn costs of comparator schemes. On the basis of this work, the Department decided to set a Phase One cost range estimate of between £31 billion and £40 billion, giving a total contingency provision of £9.9 billion (2015 prices), equivalent to 43% of future costs. The lower end of the range assumes few risks materialise that increase costs, whereas the upper end assumes the majority of modelled risks occur. The Department currently proposes to delegate £36 billion to HS2 Ltd to deliver Phase One, with the Department and HM Treasury each holding £2 billion of the remaining contingency. Given the scale, complexity and early stage of the programme, the Department and HS2 Ltd will need to consider how to monitor whether the level of contingency is sufficient for future risks materialising and when it is appropriate to narrow the range of estimated costs.

Commercial arrangements for main civil construction

3.7 At the time of publishing this report, HS2 Ltd was finalising revised commercial terms with its main civil construction contractors. We have not undertaken a detailed review of the revised contractual terms but set out some observations below. HS2 Ltd estimates that these revised terms will achieve £1 billion of savings, through contractors reducing their pricings in response to the reduced risks that they will bear. Revising the commercial arrangements was a reasonable response to HS2 Ltd's analysis on the reasons for cost increases. However, like all contractual arrangements, these revised terms carry risks to value for money, which the Department and HS2 Ltd must manage. The risks include:

- **Managing costs:** Contractors were previously incentivised to control costs because they were liable for 60% of any forecast cost increases above a target price. There is no longer a fixed target price for the contracts. HS2 Ltd has collaboratively developed an estimated cost for the works with its contractors and will be responsible for funding increases above the estimated cost. It will pay contractors a fee, as a percentage of the contract cost, to build the railway.
- **Contractor incentivisation:** To incentivise contractors to deliver, HS2 Ltd will agree performance indicators, including on cost and schedule. If contractors do not meet the required performance, they will lose a proportion of their fee. HS2 Ltd has provided contractors with the potential to 'claw back' lost fee payments if they can demonstrate improved performance. HS2 Ltd intends that this 'claw back' will offset the risk that, if contractors lose a proportion of their fee, their motivation to improve productivity will wane. The performance-related adjustment of fee due will be subject to limits to prevent contractors losing all their fee at risk and to prevent windfall profits. As well as earning a fee, contractors will also earn a proportion of whatever contingency funds remain at the end of the contract to incentivise them to control the financial impact of any risks that materialise. HS2 Ltd needs to be clear how the incentive mechanism will work in practice before committing it to contract, to ensure it works as intended.

- **Accountability for delivery:** HS2 Ltd and its contractors will form joint teams to manage the contracts. Working closely with contractors brings risks and benefits that must be managed. HS2 Ltd believes that it has set clear responsibilities and accountabilities in the contracts for roles within the joint teams, assigning these to the party best placed to undertake the role. HS2 Ltd will need to monitor whether the joint teams are functioning as expected and be ready to enforce or change the terms of the contracts if needed.

- **Capability to manage the contracts:** Having the right capability to manage these commercial contracts will be vital to Phase One's success. The scale and pace of HS2 Ltd's plans to develop its capability to support the revised commercial arrangements from 2020 is ambitious. HS2 Ltd will only control costs and secure its estimated savings from the revised commercial arrangements if it can effectively manage the risks it bears, including having a good understanding of contractors' costs, and will require strong project control and programme management capability, systems and processes.

Capability

3.8 Having the right organisational capability within HS2 Ltd will be vital to protect value for money and deliver a programme of this scale. HS2 Ltd's most recent assessment of its organisational capability found improvements in most areas, including people management, operations and leadership. However, there were areas critical to delivering the programme well, such as risk management and assurance, project management and project controls, which were below target. Our previous report raised concerns about HS2 Ltd's ability to build its organisational capability while maintaining the ambitious schedule, and this will remain a challenge as the programme proceeds.

3.9 Our work on other major programmes shows that oversight at different stages of a programme requires different capabilities and governance arrangements.[26] HS2 Ltd will have to manage multiple major aspects of the programmes, which could be considered projects in their own right, at different stages of their lifecycle, over decades, and the Department's oversight and assurance regime will need to keep pace:

- **Assuring HS2 Ltd's capability going forward**: In 2016, we reported that the Department had decided not to increase HS2 Ltd's powers to deliver the programme, because it had assessed that HS2 Ltd had not completed sufficient work on the cost estimate and programme schedule. Since then, the Department has not continued with the planned review point regime, which would grant HS2 Ltd increasing levels of autonomy. Instead, the Department plans to consider HS2 Ltd's assessment of its capability as part of the final investment decision on the programme. It will be important that the Department also has assurance on HS2 Ltd's capabilities as the programme progresses.

26 Comptroller and Auditor General, Department for Transport, *Completing Crossrail,* Session 2017–2019, HC 2106, National Audit Office, May 2019. Comptroller and Auditor General, Department for Transport, *Update on the Thameslink Programme*, Session 2017–2019, HC 413, National Audit Office, November 2017.

- **Monitoring Phase One delivery**: The Department will need to set out its role in the delivery of the programme going forward. The Department expects that its role will change on main civil construction once the main investment decision is taken and construction begins. However, stations, railway systems and the procurement of the trains are less advanced parts of the programme and are likely to require the Department to be more closely involved. The Department and HS2 Ltd will need to work closely and openly together.

- **Levers and sanctions to improve delivery**: When HS2 Ltd issued the Department with formal warnings that it could not deliver the programme successfully in October 2018 and March 2019, the Department decided that rescinding HS2 Ltd's powers would not improve delivery of the programme. The Department has launched a programme to assess and propose changes to how it oversees major projects and arm's-length delivery bodies.

- **Assurance framework**: The Department will need to ensure that it has confidence in HS2 Ltd's internal assurance processes as well as robust arrangements for securing independent assurance on progress. Since July 2018, the Department's project representative embedded within the programme has reported consistently on issues regarding the feasibility of the programme. It will be important for the Department to use the project representative function to provide the insights and assurance on programme delivery that it needs to drive improvements and support strategic decision-making.

3.10 The Department is using the lessons learned from the delivery of other major programmes to develop oversight and assurance arrangements for the programme going forward.[27] At the time of publishing this report the Department had developed its thinking on what the arrangements would look like and had launched a review of the role of the project representative. The Department planned to revise its development agreement with HS2 Ltd to formalise these arrangements in early 2020, which will require close working and agreement between the Department and HS2 Ltd.

Phase Two

3.11 Phases 2a and 2b are at much earlier stages of development than Phase One and are less certain. HS2 Ltd does not think that it is possible to open Phase 2a in 2027 and Phase 2b in 2033 as planned (Figure 5). HS2 Ltd's early design and preparatory works indicate that the railway requires more time for design and construction than originally planned.

27 The Department for Transport and Infrastructure and Projects Authority, *Lessons from transport for the sponsorship of major projects*, April 2019.

3.12 Phase 2a is a short extension between the West Midlands and Crewe and does not include constructing any new stations. HS2 Ltd estimates that it has completed around 10% of the initial scheme design, compared with around 70% to 80% on Phase One. The Department is seeking to align the programme with its wider plans for the development of a Crewe Hub station. The Department's schedule includes Parliament approving the hybrid bill, setting the route and providing HS2 Ltd with powers to start preparatory construction works for this phase in early 2020.

3.13 Despite being larger in scale than Phases One and 2a combined, Phase 2b has less funding allocated to it than the sum of the other two phases. The route of Phase 2b passes through the city centres of Leeds and Manchester, includes major connections to the conventional railway and will be built on challenging ground conditions. HS2 Ltd estimates that it has completed around 5% of the initial scheme design. The Department has been planning to introduce legislation for Phase 2b into Parliament in June 2020. However, this is ambitious and any delays will impact on the planned opening date.

3.14 The scope of Phase Two is uncertain. The outcome of the independent review of the programme may change the Department's plans for Phases 2a and 2b. The HS2 Ltd chairperson's review of the programme's status recommended that the schedule for Phase 2a be changed to align with the Phase One schedule so that services can run from London to Crewe, rather than just the West Midlands. Changes to Phase One may also require changes to the Phase One act, which may be enacted through Phase Two legislation and could delay the programme schedule.

3.15 In 2016 we reported that costs for Phase Two were at an early stage of development and could change. In December 2019, the Department's emerging estimates for the cost of Phase 2a was between £4.5 billion and £6.5 billion (between 29% and 87% more than available funding) and for Phase 2b, between £29 billion and £41 billion (between 15% and 63% more than available funding). These emerging estimates reflect:

- applying lessons from agreeing the design and rates for Phase One;
- greater realism in cost forecasting. The Department commissioned independent estimates of costs, which indicated optimism in HS2 Ltd's estimates;
- greater conservatism when estimating efficiencies possible. At the Spending Review 2015, the cost estimate for Phase 2b was £7 billion more than available funding and HS2 Ltd planned to reduce costs to within the available funding by identifying efficiencies. Since then, HS2 Ltd has removed all efficiencies from its point estimate; and
- incorporation of the costs of the Midland Main Line south of Sheffield.[28]

28 When the Department cancelled the electrification of the Midland Mainline route, it transferred the cost of the electrification south of Sheffield to HS2 Ltd.

3.16 These estimates do not reflect the cost of any changes that may result from the independent review of the programme, nor additional commitments or changes to the Phases during parliamentary scrutiny of legislation. The estimates assume that Royal Assent could be achieved in line with HS2 Ltd's plans. Costs could increase if Royal Assent is delayed.[29] For Phase 2b, the estimate does not include other additional scope such as junctions with the proposed Northern Powerhouse Rail or Midlands Connect, which the Department expects to fund separately.[30] The Department estimates this unfunded scope to total around £4 billion, including contingency.

Strategic rationale

3.17 The Department plans to update its business case for the programme to inform a decision on proceeding with Phase One in early 2020. It will need to take full account of the findings and recommendations of the independent review of the programme launched in August 2019, as well as changes to the expected demand for services and other assumptions underpinning the strategic rationale for the railway.

3.18 In deciding on whether the programme goes ahead, the Department will need to update its business case and consider the impact of cost increases and delays on the value for money of the scheme. At the time of publishing this report, the Department assessed, using the standard method for appraising transport projects that Phase One would achieve a benefit-cost ratio (BCR) of £1 of benefits for every £1 invested,[31] which the Department considers low value for money.[32] Once Phases 2a and 2b estimates are included, the phases that enable the majority of benefits, the estimate increases to £1.40 of benefits for every £1 invested, which remains low value for money.[33] These assessments reflect updates to the standard appraisal methodology as well as changes to some of the modelling assumptions used in the Department and HS2 Ltd's previous BCR assessments in 2017. However, these BCR calculations are indicative and will change as certainty on future costs and benefits improves.[34]

29 Scope decisions made by the Department on Phase One may require adjustments to be made to the Phase 2a and 2b bills, which will put pressure on the schedule for passing legislation through Parliament and increase costs. The Department estimates that delays to achieving Royal Assent of Phase 2a legislation from the end of 2019 would increase costs by between £3 million and £5 million a month. For Phase 2b, the Department estimates that delays to securing Royal Assent for Phase 2b legislation could delay opening, which would add £300 million a year.

30 Previous ministers asked HS2 Ltd to include additional areas of scope within the programme. This included junctions with the proposed Northern Powerhouse Rail and Midlands Connect schemes, future-proofing for subsequent expansion of the road network, provision for the Metrolink at Manchester Piccadilly and the cost of the Manchester Airport Station.

31 Including wider economic benefits which are less certain. Without these benefits, the BCR is £0.80 of benefits for every £1 invested.

32 The Department's standard method for appraising programmes states that programmes with a BCR of less than one are poor value for money; between one and 1.5 are low value for money; between 1.5 and two are medium value for money; between two and four are high value for money; and greater than four are very high value for money.

33 Including wider economic benefits which are less certain.

34 At the time of publishing this report the Department and HS2 Ltd were finalising the revised Full Business Case for Phase One including the BCR assessments. We have not audited the working and evidence underpinning these calculations.

Appendix One

Our audit approach

1 This report examines whether the Department for Transport (the Department) and High Speed Two Limited (HS2 Ltd) have protected value for money so far in their stewardship of the High Speed Two programme (the programme). It also examines the risks to value for money on the programme going forward. We assessed:

- the progress of the programme since we last reported in 2016;
- why the schedule is delayed and forecast costs have increased; and
- the risks that the Department and HS2 Ltd must manage.

2 To assess whether the Department and HS2 Ltd have protected value for money we applied an analytical framework with evaluative criteria, which considered what arrangements would be optimal. We reviewed:

- the Department's parameters set for the programme and how these have been kept under review;
- HS2 Ltd's progress delivering against these parameters and how this information has been reported to, and acted upon by, those charged with governance; and
- the Department and HS2 Ltd's assessment of the reasons why costs and schedule have increased and the actions they have taken in response.

3 Our audit approach is summarised in **Figure 14**. Our evidence base is described in Appendix Two.

Figure 14
Our audit approach

The objective of government

The High Speed Two programme (the programme) is the largest infrastructure project by value in the government's major programme portfolio. The programme aims to: provide sufficient capacity to meet long-term rail demand and improve resilience and reliability on the network; improve connectivity by making journeys faster and easier; and boost economic growth across the UK.

How this will be achieved

The programme aims to construct a new high-speed, high-capacity railway to improve rail connections between London, Leeds and Manchester, via the West Midlands. The new railway will join with the existing rail network to enable journeys to Liverpool, Newcastle, Edinburgh and Glasgow (Figure 1). The Department for Transport (the Department) set an opening date for the first phase of the programme between London and the West Midlands of 2026, with services commencing across the entire railway in 2033. The available funding for the programme is £55.7 billion (2015 prices).

Our study

This study examines the progress of the programme since we last reported in 2016, why the schedule is delayed and forecast costs have increased, and the risks that the Department and HS2 Ltd must manage.

Our approach

Evaluate the main factors that have led to forecast cost increases and schedule delays on the programme and draw out the key points of learning.

Examine the risks to value for money that the Department and Hign Speed Two Limited (HS2 Ltd) need to manage.

Our evidence

(see Appendix Two for details)

We evaluated progress on the programme and reasons for forecast cost increases and schedule delays by:

- reviewing and analysing programme reports, management information and internal evaluations of the programme; and
- interviewing staff from the Department, the Department's project representative in HS2 Ltd, HS2 Ltd and its contractors.

We identified the risks to value for money that must be managed by:

- reviewing and analysing key programme reports, management information and internal evaluations of the programme;
- interviewing staff from the Department, the Department's project representative in HS2 Ltd and HS2 Ltd; and
- drawing on our previous evaluations of the programme and wider work on major programmes.

Our conclusions

High Speed Two is an ambitious national programme, the construction of which will take decades. The Department, HS2 Ltd and government more widely underestimated the task, leading to optimistic estimates being used to set budgets and delivery dates. In not fully and openly recognising the programme's risks from the outset, the Department and HS2 Ltd have not adequately managed the risks to value for money. If these risks had been recognised and managed earlier, then the significant activity in a pressured environment over the past year trying to understand and contain cost increases may not have been necessary. There are lessons to be learned from the experience of High Speed Two for other major infrastructure programmes.

We welcome the increased realism on the estimated cost and schedule for the programme. However, significant risks remain. While the estimated cost and schedule for Phase One are now on a stronger footing, the challenge of getting Phase One into construction, and of monitoring and managing the programme as it progresses, is considerable. Phase Two is at a far earlier stage of development with many important decisions to be made before HS2 Ltd and the Department can improve cost and schedule estimates. Completing High Speed Two will require sustained focus and support from the Department and across government to ensure the programme is re-established on a sound basis, balancing cost, time and benefits, and delivered in a way that achieves long-term value for money.

Appendix Two

Our evidence base

1 We reached our conclusions on whether the Department for Transport (the Department) and High Speed Two Limited (HS2 Ltd) have protected value for money of the High Speed Two programme (the programme) following our analysis of evidence collected between July and December 2019. Our audit approach is outlined in Appendix One.

2 We evaluated progress on the programme and the reasons for forecast cost increases and schedule delays by:

- reviewing documentary evidence on programme progress, including key programme update reports and programme management information;
- reviewing external evaluations of programme progress, including those by the Infrastructure and Projects Authority and HM Treasury;
- reviewing monthly and thematic assurance reports by the Department's project representative embedded within HS2 Ltd;
- reviewing the results of independent reviews by consultants on the cost and schedule estimates commissioned by HS2 Ltd and the Department;
- analysing the Department and HS2 Ltd's cost and schedule forecasts for the programme;
- analysing key internal governance papers, including papers to the Department Board Investment and Commercial Committee and advice to the accounting officer;
- conducting interviews with key staff working on the programme from the Department and HS2 Ltd; and
- interviewing the Department's project representative and HS2 Ltd's contractors on the main civil construction works.

3 We examined the risks to value for money that the Department and HS2 Ltd need to manage:

- reviewing internal HS2 Ltd scrutiny documents on cost and schedule estimates, capability and external evaluations of the programme;
- conducting interviews with key staff working on the programme from the Department, the Department's project representative embedded within HS2 Ltd and HS2 Ltd; and
- drawing on our past reports on the programme and other relevant reports such as *Completing Crossrail, Modernising the Great Western Railway* and *Update on the Thameslink Programme*.

Appendix Three

The main civil construction contracts for Phase One

Figure 15
Main civil construction contracts for Phase One

HS2 Ltd divided the main civil construction works into seven contracts with a target price of £6.1 billion[1] (excluding contingency, 2016 prices) in total

Contract	Scope of works	Successful bidder
Euston tunnels and approaches	Works include construction of the 7.3 kilometre-long Euston tunnel with three access shafts and a 1 kilometre-long logistics tunnel with two temporary access shafts.	SCS JV (joint venture between Skanska Construction UK Ltd, Costain Ltd and STRABAG AG)
Northolt tunnels	Works include construction of the 13.4 kilometres of twin bored tunnels with four access shafts and the tunnel approach to Old Oak Common station.	SCS JV (joint venture between Skanska Construction UK Ltd, Costain Ltd and STRABAG AG)
Chiltern tunnels and Colne Valley viaduct	The 3.4 kilometre-long Colne Valley viaduct and 15.8 kilometre-long Chiltern twin-tunnels (with five shafts), some of the biggest engineering structures in Phase One.	Align JV (Bouygues Travaux Publics, Volker Fitzpatrick, Sir Robert McAlpine)
Chiltern tunnels north portal to Brackley	This section covers around 47.6 kilometres of the route and includes multiple viaducts, cuttings and embankments, a green tunnel at Wendover and a maintenance depot at Calvert.	EK JV (Eiffage Genie Civil SA, Kier)
Brackley to south portal of Long Itchington Wood Green tunnel	Around 30 kilometres of the route through viaducts, cuttings, embankments and green tunnels.	EK JV (Eiffage Genie Civil SA, Kier)
Long Itchington tunnel to Delta Junction and Birmingham spur	This section goes through undulating countryside requiring numerous cuttings, embankments, viaducts and highway diversions, a twin-bored tunnel and goes into Birmingham city centre.	BBV JV (Balfour Beatty Group Ltd, Vinci Construction Grands Projects, Vinci Construction UK Ltd, Vinci Construction Terrassement)
Delta Junction to West Coast mainline tie-in	Delta Junction consists of complex viaducts crossing over the M6 and M42. The route to the north of the Delta Junction towards Lichfield consists of embankments and cuttings with several viaducts crossing natural watercourses and canals.	BBV JV (Balfour Beatty Group Ltd, Vinci Construction Grands Projects, Vinci Construction UK Ltd, Vinci Construction Terrassement)

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