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COMPTROLLER AND
AUDITOR GENERAL

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Department for Transport

# High Speed 2: A review of early programme preparation

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National Audit Office

Department for Transport

# High Speed 2: A review of early programme preparation

Report by the Comptroller and Auditor General

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Amyas Morse
Comptroller and Auditor General
National Audit Office

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This, our first report on High Speed 2, is an early look at the Department's progress in putting in place the foundations for successful programme delivery.



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# Contents



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This report can be found on the National Audit Office website at www.nao.org.uk/HS2-2013

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# Key facts

**£15.4bn to £17.3bn**

estimate of the capital cost of constructing phase one

**2026**

phase one, between London and the West Midlands, is due to open

**1.4 to 1**

the most recent transport benefit–cost ratio for phase one, published in August 2012

**2.5 to 1** August 2012 benefit–cost ratio for the Y-shaped network from London to the West Midlands, Manchester and Leeds, when wider economic impacts are also included. For phase one this ratio is 1.7 to 1

**£3.3 billion** Amount to be found by government spread over the four peak years of construction of phase one (2017-18 to 2020-21) to cover the gap between the Department's forecast capital spending and its capital budgets if these were kept at 2014-15 levels

# Summary

## Introduction

1 In January 2012, the Department for Transport (the Department) decided to proceed with High Speed 2, a programme to develop a new high-speed rail network between London, the West Midlands, Manchester and Leeds (Figure 1 in Part One). The Department supported its decision with a strategic outline business case.

2 The Department has developed its case for High Speed 2 incrementally. In January 2009, the Department set up a wholly-owned company, High Speed 2 (HS2) Limited, to advise on the case for high-speed services by first developing options for a new line between London and the West Midlands. Before its January 2012 decision, the Department announced its plans to develop a Y-shaped network in March 2010. It consulted on this strategy, as well as its proposed route for the first phase between London and the West Midlands, in 2011.

3 The programme is still at a very early stage. Since the January 2012 decision, the Department has published its preferred route for the second phase, two spurs from the West Midlands to Manchester and Leeds. It plans to complete an outline business case in 2013 before it introduces a hybrid bill to Parliament for phase one.

4 The Department's objectives for High Speed 2 are to:

- increase rail capacity to meet growing demand and tackle the projected shortage of capacity on the West Coast Main Line;
- encourage sustainable long-term, including regional, economic growth; and
- help support the government's objectives to reduce carbon emissions, by shifting passengers to rail travel from air and road.

## Scope of the report

**5** This, our first report on High Speed 2, is an early look at the Department's progress in putting in place the foundations for successful programme delivery. We summarise our audit approach and methods in Appendices One and Two. This report examines:

- the Department's case for building a high-speed railway (Part Two);
- the Department's cost estimate for phase one, between London and the West Midlands, and its assessment of the programme's affordability (Part Three); and
- how the Department has set up the programme (Part Four).

We will carry out regular reviews of the programme as it progresses.

## Key findings

### Business case

**6 The Department's strategic reasons for developing High Speed 2 are not presented well in the business case.** In our view, the strategic case should be better developed at this stage of the programme. In line with its guidance, the Department has focused on developing the economic case which includes estimating benefit–cost ratios for phase one and the full Y-shaped network:

- The Department's general approach for assessing the economic case for High Speed 2 is consistent with how it appraises other transport projects and is a useful tool when comparing similar projects and programmes. This methodology puts a high emphasis on journey time savings, from faster and more reliable journeys. The relationship between these savings and the strategic reasons for doing the project, such as rebalancing regional economies, however is unclear (paragraphs 2.9 to 2.12).
- The strategic case contains evidence of general growth in rail travel but has limited evidence on where, and by how much, increases in capacity are needed on the West Coast Main Line. Including this information would help the Department to demonstrate why it has concluded that alternative options would not deliver sufficient capacity to meet forecast passenger demand (paragraphs 2.4 to 2.6 and 2.22 to 2.23).

- It is not clear how High Speed 2 will deliver the Department's strategic objective of delivering and rebalancing economic growth. The Department estimates the line will support 100,000 jobs through development around stations, and in constructing and operating the line. It does not know how many jobs would be created without this investment. The benefit–cost ratio includes a calculation of wider economic impacts. This recognises that improving transport connections and reducing transport costs brings benefits to businesses and workers, but does not attribute impacts to specific locations. HS2 Limited has recently commissioned work to understand the likely impacts of High Speed 2 on regional economic growth (paragraphs 2.7 to 2.8 and 2.11).

- It is unclear to us whether the business case covers the full Y-shaped network or just the route between London and the West Midlands. The Y-shaped network has a stronger economic case but this is much less certain as route designs are less well-developed. HS2 Limited's most recent benefit–cost ratio analysis, published in August 2012, is 1.9 to 1 for the Y-shaped network compared to 1.4 to 1 for phase one. Including wider economic impacts the figures are 2.5 to 1 and 1.7 to 1 respectively (paragraphs 2.9, 3.8 and Figure 6).

7 **The benefit–cost ratio will change during the lifetime of the programme.** This is to be expected as the ratio is sensitive to changes in the data underpinning assumptions, particularly cost estimates, GDP growth forecasts and the relationship between GDP and passenger demand. This sensitivity and the long time horizons for High Speed 2 mean that the ratio for phase one is unlikely to stay at 1.4 to 1 (paragraphs 2.9 and 2.13).

8 **The benefit–cost ratio calculated for phase one has twice contained errors and the Department has been slow to carry out its own assurance of the underlying analysis.** The first benefit–cost ratio HS2 Limited estimated, in March 2010, – at 2.4 to 1, restated to 2.6 to 1 to be comparable with later calculations – was significantly higher than the ratio the Department had calculated for a similar stage of the High Speed 1 project. HS2 Limited subsequently found that the ratio contained errors in how passenger demand was modelled, which had the effect of double-counting some benefits. When HS2 Limited corrected these errors and also incorporated lower GDP growth forecasts the ratio for phase one published in February 2011, without wider economic impacts, reduced to 1.6 to 1. HS2 Limited identified another error in the passenger demand forecasts used to calculate the phase one benefit–cost ratio which supported the Department's decision in January 2012. In both instances HS2 Limited published corrections to the economic case. During the summer of 2012, the Department increased its oversight of the analysis. In addition, HS2 Limited began to plan in November 2011, an independent audit of the passenger demand forecasts and analysis behind the ratio. This audit began in August 2012 and is due to report later in 2013 (paragraphs 2.9 and 2.13 to 2.16).

**9 In our opinion the Department and HS2 Limited should update the data underpinning key assumptions in the benefit–cost ratio:**

- The most recent benefit–cost ratio does not contain the Department's current assumption on the relationship between passenger numbers and GDP growth. In August 2012, the Department adopted a lower assumption for long-distance rail travel. This means passenger numbers are expected to grow more slowly when GDP increases. This will be one of several changes in assumptions which the Department and HS2 Limited are making and the overall impact of these changes on the next benefit–cost ratio is uncertain (paragraph 2.18).
- In line with its guidance, the Department uses the most up-to-date data available. However, to calculate benefits for business travellers, the largest estimated benefit, the Department is using data which are over ten years old. The Department estimates phase one will deliver £12.6 billion (2011 prices and present values) benefits to business travellers from faster, more reliable and less crowded journeys. The value it uses for business travellers' time is higher than for other types of travellers, and is based on survey data from 1999 to 2001. The Department also needs to research how business travellers use their time on trains (paragraphs 2.10 and 2.20).
- HS2 Limited has not yet analysed the effect of premium pricing on forecast passenger demand, revenues and the benefit–cost ratio. To forecast passenger demand, HS2 Limited uses the same average fares for high-speed and conventional rail in its models, although premium fares are charged on High Speed 1. In August 2012, HS2 Limited began developing new tools designed to model different fare prices and potential competitive responses to High Speed 2 (paragraph 2.21).

## Programme management

**10 The Department's published timetable for introducing the hybrid bill for phase one to Parliament is October 2013. We believe this is overambitious.** The Department's programme plan is now based on introducing the bill in December 2013, which is still challenging. The timetable contains no contingency and is shorter than for other comparable programmes although much work is needed to support the bill. For example, the Department and HS2 Limited have had to carry out a year-long survey before assessing the environmental impact of the line, consulting and making changes to the route design to reduce impacts. Our report on cancelling the InterCity West Coast franchise procurement highlighted the mistakes that can be made in trying to meet an unrealistic timetable (paragraphs 4.4 to 4.7).

**11 The Department's management and oversight of the programme needs further improvement.** We have summarised our findings, below, against five safeguards against poor decision-making – clarity of objectives, strong project and programme management, senior management oversight, effective stakeholder engagement, and assurance. We reported that these safeguards had failed in the InterCity West Coast franchise procurement and we have, therefore, examined whether these issues could be repeated on High Speed 2.

### Clarity of objectives

**12 The relationship between the Department's strategic objectives for High Speed 2, such as rebalancing the economy, and journey time savings, the largest quantified benefit in the economic case, is unclear.** The Department has not structured its programme management around how it will deliver the strategic objectives. Decisions that are being made at this early stage to control costs may impact on achieving the programme objectives, for example on developments around stations (paragraph 4.10).

### Strong project and programme management

**13 The Department has taken steps to improve programme management.** For example, the Department developed a critical path of activities in October 2012, which the programme board started to use in February 2013 to coordinate programme tasks (paragraphs 4.11 to 4.13).

### Senior management oversight

**14 The Department strengthened its oversight by appointing a director general whose sole responsibility is high-speed rail.** Up to January 2013, the senior responsible owner for High Speed 2 was the 'Director General, Domestic', who had a number of other responsibilities. More of the staff contributing to the programme will be line managed by the new senior responsible owner under the arrangements introduced in January 2013. The Department has also appointed two new directors to oversee key areas of the programme (paragraphs 4.14 to 4.15).

### Effective engagement with stakeholders

**15 The Department is not sufficiently engaged with its stakeholders.** The Department is responsible for managing some relations, particularly with other government departments, while HS2 Limited leads on relations with communities. There have been past issues with coordination with other government departments. For example, there was a lack of clarity between the Department and HS2 Limited over the cross-government approvals process that HS2 Limited needed to follow before letting some contracts. This process provides assurance but meant that HS2 Limited could not let contracts as quickly as it had planned (paragraphs 4.16 to 4.18).

### Assurance

**16 The Department has been slow to respond to issues raised by internal and external assurance.** The Major Projects Authority first alerted the Department to risks to the timetable, governance arrangements and resources in late 2011 and the need to plan ahead for future developments. The Department's own internal auditors raised concerns about governance and resources again in October 2012 and the Department has not yet fully implemented the recommendations they made (paragraphs 4.19 to 4.20).

## Cost estimating and affordability

**17 The Department made an early estimate of the cost of constructing phase one for its business case and to assess affordability, which will change as costs become firmer.** The Department's January 2012 £16.3 billion (2011 prices, undiscounted) cost estimate for constructing phase one was made by a high level desk-based exercise. In some of the Department's documents the estimate is given as a range of between £15.4 billion and £17.3 billion. We would have expected this estimate to have been presented only as a range given its uncertainty. The Department reviewed the estimates in late 2011 but included £1.5 billion efficiency savings. It has set up an efficiency programme but it cannot at this stage know how much will be saved. A new estimate for phase one is being developed, based on a clearer route and more information, including ground surveys, which the Department intends to finalise for the outline business case. The costs of the full Y-shaped network, estimated at £32.7 billion in January 2012, are understandably less certain (paragraphs 3.3 to 3.6 and 3.8).

**18 There is currently no cross-government mechanism to agree in-principle funding for the life of the High Speed 2 programme.** We estimate there is a £3.3 billion gap spread over four years (2017-18 to 2020-21) which the government will need to fill between the Department's forecast capital expenditure in the peak construction years of phase one and its budgets if these were continued at 2014-15 levels. The government has yet to decide how this will be funded although options are being considered as part of the current spending round and the 2013 Budget announced a £3 billion increase in capital spending across the whole of government in each year from 2015-16 compared to previous plans. HS2 Limited is likely to have to pay VAT, which it may not be able to reclaim. The Department has not included VAT in its published construction cost estimate. Public perception of how well the Department manages the High Speed 2 programme may be adversely affected if the estimate is increased to include VAT even though this represents an internal transfer within government rather than an additional cost (paragraphs 3.9 to 3.12).

### Departmental changes

**19 We are concerned about the Department's capacity to undertake this programme to a challenging timetable alongside its other business and having experienced considerable organisational change.** The Department is responsible for a number of significant programmes and initiatives including the Thameslink, Crossrail, Intercity Express and restarted rail franchising programmes; reforms to how it delivers motoring services; and a review of aviation policy. The Department restructured in 2010 and is undergoing further organisational change in response to the cancellation of the InterCity West Coast franchise competition. There has been considerable turnover in departmental senior positions in the past two years (paragraphs 4.2 to 4.3).

## Conclusion on value for money

**20** High Speed 2 is at a very early stage of planning and development and, as such, we cannot conclude on whether the programme is likely to deliver value for money. The cost and benefit estimates in its economic case are uncertain and will change because the programme is at an early stage. Furthermore, there have been past errors in the underlying model and some key data needs to be updated. In presenting its case for investment, the Department has poorly articulated the strategic need for a transformation in rail capacity and how High Speed 2 will help rebalance economic growth. The Department and HS2 Limited have started a lot of work recently to strengthen the evidence and analysis on which the case is based. The challenging programme timetable, however, makes delivering this work difficult and increases the risks that the programme will have a weak foundation for securing and demonstrating success in the future.

## Recommendations

### Business case

a **The Department should prepare a complete business case for the full Y-shaped network recognising that it is developing a high-speed rail network in different phases.** The business case should clearly set out the strategic reasons and supporting evidence for building the whole network.

b **The Department and HS2 Limited should recognise explicitly the uncertainty in the economic case by quoting ranges rather than a point estimate.** The risks and uncertainty to the benefit–cost ratio have not been clearly stated.

c **The Department should routinely update data upon which it bases key assumptions and forecasts.** The Department needs to update the value of time it uses, so it is based on current travellers' salaries and carry out research to understand how business travellers use travelling time. It should model the effects of premium pricing and potential competitive responses from other operators on forecasts of passenger demand and the benefit–cost ratio, drawing on work that HS2 Limited is carrying out.

d **The Department needs to define and, if possible, quantify how High Speed 2 will meet its strategic objective to transform regional economies by delivering growth and jobs.** Using research commissioned by HS2 Limited, this will allow the Department to understand the relationship between objectives and costs so that it can analyse the impact of investment and cost changes on expected benefits.

### Programme management

e **The Department should ensure that it has sufficient time to develop the programme, including to respond to unexpected issues, and that its work is structured around the key objectives it is trying to achieve:**

- It should develop a realistic timetable for the hybrid bill, which includes allowances for unforeseen or uncontrollable delays and builds in sufficient time for proper scrutiny and quality assurance.
- It should structure the programme's key processes and documents so they focus on meeting the programme's objectives, including achieving regional economic growth.
- The Department should set a timescale for management to respond to issues raised in assurance reports on the programme and monitor how recommendations are implemented.

## Cost estimates and affordability

f **Once a mature cost estimate has been developed, the Department and HM Treasury should agree long-term, in-principle, funding for High Speed 2.** Work by Infrastructure UK identified the uncertainty of funding for the UK construction 'pipeline' as a contributor to increased UK infrastructure costs. The Department should also clarify the VAT position for the programme with HS2 Limited and HM Revenue & Customs.

# Part One

## Introduction

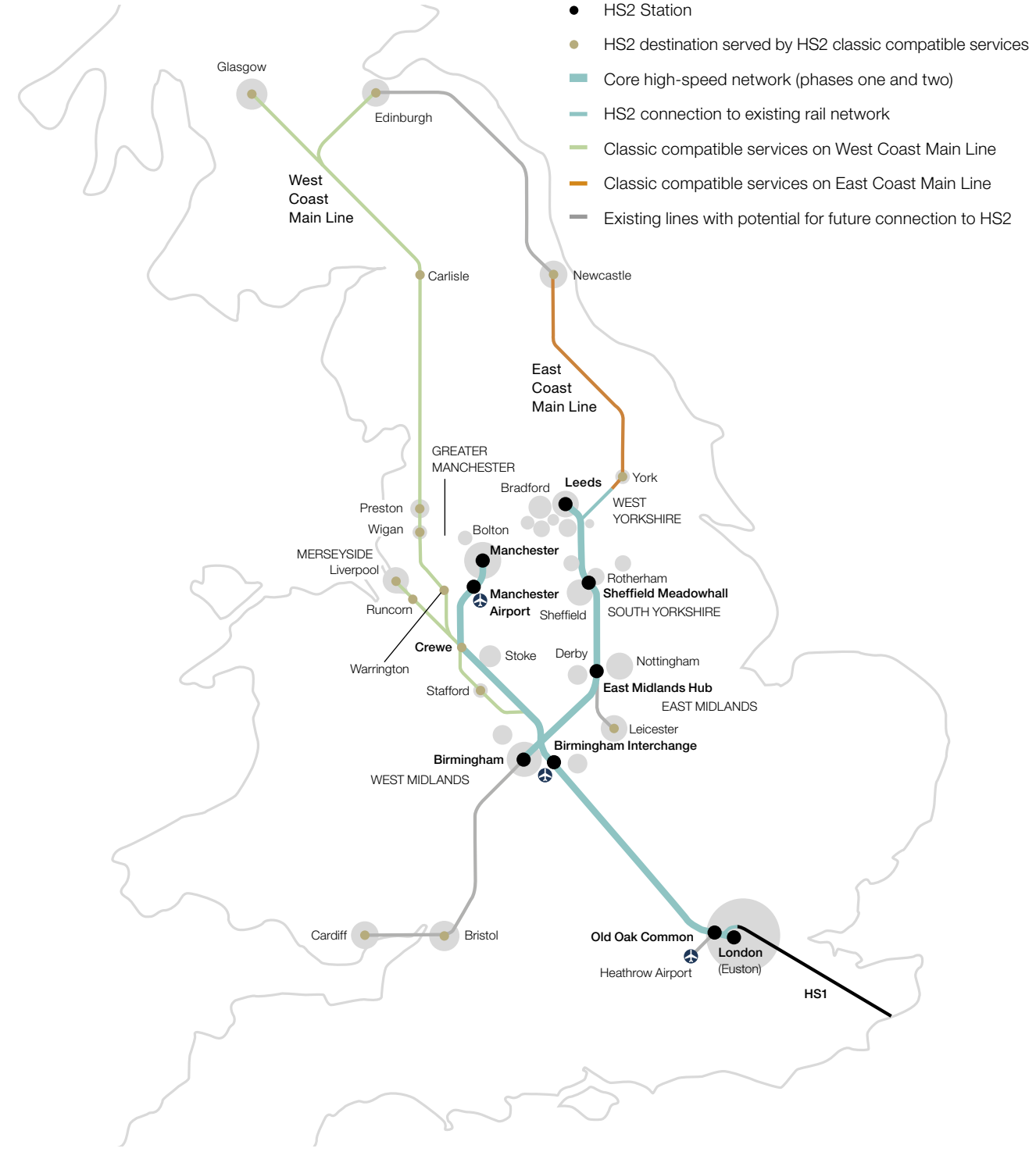
**1.1** In January 2012, the Department for Transport (the Department) decided to develop a high-speed rail network from London to the West Midlands, Manchester and Leeds. The line will carry an estimated 270,000 passenger journeys a day to or from London, plus an additional 110,000 passengers on non-London trips by 2037. It is being designed to run up to 18 trains an hour in each direction, travelling at up to 225 miles per hour and with a maximum capacity of 800,000 passenger journeys a day. The Department intends private sector contractors to build the line in two phases: phase one, from London to the West Midlands with a link to High Speed 1,[1] is due to open in 2026; and phase two, with lines from Birmingham to Manchester and Leeds to form a Y-shaped network, is due to open in 2033 (**Figure 1**).

**1.2** The Department made an early estimate of costs for the business case which supported its January 2012 decision. At this time its estimate of the cost of constructing phase one was £16.3 billion (undiscounted), which the government expects to fund. It has not decided how it will fund new trains, estimated at £2.9 billion (undiscounted) for phase one, or how the high-speed line will be operated.[2]

1 High Speed 1 is the line from London to the Channel Tunnel.
2 All estimated costs and benefits in this report are in 2011 prices. Estimated costs and benefits in Part Two are discounted to present values as is standard for the Department's economic appraisals and benefit–cost ratios. To allow comparisons with published information and with actual costs as the line is built, estimated construction and train purchase costs given in Part Three are undiscounted. We have also used undiscounted costs when considering affordability.

## Figure 1
High Speed 2 route

**High Speed 2 will run from London to Birmingham, Manchester and Leeds**




*Source: Department for Transport*

**1.3** The timetable to develop and construct phase one is set out in full in Appendix Three. The programme is at an early stage (**Figure 2**). For phase one to open as planned in 2026, the key milestones that the programme must meet are as follows:

- 2013: deposit a hybrid bill in Parliament (which provides the necessary powers to construct and operate the line, including powers to compulsorily purchase land). The Department also plans to introduce a paving bill to obtain parliamentary approval to incur expenditure on preparatory works.
- May 2015: royal assent granting powers to build phase one.
- September 2015: funding in place.
- January 2017: construction to start.
- March 2026: construction to end.

## Background

**1.4** In the past ten years there have been several studies commissioned by the Strategic Rail Authority, Network Rail as well as the Department examining the case for high-speed rail in the UK. These reached different conclusions about the merits and need for high-speed rail. In particular, *The Eddington Transport Study (2006)*[3] recommended improving existing infrastructure while Network Rail's 2009 *The New Lines Programme: Strategic Business Case*[4] indicated a strong business case for building new high-speed lines between key urban centres.

## Roles and responsibilities

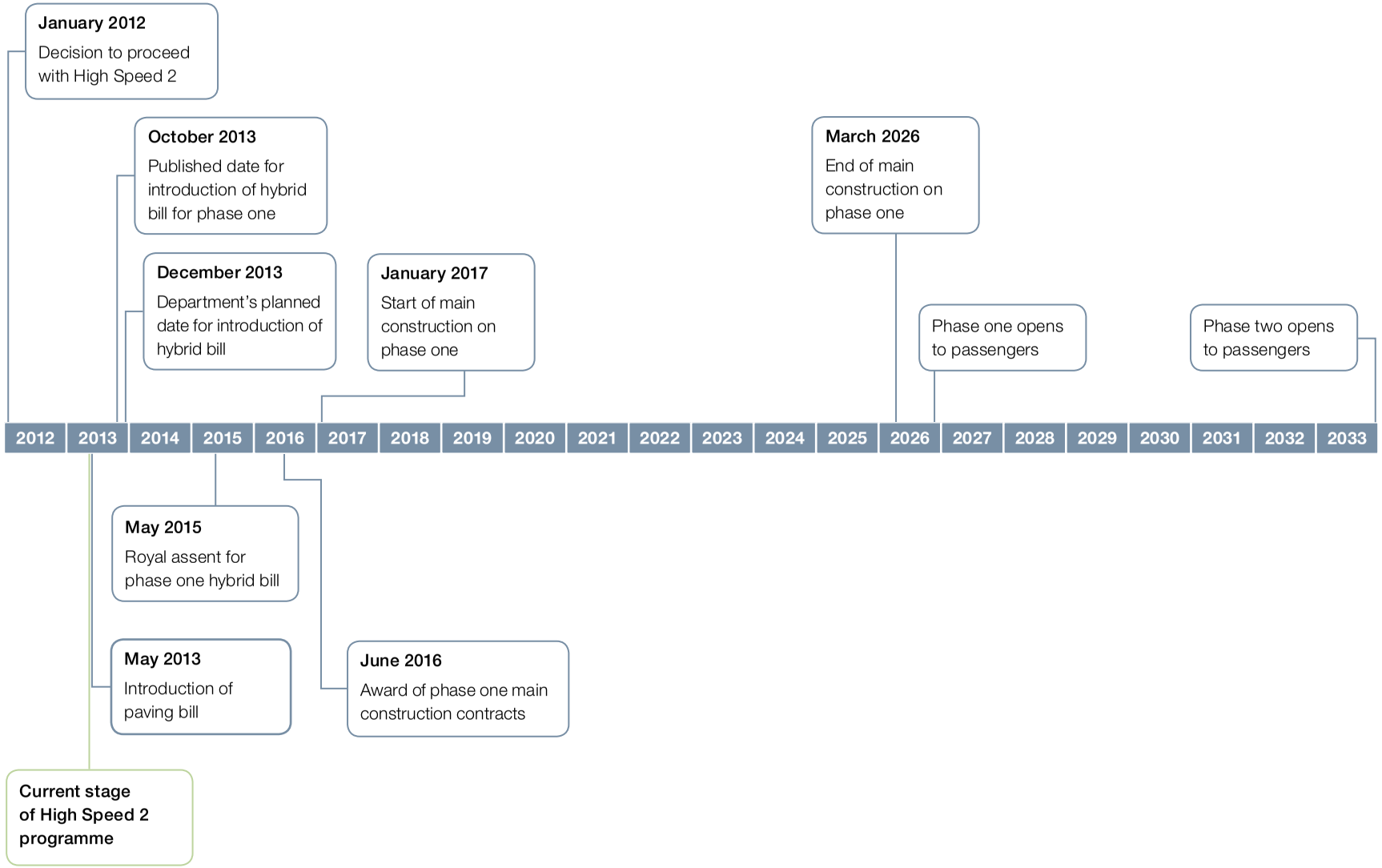
**1.5** Since January 2012, HS2 Limited's role has been to promote High Speed 2 and carry out work needed for the hybrid bill (**Figure 3** on page 18). It also developed proposals for the route options beyond Birmingham to Leeds and Manchester.

**1.6** The Department has two distinct roles in relation to HS2 Limited: as sponsor, responsible for the investment decision and defining the direction of the High Speed 2 programme; and as guarantor of HS2 Limited's corporate governance. HS2 Limited is a non-departmental public body, which the Department owns and funds.

3 HM Treasury and the Department for Transport, *The Eddington Transport Study: The case for action, Sir Rod Eddington's advice to Government*, December 2006.
4 Network Rail, *New Lines Programme: Strategic Business Case,* 2009, available at: www.networkrail.co.uk/newlinesprogramme/

## Figure 2
High Speed 2 programme timeline

**The programme is at an early stage**




*Source: National Audit Office analysis*

## Figure 3

The Department and HS2 Limited's roles for phase one within the High Speed 2 programme

**HS2 Limited provides immediate specialist and technical expertise, while the Department prepares legislation and considers longer-term, wider strategy and policy**

**The Department is accountable for**

Overall policy requirements and governance framework for HS2 Limited.

The programme of work to deliver the phase one hybrid bill.

With HM Treasury, funding construction (and acquiring new trains).

Deciding how the new railway will be regulated.

Deciding how the railway will be owned, operated and maintained when complete.

Interaction of high-speed services with the rest of the railway.

Procuring services to operate on the railway and provide domestic and international open-access services.

Managing the interdependencies with wider transport policy.

**HS2 Limited is accountable for**

Delivery of a safe and affordable route design including detailed scope and functionality of the London to West Midlands route and its compliance with the appropriate technical, environmental and construction standards.

Assessment of the environmental impacts and production of the Environmental Statement. Consultation with all relevant bodies including managing and analysing the responses.

Promoting the London to West Midlands project and engaging with national bodies (for example English Heritage and Natural England), local authorities and local communities.

All other support the Department requires for the phase one hybrid bill including financial and business case modelling.

Continuing work on phase two and longer-term options for serving the North East and Scotland, as agreed from time to time by the Department.

*Source: Department for Transport*

# Part Two

## The case for High Speed 2

**2.1** The case for High Speed 2 has developed incrementally:

- In January 2009, the Department set up HS2 Limited to advise on the case for high-speed services from London to Scotland, to support sustainable economic growth following the financial crisis. HS2 Limited's first task was to develop options for a new line between London and the West Midlands.
- HS2 Limited reported in late 2009, and in March 2010 the Department announced that it was proposing a Y-shaped high-speed rail network, from London to Manchester and Leeds via Birmingham, and would consult the public on its proposals. It published a first estimate of the benefits and costs for phase one, between London and the West Midlands.
- Following the change in administration in May 2010, the coalition government's agreement included a commitment to develop a high-speed rail network.
- From February to July 2011, the Department ran a public consultation asking for views on its strategy for a high-speed rail network and its proposed route between London and the West Midlands. The Department updated its economic analysis for phase one and published an estimate of benefits and costs for the Y-shaped network.
- In January 2012, following the consultation, the Department confirmed its intention to build a Y-shaped high-speed network in two phases and its route for phase one between London and the West Midlands. It supported its decision with a strategic outline business case including updated economic analysis.
- The Department published its preferred routes for phase two in January 2013. It intends to confirm the routes in 2014 following a public consultation. The Department did not update the economic case for the programme in January 2013. The next update is due later in 2013.

**2.2** The key decision points on the programme so far were in March 2010 and January 2012. This part examines the information that the Department used to make its decisions at these stages as well as more recent information including the update to the economic case for High Speed 2 published in August 2012.

## The strategic case

**2.3** In March 2010, the *High Speed Rail* Command Paper[5] set out a need to enhance capacity and connectivity in a sustainable way to support economic growth. It set out the need to deliver a step-change in capacity to meet growing rail demand. High-speed rail could potentially treble capacity, rather than deliver the small improvements achieved by upgrading existing lines. High-speed rail would also improve connections between cities through faster journey times.

### Passenger forecasts and capacity shortages

**2.4** The Department expects demand for rail travel to continue to grow. General rail trends show that overall rail passenger numbers have increased since 1984-85 and are forecast to continue to grow. From the data and forecasts, including Network Rail's 2009 New Lines Programme, the Department concluded that a new line was needed to deal with expected capacity shortages on the West Coast Main Line. The line would carry a significant proportion of intercity services and provide space for additional commuter, regional and freight services on the existing line.

**2.5** The Department's business case states that passenger demand is forecast to grow on the three main north-south rail lines – the East Coast, West Coast and Midlands Main Lines. It lacks detail on the expected capacity shortages on all three lines and why an increase is needed first on the West Coast Main Line.

**2.6** Our analysis of West Coast Main Line forecasts shows that, without intervention, it is suburban services arriving at London Euston that will become most crowded (**Figure 4**). A new line would release capacity for extra commuter services as most intercity services would transfer. Birmingham City Council also told us that its commuter lines are congested and that it needs the additional rail capacity that High Speed 2 will provide.

### Regional growth

**2.7** The Department believes that high-speed rail will generate economic growth by creating jobs and stimulating regeneration around stations. HS2 Limited estimates that the line will support 100,000 jobs. This figure comprises temporary construction jobs, permanent operation and maintenance jobs, and an estimate of the number of jobs supported in the areas around the proposed station locations. It is separate to the economic analysis of High Speed 2. The analysis does not estimate how many of these jobs are additional and how many would have been created without investment in a high-speed line. The business case provides little supporting evidence to prove that a high-speed line will help to rebalance the economy by supporting regional growth. HS2 Limited commissioned research in August 2012 to understand the potential impact of the line on regional economies.

5 Department for Transport, *High Speed Rail,* Cm 7827, March 2010.

## Figure 4

Standard class rail passenger demand at London Euston in the morning peak hour, in 2011, and forecasts for 2026 and 2033

**Crowding is forecast to be most severe on suburban commuter services in the morning peak hour**

| Year | 2011 | | 2026 | | 2033 | |
|---|---|---|---|---|---|---|
| Arrivals 08:00 to 08:59 | Passenger numbers | Percentage of occupied seats | Passenger numbers | Percentage of occupied seats | Passenger numbers | Percentage of occupied seats |
| Long-distance intercity | 2,500 | 76 | 4,100 | 84 | 5,100 | 104 |
| Suburban commuter services | 7,800 | 118 | 11,100 | 168 | 12,800 | 194 |

NOTES

1 Average standard class passengers arriving and forecast to arrive between 08:00 and 08:59 at London Euston by types of service.

2 Forecasts assume that demand is not constrained by lack of capacity but exclude any additional demand expected from building High Speed 2. Seating capacity is standard class only.

3 Long-distance intercity data for 2011 are based on 9-car Pendolino services, while forecasts assume 11-car trains.

4 Crowding statistics for suburban services normally include allowance for some passengers to stand.

5 Excludes Transport for London services arriving at London Euston.

*Source: National Audit Office analysis of Department for Transport data and Network Rail forecasts*

**2.8** Birmingham City Council told us that they are confident that the programme will act as a stimulus to regenerate parts of the city centre. Centro, the Integrated Transport Authority for the West Midlands, commissioned separate analysis of the impact of High Speed 2 which estimated the line could support an extra 22,000 jobs in the West Midlands.

## The economic case

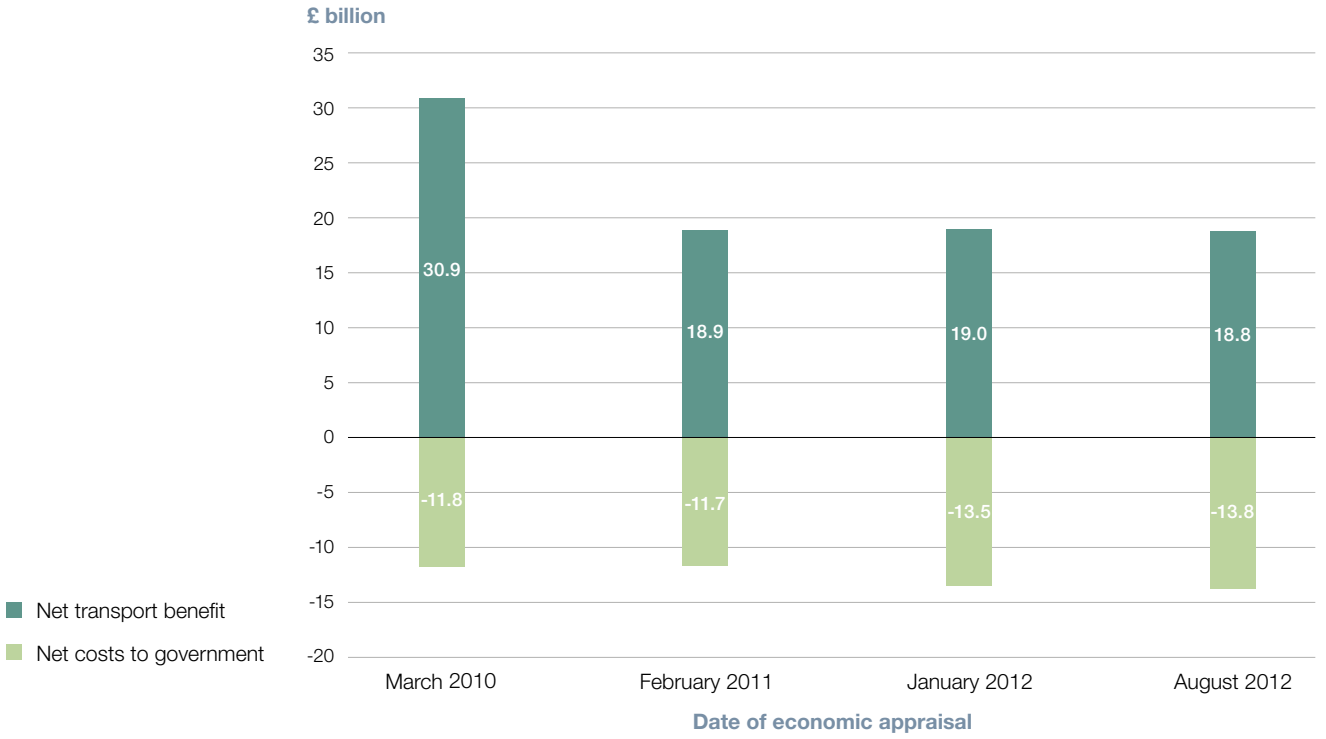
**2.9** The Department carried out analysis and estimated a benefit–cost ratio to support each key decision point. The first economic appraisal that accompanied the *High Speed Rail* Command Paper[6] in March 2010, calculated a benefit–cost ratio, without wider economic impacts, of 2.4 to 1. We have restated the March 2010 ratio using guidance the Department subsequently published on benefit–cost ratios, so that it is comparable with later calculations. This produces a revised ratio for March 2010 of 2.6 to 1 (**Figure 5** overleaf). The benefit–cost ratio in January 2012 was 1.4 to 1, and this was confirmed by further analysis published in August 2012. The benefit–cost ratio for the full network is higher. In August 2012, it was estimated at 1.9 to 1, without wider economic impacts. An adjusted benefit–cost ratio including wider economic impacts was 2.5 to 1.

6 Department for Transport, *High Speed Rail,* Cm 7827, March 2010.

## Figure 5

Economic appraisals for High Speed 2 phase one, March 2010 to August 2012 (2011 prices and present values)

**Between March 2010 and August 2012, the restated benefit–cost ratio (excluding wider economic impacts) fell from 2.6:1 to 1.4:1**




| | March 2010 | February 2011 | January 2012 | August 2012 |
|---|---|---|---|---|
| Benefit–cost ratio | 2.6:1 | 1.6:1 | 1.4:1 | 1.4:1 |
| Reason for publications | High Speed Rail Command Paper | Consultation for High Speed 2 phase one | Decision to proceed with High Speed 2 | Update in evidence |

**NOTES**

1 Benefits for High Speed 2 are the additional benefits forecast from building the line. They have been assessed against a 'do minimum' case of forecast passenger demand if the high-speed line was not built which takes account of other planned transport investment. The 'do minimum' case for August 2012 excludes investment the Department agreed Network Rail would carry out between 2014 and 2019 (referred to as high level output specification, HLOS 2) as some of the economic analysis predated the agreement.

2 We have restated the benefit–cost ratio for the March 2010 economic appraisal (2.4:1) so that it is comparable with subsequent economic appraisals by subtracting indirect tax impacts from benefits rather than costs. The March 2010 and February 2011 figures have also been restated in 2011 prices and present values.

3 Projected benefits include reliability benefits but exclude wider economic and landscape impacts.

4 See Appendix Four for a reconciliation between the £13.8 billion net cost to government (August 2012) and the £16.3 billion construction cost estimate.

*Source: National Audit Office analysis*

**2.10** Quantified benefits are largely expected to be for travellers, particularly through faster, more reliable and less crowded journeys. Within net transport benefits of £18.8 billion (**Figure 6**), benefits for business travellers, whose time is given a higher value than other travellers, are estimated at £12.6 billion. The value of benefits depends on the number of forecast passengers. High Speed 2 is expected to carry 148,000 passengers between London and the West Midlands a day in 2037 and trains will be, on average, between 50 and 60 per cent full. If the forecasts prove inaccurate the expected level of transport user benefits from High Speed 2 could be higher or lower. In our previous reports on High Speed 1, we drew attention to the impact of over-optimistic passenger demand forecasts on the programme's economic case.[7]

## Figure 6

Estimated economic impacts of High Speed 2 phase one at August 2012 (2011 prices and present values)

**This detailed breakdown for High Speed 2 phase one shows forecast transport benefits of £18.8 billion**

| | £ billion |
|---|---|
| Transport user benefits (business travellers) | 12.6 |
| Transport user benefits (leisure travellers and commuters) | 7.2 |
| **Total transport user benefits**[1,2] | **19.8** |
| Other quantifiable impacts | 0.6 |
| Loss to government of indirect taxes[3] | -1.6 |
| **Net transport benefits (excluding wider economic impacts)** | **18.8** |
| Wider economic impacts | 4.8 |
| **Net benefits** | **23.6** |
| Net costs to government | 13.8 |
| **Transport benefit–cost ratio (excluding wider economic impacts)** | **1.4** |
| **Benefit–cost ratio with wider economic impacts** | **1.7** |

NOTES

1 Estimates of transport user benefits include reliability benefits, which the Department estimated at £3.2 billion in January 2012. The Department's guidance recommends that all this should be excluded from the initial benefit–cost ratio. Also excludes adverse landscape impacts estimated at around £1.0 billion, in January 2012.

2 Transport user benefits include benefits to road and air travellers as well as rail users.

3 The government loses taxes if passengers switch from road to rail because this reduces road fuel duty and VAT revenues and increases spending on rail fares, which are zero-rated for VAT.

*Source: HS2 Limited*

7 Comptroller and Auditor General, *The completion and sale of High Speed 1*, Session 2010–2012, HC 1834, National Audit Office, March 2012; and Comptroller and Auditor General, *The Channel Tunnel Rail Link*, Session 2000-01, HC 302, National Audit Office, March 2001.

**2.11** In addition to benefits to business travellers, the Department and HS2 Limited have estimated that High Speed 2 will create wider economic impacts of £4.8 billion for phase one. This recognises that improving transport connections and reducing transport costs brings benefits to businesses and workers through, for example, increased productivity. The Department's method for calculating wider impacts does not consider how the line will help rebalance regional economies because it does not allocate impacts to specific locations. These impacts are difficult to measure and, therefore, evaluate.

**2.12** The Department has broadly used the same methodology to analyse High Speed 2 that it uses on other transport projects. Its methodology acknowledges that people value journey time savings and is based on research that suggests there is a link between these savings for business travellers and economic outcomes such as increased productivity and employment. The relationship between journey time savings and the strategic reasons for doing the project – in this case regional growth – is, however, unclear. This means there is a disconnect between the two elements of the business case and makes it difficult for the Department to explain why it believes the project is necessary to stakeholders. This lack of clarity might cause problems later with making decisions about delivery and build.

## Changes to the benefit–cost ratio

**2.13** We would expect the benefit–cost ratio to change as the programme develops and information on costs becomes firmer and underlying data supporting assumptions, for example on GDP, are updated. However, the ratio has also changed because there were errors in passenger demand forecasts (Figure 5):

- Between March 2010 and February 2011, benefits reduced by £12 billion. Nearly two-thirds of this reduction was due to errors in the way passenger demand was modelled. The main effect was that some benefits were double counted. When HS2 Limited corrected these errors and incorporated lower GDP growth forecasts, which drive predictions of rail passenger demand, the benefit–cost ratio reduced from 2.6 to 1[8] to 1.6 to 1 without wider economic impacts.
- Between February 2011 and January 2012, net costs to government increased by £1.8 billion mainly due to a reduction in forecast revenues and an increase in forecast operating costs.
- Between January and August 2012, benefits were reassessed to correct for an error in the January 2012 economic case, and to reflect changes in the way demand was modelled and a government-wide change in the inflation index. This reduced benefits by £0.2 billion. More detailed estimates increased net costs to government by £0.3 billion.

8 The March 2010 published ratio was 2.4 to 1. We have restated this to reflect updated departmental guidance so that the ratio is comparable with later calculations.

**2.14** The Department had calculated benefit–cost ratios in the early stages of the High Speed 1 project which ranged between 1.4 to 1 and 1.1 to 1.[9] We would have expected the Department to investigate why the first benefit–cost ratio calculated for High Speed 2 (of 2.4 to 1, restated to 2.6 to 1 in this report) was so much higher.

## Quality assurance

**2.15** The modelling used to provide analysis supporting the economic case for High Speed 2 is complex. Separate models owned by the Department are used to forecast overall growth in the demand for rail, air and road travel in commuter and long-distance markets; and an additional model is used to forecast demand growth for international rail travel (**Figure 7** overleaf). These models were not all constructed specifically for the purpose of appraising High Speed 2 because the Department set HS2 Limited a deadline of producing a detailed economic case for its preferred option by the end of 2009. The short timescale of less than a year meant that HS2 Limited's lead model developer, Atkins, did not have time to construct a new model.[10] Instead, it drew together and adapted existing models, some of which it had originally created between 2001 and 2003 for the Strategic Rail Authority. The adapted models produce a limited range of outputs, which are expressed as point estimates rather than ranges. HS2 Limited has let contracts to external consultants to develop and analyse the models – from October 2010, this has involved Arup, Atkins, Mott MacDonald, MVA Consultancy and, in a limited way, more recently, Rand Europe.

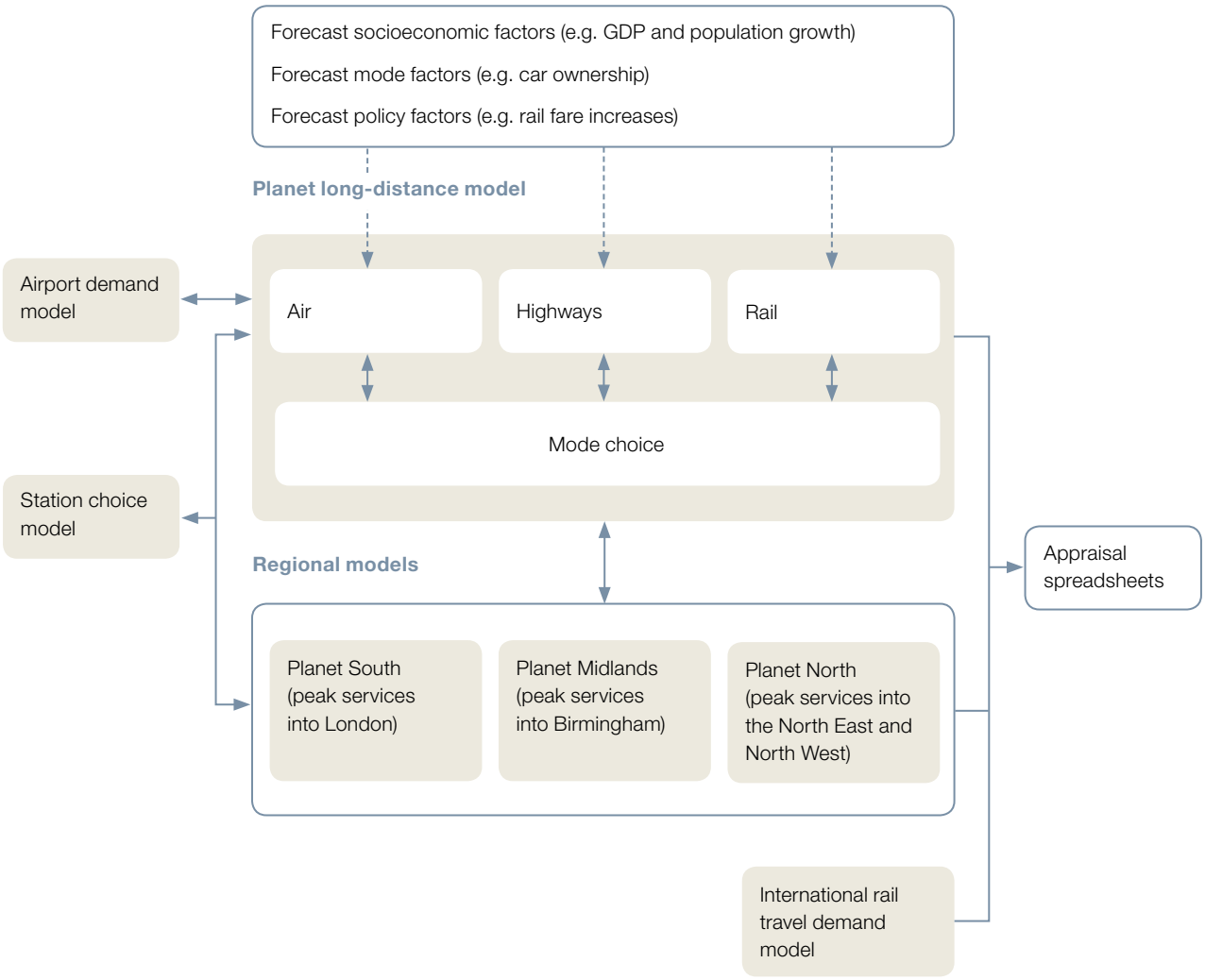
**2.16** The Department has been slow to respond to the modelling errors that were identified. We would have expected the Department to set high standards of quality assurance, model validation and governance given the scale of proposed investment:

- The Department has not requested access to the models and has only carried out limited challenge of the numbers produced from it to try to understand underlying risks. The Department performed a high-level review of the models and its outputs in the second half of 2011.
- The errors were identified by internal quality assurance by HS2 Limited and contractors carrying out the modelling after analysis based upon them had been published.
- In the summer of 2012, the Department set up a group with HS2 Limited to jointly oversee the economic analysis. In addition, HS2 Limited had already in November 2011 begun to plan an independent model audit. This work, which is being carried out by Sinclair Knight Merz and Jacobs, is checking that the High Speed 2 modelling framework operates as specified, is documented correctly and complies with the Department's latest transport analysis guidance. Based on our review of the scope and terms of reference of the audit and a meeting with the contractors performing the work, we gained assurance that the audit would be detailed and thorough. The audit began in August 2012 and is due to report shortly after we have published this report.

9 Comptroller and Auditor General, *The completion and sale of High Speed 1*, Session 2010–2012, HC 1834, National Audit Office, March 2012.
10 Atkins was supported by Arup and Sinclair Knight Merz.

## Figure 7
High Speed 2 models

**There are several models which together forecast passenger demand**




*Source: National Audit Office analysis*

## Key assumptions

**2.17** The Department has to make assumptions in all its transport projects to forecast passenger numbers and value the benefits it expects from its investment. These should be based on the latest available information. Forecasts quickly become out of date as new data underpinning the assumptions becomes available.

**2.18** Decisions that the Department has made on some assumptions have had the effect of increasing the benefit–cost ratio. The Department has also used a different approach in some areas which makes it difficult to compare the economic analysis for High Speed 2 to the Department's other transport projects:

- Benefits from increased reliability on High Speed 2, estimated at over £3 billion for phase one, are included in net transport benefits because they are not calculated separately in HS2 Limited's modelling. In other transport projects these benefits are included alongside wider economic impacts, in an adjusted benefit–cost ratio, because their value is less certain than other transport benefits.
- As we reported on the InterCity West Coast franchise competition,[11] the Department was considering a lower demand elasticity for long-distance rail travel in 2011, which it has since adopted. This means passenger numbers are not expected to grow by as much when GDP increases. The Department used the lower elasticity on the franchise, anticipating the change in its guidance, but decided not to do so in analysis on High Speed 2.
- The Department does not assume that passenger numbers will grow indefinitely in its transport forecasts. It has chosen to cap growth later on High Speed 2 than the year recommended in its guidance to reflect the long programme timescale. The cap is based on the number of rail trips over 100 miles reaching a certain level, broadly equivalent to a doubling in demand from 2010 figures. As a consequence, the year in which growth is capped changes as passenger forecasts change.

**2.19** The Department has taken some decisions which have had the effect of reducing the benefit–cost ratio. For example, it has not included potential reliability improvements on the West Coast Main Line once High Speed 2 is introduced in its adjusted benefit–cost ratio. We could not estimate the combined effect of the Department's decisions on the overall benefit–cost ratio.

11 Comptroller and Auditor General, *Lessons from cancelling the InterCity West Coast franchise competition,* Session 2012-13, HC 796, National Audit Office, December 2012.

### Business travellers' time

**2.20** In our view the Department has not done enough to understand and update the value of business travellers' time, which is a key assumption in the economic appraisal. The Department intends to carry out research in 2013 to understand these effects better but does not know if results will be available in time for its next update to the economic case.

- In line with its guidance, the Department uses the most up-to-date data available. However, to calculate benefits for business travellers, the Department is using data which are over ten years old. The Department's assessment is based on income from business travellers in the 1999–2001 National Travel Survey, which the Department has assumed have increased in line with subsequent GDP growth.
- The Department's methodology uses a simplifying assumption that time spent travelling is unproductive and business travellers will use all the time saved from faster journeys to work. While this approach is used in appraisals in other countries, it has been challenged by opponents of the High Speed 2 programme on the basis that it is unrealistic for rail travel.
- Research commissioned by the Department suggests that business travellers do work on trains for at least part of their journeys, and a proportion of the time saved from faster journeys may be used for leisure purposes. Taken alone, these findings would have the effect of reducing assessed time-saving benefits. On the other hand, the Department argues that if business travellers work on trains then reducing crowding would allow them to do more work – a benefit that is not currently assessed – and, in the long run, business travellers will use time saved from faster journeys to work.

### Premium fares

**2.21** HS2 Limited's models use the same average fares for high speed and conventional rail to forecast passenger demand. This limitation means that HS2 Limited cannot model the effects that charging premium fares on High Speed 2 or other train operating companies charging lower fares will have on forecast passenger demand and revenues. One of the reasons the Department gave for the lower than expected passenger numbers experienced on High Speed 1 was price competition from low-cost airlines and ferry companies.[12] Until recently, the Department and HS2 Limited prioritised other development above work that would allow them to easily model the effect of different fare prices. In August 2012, HS2 Limited began developing new tools to model different fare prices and potential competitive responses to High Speed 2.

12 HC Committee of Public Accounts, *The completion and sale of High Speed 1*, Fourth Report of Session 2012-13, HC 464, July 2012.

## Alternative options

**2.22** The Department assessed alternative options to building High Speed 2 against its objective of increasing capacity and on benefits and costs. For its decision in March 2010, the Department commissioned consultants, Atkins, to analyse road widening schemes and rail improvement options. Atkins did further analysis of alternative rail options for the Department's January 2012 decision, including an alternative to the full Y-shaped network (**Figure 8** overleaf).

**2.23** The Department concluded that the alternative options would not provide enough capacity to meet forecast passenger demand. The business case does not demonstrate how the Department reached its conclusion because it lacks transparency, such as details on where and by how much it forecasts that extra capacity is needed on the main north-south rail lines. It also decided to proceed with a high-speed network because it offered the highest net present value of benefits, when wider economic impacts are included. The Department and Network Rail are developing the alternatives to the full Y-shaped network, to assess High Speed 2 against, for the next version of the business case.

## Figure 8

Comparison of benefits and costs for High Speed 2 and alternatives (£ billion, 2011 prices and present values)

**Most alternatives have higher benefit–cost ratios but the net present values of benefits are lower**

| Alternatives | **High Speed 2 phase one**[1] | New conventional speed line | Rail package 2 | Rail package 2a | 51M alternative | **High Speed 2 Y-shaped network**[1] | Scenario B |
|---|---|---|---|---|---|---|---|
| Description | **New high-speed line between London and the West Midlands** | A new line running services at 125 miles per hour | Infrastructure improvements to allow more trains on the West Coast Main Line | Rail package 2 with different performance levels | Changes to trains and services on the West Coast Main Line | **New high-speed line between London, Manchester and Leeds** | Rail package 2 and improvements to the East Coast and Midlands Main Lines |
| Assessment by | **HS2 Limited** | HS2 Limited | Atkins | Atkins | Atkins | **HS2 Limited** | Atkins |
| Net transport benefits | **18.8** | 12.8 | 7.9 | 7.0 | 6.1 | **48.2** | 13.7 |
| Net costs | **13.8** | 12.0 | 2.0 | 2.6 | 1.2 | **25.7** | 9.7 |
| Transport benefit–cost ratio[2] | **1.4** | 1.1 | 4.0 | 2.7 | 5.2 | **1.9** | 1.4 |
| Net present value of transport benefits[3] | **5.0** | 0.8 | 5.9 | 4.4 | 4.9 | **22.5** | 4.0 |
| Wider economic impacts | **4.8** | 3.6 | 1.3 | 1.0 | 1.0 | **15.4** | 1.9 |
| Net present value including wider economic impacts | **9.8** | 4.4 | 7.2 | 5.4 | 5.9 | **37.9** | 5.9 |

**NOTES**

1 High Speed 2 figures are the most recent analysis, published in August 2012. All other information was published in January 2012.

2 The transport benefit–cost ratio excludes wider economic impacts. Ratios may differ when calculated from the numbers in the figure due to rounding.

3 The net present value is the value of net benefits less net costs.

*Source: National Audit Office analysis of Atkins and HS2 Limited data*

# Part Three

## Cost and affordability

**3.1** The Department has begun to estimate how much construction of the high-speed line will cost to inform its economic appraisal, consider affordability and prepare for the hybrid bill. High Speed 2 is at a very early stage, with construction of phase one not due to begin until 2017. At this stage of the programme estimates are understandably uncertain.

**3.2** In this part we examine the:

- construction cost estimates for phase one and estimated savings on the existing network; and
- risks to affordability.

In this part all construction cost estimates are undiscounted, in contrast to the figures in the economic appraisal in Part Two. The economic appraisal also includes the costs of trains, renewals and operating the line to 2086 for phase one. We have used undiscounted construction cost estimates to allow comparison with published information and with actual construction costs (after removing inflation) as the line is built. Appendix Four reconciles the estimated construction costs and the costs used in the economic appraisal.

### Phase one cost estimate

**3.3** The Department needed an estimate of costs in order to calculate the benefit–cost ratio as part of the business case supporting its January 2012 decision to proceed with High Speed 2. This estimate of £16.3 billion was made by a high level, desk-based process and was reviewed by officials from the Department's major projects team based on their experience of Thameslink and Crossrail. It included a reduction of £1.5 billion based on work by Infrastructure UK, which had concluded that UK construction costs on high-speed rail were over 20 per cent higher than in Europe.[13, 14]

**3.4** The estimate was by necessity uncertain given the early stage of the cost estimating process. In some of the Department's documents the £16.3 billion estimate is given as a range of between £15.4 billion and £17.3 billion. It was unwise to present it as a single figure instead of a range in any of the published documents. It was also possibly optimistic to include the Infrastructure UK reduction while the costs were so uncertain. In September 2012, the Department started working with Infrastructure UK, HS2 Limited and others on how the £1.5 billion savings may be made.

13 HM Treasury and Infrastructure UK, *Infrastructure Cost Review*, December 2010.
14 Infrastructure UK is part of HM Treasury, set up to develop a new approach to planning, prioritising and enabling investment in infrastructure.

**3.5** There are some other specific risks regarding the £16.3 billion estimate, other than it being a very early estimate. For example, the Department has assumed that construction inflation will be the same as UK general price inflation. While in recent years construction inflation has been less than general price inflation this may change in the future as a consequence of a return to global economic growth. Our work on initiating successful projects[15] emphasised the widespread existence of a perverse incentive to underestimate costs to secure funding. This is compounded by a tendency to be overly optimistic when estimating project costs, benefits and timescale (known as optimism bias). For example, Crossrail estimates rose from £12.1 billion in 2002, including 30 per cent contingency, to £15.9 billion when the total funding was originally agreed. This was reduced to £14.8 billion in the 2010 spending review.[16]

**3.6** Following the announcement in January 2012, which included the route for phase one, HS2 Limited has contracted with professional services firms to assist it to update the construction cost estimates. This work is based on more detailed information, including ground surveys, which has led to some design changes. The Department has engaged industry experts to act as its representative to review and challenge HS2 Limited's work. Early indications are that the next iteration of the construction cost estimate will be higher, which is not unexpected for this stage of the programme.

## Operating cost savings

**3.7** The Department has forecast that phase one will result in reduced operating costs on the existing network of £3.0 billion (discounted) over 60 years. This saving is estimated on the assumption that fewer long-distance services are likely to run on the West Coast Main Line when phase one is in operation. The actual service pattern will be decided at a future date. The Department expects that if the assumed changes to services were implemented, then there would be lower staff and maintenance costs because the overall distances travelled by those trains will be lower.[17] The £3.0 billion includes contingency ranging between 18 and 41 per cent on top of the estimate of cost savings even though it is unlikely that savings would be underestimated in the same way as costs.

## Affordability

**3.8** The Department considered affordability as part of the initial business case. To do so, in January 2012, HS2 Limited estimated the construction cost of the complete Y-shaped network at £32.7 billion plus £8.2 billion for the cost of the trains.[18] This was less certain than estimates for phase one as the route designs are less well-developed.

15 National Audit Office, *Initiating successful projects*, December 2011, available at: www.nao.org.uk/publications/1012/initiating_successful_projects.aspx
16 Crossrail is a new railway linking east and west London. Estimates are in 2010 prices.
17 The forecast reduction is equivalent to 40 per cent of distances currently travelled by trains on the West Coast Main Line.
18 Having announced the preferred route for phase two in January 2013, HS2 Limited now estimates that construction of the full network will cost £33.1 billion excluding a spur to Heathrow.

**3.9** The Department's spending plans are provisional after March 2015 when the current 2010 spending review period ends. The Department has prepared forecasts of what it expects its capital expenditure on High Speed 2 to be over the longer term (**Figure 9** overleaf). It has also prepared provisional forecasts of its wider capital expenditure, which include High Speed 2 (**Figure 10** on page 35). In the next paragraphs we consider the cost of High Speed 2 in the context of those forecasts. We note that future budgets will be agreed in future spending reviews and that options for funding High Speed 2 are being considered by the Department and HM Treasury as part of the current spending review.

**3.10** The government's 2013 Budget announced that capital spending across the whole of government would be £3 billion higher in each year from 2015-16 compared to previous plans. Despite this commitment, the increase in capital spending on High Speed 2 may restrict the ability to fund other capital projects across government. We estimate that there could be a gap in affordability of £3.3 billion spread over the four years from 2017-18 to 2020-21, which are the peak spending years for phase one. The Department's capital forecast for these four years is £33.7 billion but its capital budget if kept constant at 2014-15 levels would be only £30.4 billion.

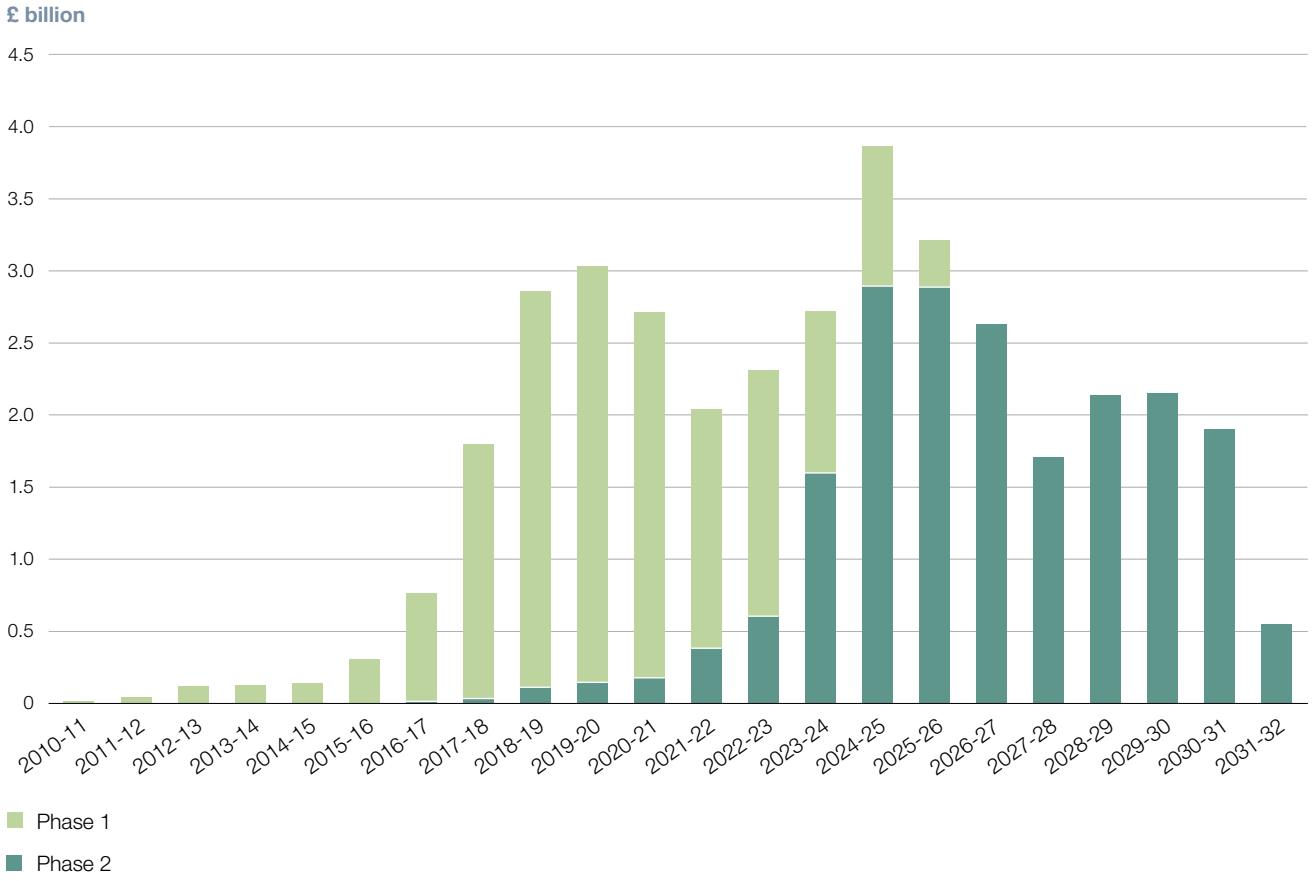
**3.11** While the current spending round will include setting long-term plans to 2020-21 for key areas of capital expenditure, there is currently no mechanism for HM Treasury to approve in-principle funding for High Speed 2 for the life of the programme. The government's decision to progress development of High Speed 2 on an ambitious timetable requires sizeable investment early in the programme. It is important that the resources needed to plan properly in the early stages of projects are available. However, if a future government were to decide that it could not afford to construct High Speed 2, then either considerable sums spent developing the programme will have been wasted or the full benefits will not be realised. HS2 Limited's budgets for 2012-13 to 2014-15 currently amount to £543.1 million, which includes a £15.7 million increase in 2012-13 largely due to additional design work for phase one.

## Factors affecting affordability

**3.12** The Department has not included VAT in its cost estimates or affordability assessments. An allowance for VAT was included in the economic case. HS2 Limited will be liable for VAT at 20 per cent on almost all of its spending but it is uncertain whether that VAT will be reclaimable. This will depend on the future role of the company and whether it can show HM Revenue & Customs that it will generate income from the line. The Department has not yet decided whether HS2 Limited will either operate the line or receive income from another operator. Public perception of how well the Department manages the High Speed 2 programme may be adversely affected if the estimate is increased to include VAT even though this represents an internal transfer within government rather than an additional cost.

## Figure 9
Capital spending on High Speed 2

**Spending is forecast to peak in 2019-20 (phase one construction) and 2024-25 (phase two construction)**




**NOTES**

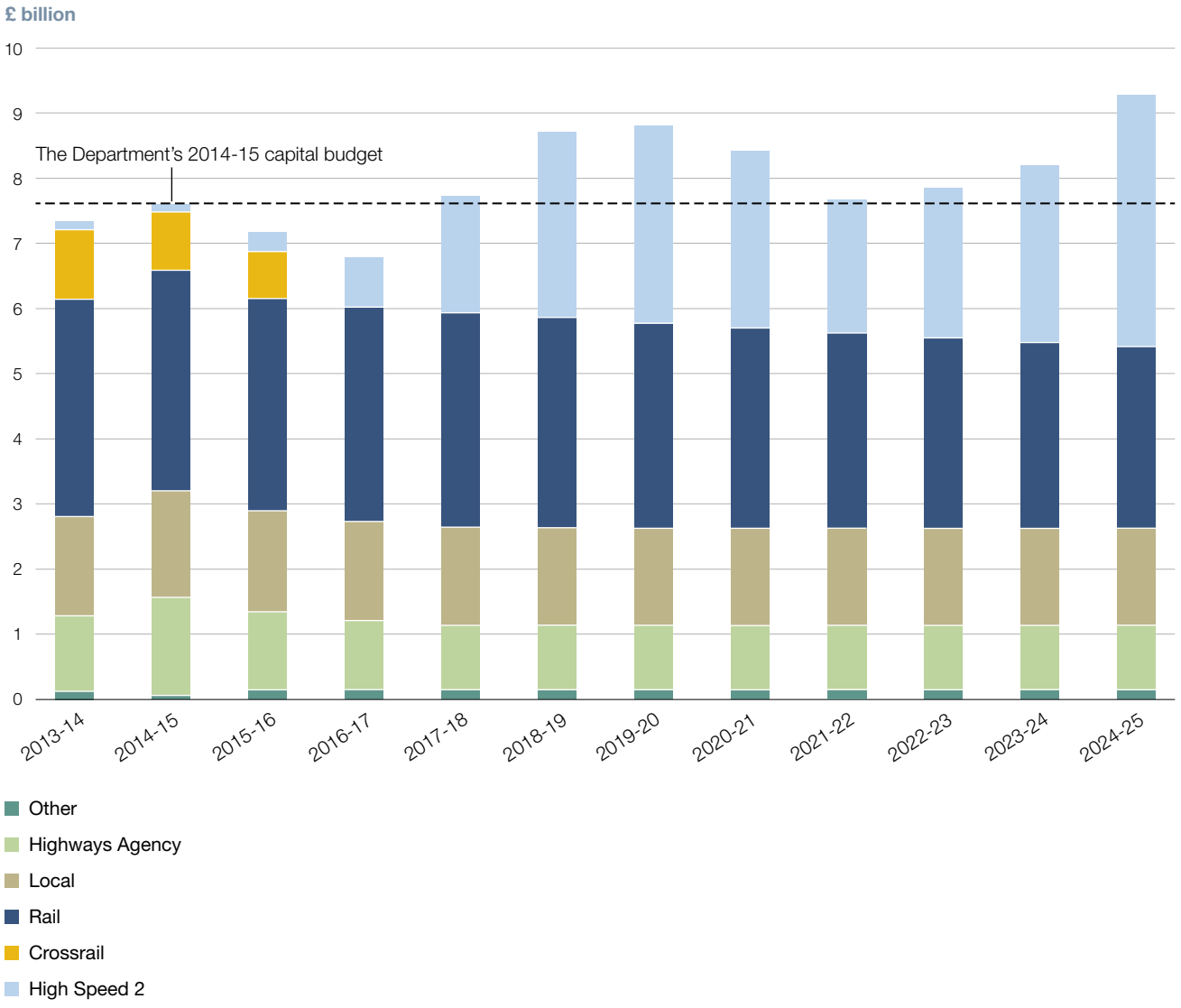
1 These figures are undiscounted and do not include VAT.

2 These are capital costs so they include the cost of buying trains as well as the cost of constructing the line, but exclude programme management costs.

*Source: National Audit Office analysis*

## Figure 10
Capital spending during construction

**The Department forecasts that its capital spending will rise in real terms during the peak years of construction**




**NOTES**

1 High Speed 2 data are phase one and two combined including the cost of trains.

2 These figures are undiscounted and do not include VAT.

3 The Department's spending plans after the end of March 2015 are provisional and depend on decisions made at subsequent spending reviews.

4 2014-15 is the final year of the 2010 spending review period and is the base year after which some additional capital funding will be available across government.

*Source: Department for Transport*

# Part Four

## Setting up the High Speed 2 programme

**4.1** In this part we examine the timetable, governance and management arrangements for the High Speed 2 programme. Our Guide to *Initiating successful projects*[19] identified that departments' early actions are likely to be crucial to success and achieving value for money.

### Departmental capacity

**4.2** High Speed 2 is one of the government's largest and most high profile infrastructure programmes. The Department is also responsible for a number of other large and complex initiatives and programmes including: Thameslink, Crossrail, and the Intercity Express Programme; restarting rail franchising; reforming motoring services; and reviewing aviation policy. It restructured in 2010 and is also undergoing further organisational change in response to cancelling the InterCity West Coast franchise competition. The number and scale of the Department's initiatives places substantial pressure on the Department's board, its senior officials – many of whom have only recently taken up their current posts – and staff at all levels.

**4.3** The Department has identified a high risk that it may have insufficient skilled staff in the areas of procurement, corporate finance, rail technical and programme management. It is already taking steps to strengthen its high-speed rail team, largely by bringing skilled staff from elsewhere in the Department, including those who worked on the London 2012 Olympic Games.

### Programme timetable

**4.4** The High Speed 2 programme includes all activities required to establish an operational high-speed line. These include construction, acquiring rolling stock, and associated activities such as promoting legislation, setting the regulatory framework and consulting and managing stakeholders. The next major milestone is introducing a hybrid bill for phase one. This will provide the planning consent and compulsory purchase powers needed to start construction. It allows those affected by the line to petition Parliament with their concerns. The Department also plans to introduce a paving bill in 2013 to obtain parliamentary approval to incur expenditure on preparatory works before achieving royal assent on the hybrid bill.

19 National Audit Office, *Initiating successful projects*, December 2011, available at: www.nao.org.uk/publications/1012/initiating_successful_projects.aspx

**4.5** Phase one has shorter periods for planning and passing the bill through Parliament than either High Speed 1 or Crossrail, even though it is a much larger programme (**Figure 11**). Slippage against the timetable would delay achieving the forecast benefits from High Speed 2.

## Figure 11
### Comparison of rail project timescales

**The timetable for High Speed 2 phase one is ambitious compared with other major rail projects**

| | High Speed 2 phase one | Crossrail | High Speed 1 |
|---|---|---|---|
| **Specification** | | | |
| Length of new railway built | 225 km | 21 km | 109 km |
| Length of twin-bored tunnels | 28 km | 21 km | 20 km |
| Number of new or significantly remodelled stations | 4 | 8 | 3 |
| **Timescale** | | | |
| Overall | 2009 to 2026 | 1990 to 2018 | 1987 to 2007 |
| Planning | 4 to 5 years | 14 years[1] | 7 to 8 years |
| Hybrid bill | 1 year 5 months | 3 years 5 months | 2 years 1 month |
| Preparation for construction | 1 year 8 months | 10 months | 2 years 8 months |
| Construction | 9 years | 8 to 9 years | 8 years |
| Preparation for operations | 10 months | 1 year | 1 year[2] |

**NOTES**

1 The government originally gave the go ahead for the Crossrail project in October 1990. A hybrid bill was submitted in 1991 but rejected by Parliament in 1994. The project was revived in 2000 and a second bill presented to Parliament in 2005.

2 Applies to preparations to open section 2 of High Speed 1, between central London and Kent, and the start of international train services from St Pancras station.

*Source: National Audit Office analysis*

**4.6** The Department and HS2 Limited have much work to do to prepare documents for the hybrid bill. Much of this work is interdependent:

- A detailed route design is needed to assess the environmental impact of the high-speed line, which in turn may lead to design changes to reduce the impact.
- Work on the environmental impact assessment had to begin soon after the government's decision because it requires a year-long survey of the environment alongside the route. HS2 Limited let five contracts for this work in February and March 2012. This leaves seven months for the Department and HS2 Limited to finalise the route plan and environmental statement to meet the published date for introducing the hybrid bill.
- HS2 Limited is planning to consult on its proposed environmental mitigations. This is important as successfully meeting the concerns of stakeholders could reduce the number who petition against the hybrid bill.
- The Department needs to develop the outline business case for the whole programme, incorporating the costs and benefits of the detailed route design for phase one.
- A number of documents have to be deposited when the hybrid bill is introduced including:
    - route plans and sections;
    - a 'book of reference' detailing all interests in land along the route;
    - the environmental statement;
    - a planning and heritage memorandum;
    - a code of construction practice;
    - a cost estimate; and
    - a housing statement.

**4.7** The Department is publicly committed to introducing the bill in October 2013. However, HS2 Limited and the Department now have plans which extend the timetable to the end of December 2013 but even these do not contain contingency and require quick decisions and approvals. Introducing the bill earlier than December 2013 would only be achievable if no significant changes are required to the design or the draft environmental statement following consultation. The Department recognises that its December 2013 timetable presents substantial risks to the quality of initiation and this includes compressing the time for external assurance (**Figure 12**). Faster preparation for the bill may increase the extent of petitions to Parliament which may make it less likely that royal assent is granted by the planned date of May 2015. It may also divert the Department and HS2 Limited from focusing on the deliverability of the design.

## Figure 12
Programme risks

**These risks relate to the tight timetable**

| Risk area | Risk description |
|---|---|
| Impact of pace | The nature of the timetable may lead to reducing the quality of bill documents and supporting evidence. |
| Bill timetable | The challenging timetable may hinder the ability to:<br>• maintain up-to-date plans and reach milestones on time;<br>• manage opposition to the scheme including obtaining access for land surveys;<br>• keep governance arrangements up to date and clear;<br>• make appropriate decisions and obtain stakeholder support;<br>• make adjustments to the timetable to alleviate pinch points;<br>• manage resourcing pressures within the Department and HS2 Limited; and<br>• minimise the risk of legal challenge. |
| Resourcing | Delays in staffing up posts identified as urgent in the corporate plan may undermine the ability to meet priorities. There are key risks concerning legal resources, economists and major project expertise. |

*Source: Department for Transport*

## The Department's governance of High Speed 2

**4.8** Programme governance refers to the functions, responsibilities, processes and procedures that define how a programme is set up, managed and controlled. The importance of effective governance and clear roles and responsibilities at the Department, particularly in the context of high-risk projects, is highlighted in much of our work. Most recently we reported on how the Department handled the InterCity West Coast franchise competition.[20]

**4.9** We identified three areas of risk to the Department's effective governance of the High Speed 2 programme:

- Underdeveloped governance and programme management.
- Insufficient resources in the Department's High Speed 2 team.
- Inadequate stakeholder management.

20 Comptroller and Auditor General, *Lessons from cancelling the InterCity West Coast franchise competition*, Session 2012-13, HC 796, National Audit Office, December 2012.

**4.10** As we say in Part Two, there is a disconnect between the strategic case for High Speed 2, particularly to rebalance economic growth, and the economic case because the relationship between the strategic objectives for High Speed 2 and journey time savings is unclear. The Department has not placed much emphasis in its programme management on achieving the strategic objectives. This could cause a lack of clarity about the programme objectives and lead to problems when decisions on cost control have to be taken. For example, on whether to develop station sites to maximise the scope for jobs.

**4.11** The programme has a complicated governance structure (**Figure 13**). This is because the Department aims to preserve some independence for its development body, HS2 Limited, while also maintaining effective governance. The effectiveness of the governance structure depends on a clear understanding by those involved of their respective roles and responsibilities. The Department must be clear about what it wants. There should be an agreed reporting mechanism based on well-defined milestones, a shared risk register and open sharing of information. Staff at the Department and HS2 Limited share a collaborative and constructive approach to making progress on High Speed 2. However, the formal documented processes are not as developed as they should be at this stage.

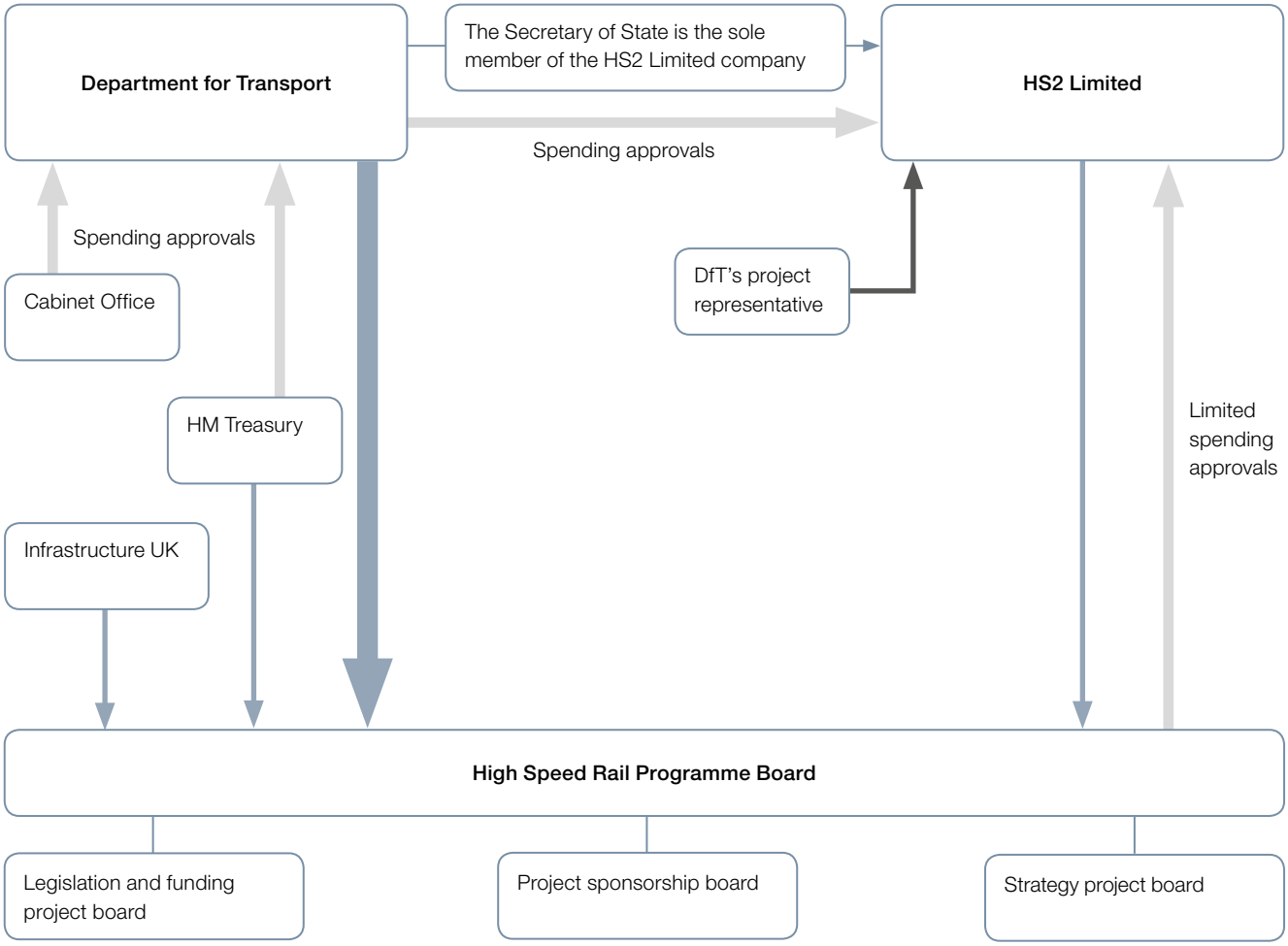
**4.12** The High Speed Rail programme board is the key element of programme governance. The programme board is chaired by the senior responsible owner. Its membership includes representatives from the Department, HS2 Limited, HM Treasury and Infrastructure UK. It has delegated authority from the Department's board to make decisions within defined parameters, including development work up to £100 million.

**4.13** We found that the programme board's programme management tools were unsophisticated. Until recently, the programme plan did not have a critical path showing dependencies and the order tasks needed to be completed. The risk register also needed improvements, including on ownership and tracking mitigating actions, and there was no system for issue management. The programme board has made improvements and the Department introduced a new plan with an identified critical path in October 2012. The programme board started using the new plan to coordinate activities and manage risks in February 2013. Our work on initiating successful projects found that weak governance structures and poor performance management systems can result in missed benefits, or escalating costs and timescales.[21]

21 National Audit Office, *Initiating successful projects*, December 2011, available at: www.nao.org.uk/publications/1012/initiating_successful_projects.aspx

## Figure 13
High Speed 2 governance structure

**The programme's governance structure is complicated**




**NOTES**

1 The Department's senior responsible owner for High Speed 2 is the Department's Director General for High Speed Rail who also chairs the High Speed Rail Programme Board.

2 The Chief Executive and Chair of HS2 Limited and a nominee each from HM Treasury and Infrastructure UK are members of the Programme Board. The remaining five members, including the chair, are senior officials from the Department.

3 The Department has appointed industry experts Parsons Brinkerhoff to act as its 'project representative' to provide it with assurance that HS2 Limited is progressing the project in line with the sponsor's requirements; is capable of delivery; and preparatory work for the hybrid bill is fit for purpose.

*Source: National Audit Office analysis of Department's data*

## Organisation of the Department's High Speed 2 team

**4.14** Until recently, the Department's Director General, Domestic Group was the senior responsible owner for the programme, alongside a number of other responsibilities. The programme involves contributions from staff across the Department with separate line management arrangements.

**4.15** The Department appointed a new director general dedicated to the High Speed 2 programme, who took up post in January 2013. He is the senior responsible owner and will ultimately be accountable for ensuring that the programme meets its objectives and realises the expected benefits. He also has line management responsibility for more of the staff working on High Speed 2 in the Department than under previous arrangements, in particular the project sponsorship team.[22] The Department has appointed two new directors so there are now three overseeing the programme. It is also putting in more resources for governance; planning; assurance; and regeneration; and to realise the benefits. The Department is to be commended for taking action to change the High Speed 2 programme, based on lessons from the failure of the InterCity West Coast franchise competition.

## Stakeholder management

**4.16** There are particular risks for the Department if it fails to effectively meet or manage stakeholders' expectations. The government's January 2012 decisions were subject to judicial review[23] and the hybrid bill process allows dissatisfied stakeholders to petition Parliament for programme changes, which may add delay and cost. The Department faces challenges managing the concerns and aspirations of many stakeholders including members of government, local authorities, rail passengers and operators, citizens, interest groups and technical partners.

**4.17** HS2 Limited has a director responsible for external and parliamentary relations including stakeholder and community management, while the Department is responsible for managing relationships with other government departments. The programme needs cross-government support and coordination, however, the Department has not always managed this effectively. For example, there was a lack of clarity between the Department and HS2 Limited over the full requirements to comply with cross-government approval processes which meant the company's original timetable for letting some contracts was unachievable. The Department has carried out some consultation with the rail industry and other stakeholders, such as the Office of Rail Regulation, but has not taken full advantage of their expertise on operating services, forecasting operating costs and revenues, and establishing regulatory frameworks and industry structures.

22 Until February 2013, the project sponsorship team of the Department's High Speed 2 team were line managed through the Director General Major Projects and London.
23 Nine out of ten points were decided in the government's favour in March 2013.

**4.18** The Department has taken steps to improve its stakeholder management in some areas. In January 2013, the Department appointed a single stakeholder manager to its High Speed Rail team whose responsibilities will include working with local authorities and other bodies at the locations of the high-speed line stations to support the government's objective to provide regional economic growth.

## Assurance

**4.19** The Department has been slow to respond to the issues identified through internal and external assurance. In its reviews of the High Speed 2 programme the Major Projects Authority has raised a number of issues and has highlighted the need to plan ahead for future developments as the programme progresses. For example, the Major Projects Authority has repeatedly raised concerns about management and governance structures (**Figure 14**). The Authority's most recent assessment of Amber/Red is driven by the Department's timetable for achieving royal assent on the hybrid bill as well as in part by external risks, such as stakeholder resistance.

**4.20** The Department's internal auditors reviewed the Department's governance and sponsorship of High Speed 2 in October 2012. The review stated that controls and processes had not yet reached a sufficient level of maturity. The internal auditors reported on progress in April 2013 and found that only one of their recommendations had been fully implemented. The Department's internal auditors have established a group for assurance organisations involved in the programme to meet and coordinate activities. We are observers to this group.

### Figure 14
Major Projects Authority reports on High Speed 2

**The Major Projects Authority has raised repeated concerns about a number of issues**

| | June 2011 | November 2011 | June 2012 |
|---|---|---|---|
| 'Delivery confidence assessment' | Amber | Amber/Red | Amber/Red |
| **Issues raised** | | | |
| Risky timetable | ✔ | ✔ | ✔ |
| Management and governance structures at early stage | ✔ | ✔ | |
| Concerns regarding skills, capability and resources | ✔ At HS2 Limited and at the Department | ✔ At HS2 Limited | ✔ At the Department |
| More work required on costs and affordability | | ✔ | ✔ |

*Source: National Audit Office analysis of Major Projects Authority reports*

# Appendix One

## Our audit approach

**1** This report examined the Department for Transport's progress in putting in place the foundations for successful delivery of High Speed 2. We focused on the first phase of the programme. We evaluated the Department against the five key elements of success identified in our Guide to *Initiating successful projects*,[24] which is based on our experience of 40 major government projects.

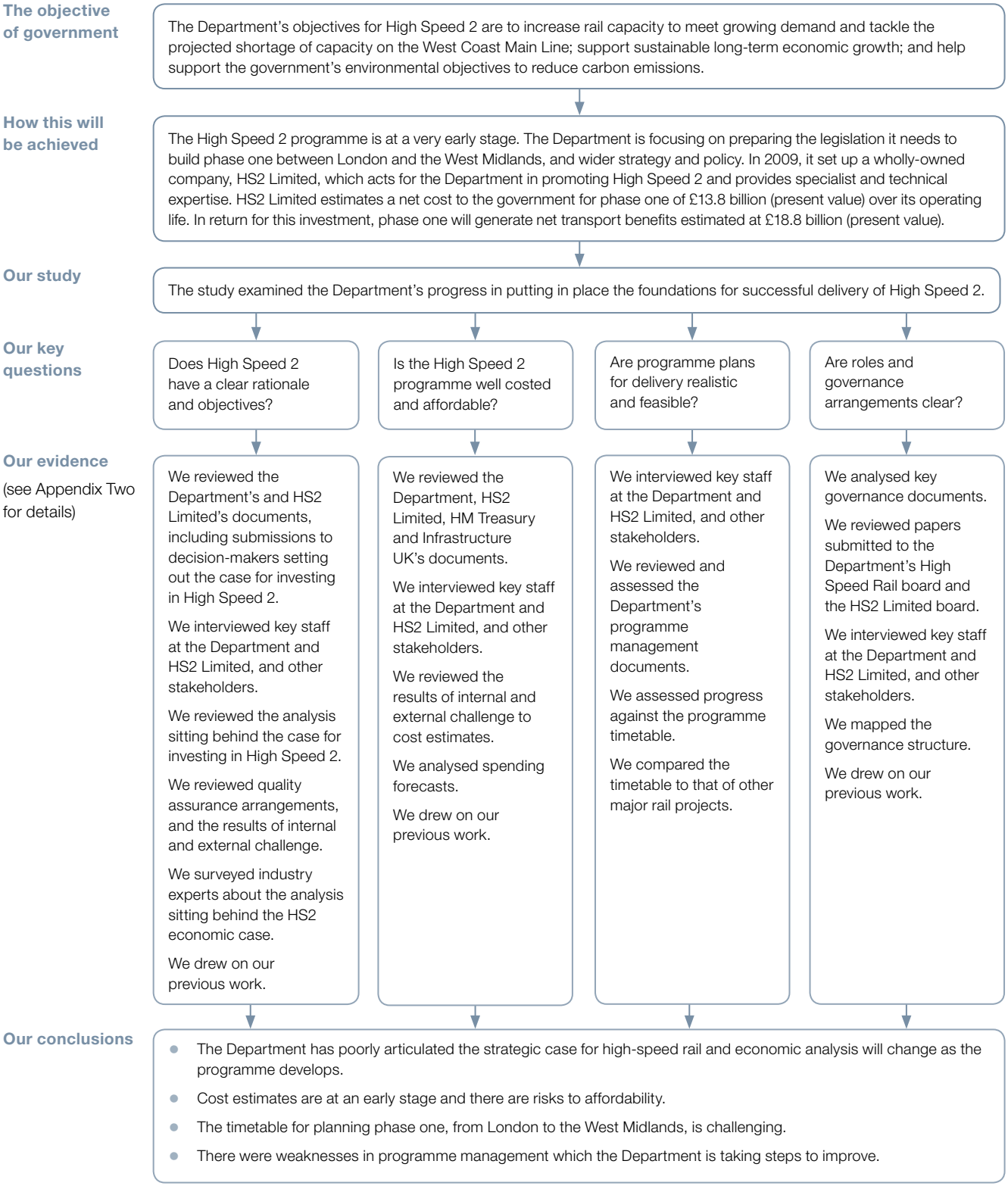
**2** We reviewed:

- the Department's case for building a new high-speed railway;
- the Department's cost estimates for phase one and its assessment of the programme's affordability; and
- how the Department has set up the programme.

**3** Our audit approach is summarised in **Figure 15**. Our evidence base is described in Appendix Two.

24 National Audit Office, *Initiating successful projects*, December 2011, available at: www.nao.org.uk/publications/1012/initiating_successful_projects.aspx

## Figure 15
Our audit approach



# Appendix Two

## Our evidence base

**1** Our independent conclusions on the early programme preparation of High Speed 2 were reached following our analysis of evidence collected between July and November 2012.

**2** We applied an analytical framework with evaluative criteria that drew upon good practice guidance set out in our Guide to *Initiating successful projects*;[25] our option appraisal toolkit; HM Treasury's business case and *Green Book*[26] guidance; and the Department for Transport's transport analysis guidance (called WebTAG). Our audit approach is outlined in Appendix One.

**3 We reviewed the clarity of objectives and the rationale for the first phase of High Speed 2:**

- We reviewed the Department, HS2 Limited and HM Treasury's documents to understand how the business case for High Speed 2 had been developed and approved; and assessed the case against good practice.
- We reviewed submissions to decision-makers for clarity of rationale and purpose.
- We carried out semi-structured interviews with key staff at the Department and HS2 Limited to obtain further information about the business case for High Speed 2 and confirm our understanding from the documentation. We met other stakeholders (for example, Network Rail, Office of Rail Regulation and Birmingham City Council) to gain their perspectives on the need for High Speed 2.
- We performed an in-depth assessment of the analysis sitting behind the High Speed 2 economic case to understand how estimates had been produced and identify key sensitivities.
- We reviewed quality assurance arrangements, and the results of internal and external challenge to establish whether findings and recommendations had been acted upon. We did not directly review or test the passenger demand models on which the economic case is based.

25 National Audit Office, *Initiating successful projects*, December 2011, available at: www.nao.org.uk/publications/1012/initiating_successful_projects.aspx
26 HM Treasury, *The Green Book, Appraisal and Evaluation in Central Government*, 2003 edition updated in July 2011.

- We surveyed members of HS2 Limited's analytical challenge panel – a panel of industry experts and academics set up to provide advice and challenge on the High Speed 2 economic case – to gain their perspectives about the modelling used to inform the analysis.
- We drew on our past work, for example our studies on *The nationalisation of Northern Rock* and *The completion and sale of High Speed 1*.[27]

**4 We assessed whether the High Speed 2 programme is well costed and affordable:**

- We reviewed the Department, HS2 Limited, HM Treasury and Infrastructure UK's documents to assess how cost estimates had been produced and risks to affordability.
- We carried out semi-structured interviews with key staff at the Department and HS2 Limited, and other stakeholders (for example, HM Treasury, Infrastructure UK, the Major Projects Authority and HS2 Limited's development partner, CH2M Hill).
- We reviewed the results of internal and external challenge to cost estimates to examine whether their findings and recommendations were being acted upon.
- We analysed spending forecasts to see whether they were compatible with spending constraints.
- We drew on our past work, for example our study on *The budget for the London 2012 Olympic and Paralympic Games*.[28]

**5 We assessed the realism and feasibility of the early plans to deliver the High Speed 2 programme:**

- We reviewed and assessed the Department's programme management documents, including risk registers and delegated authorities, against good practice.
- We carried out semi-structured interviews with key staff at the Department and HS2 Limited, and other stakeholders (for example, the Major Projects Authority, and HS2 Limited's development partner, CH2M Hill).
- We assessed progress against target dates, reviewed the timetable going forward and compared timescales against other major rail projects.
- We identified key risks to the successful delivery of the programme.

27 Comptroller and Auditor General reports, *The nationalisation of Northern Rock*, Session 2008-09, HC 298, National Audit Office, March 2009; and *The completion and sale of High Speed 1*, Session 2010–2012, HC 1834, National Audit Office, March 2012.

28 Comptroller and Auditor General, *The budget for the London 2012 Olympic and Paralympic Games*, Session 2006-07, HC 612, National Audit Office, July 2007.

**6 We assessed the clarity of roles and governance arrangements for the High Speed 2 programme:**

- We reviewed key governance documents to assess clarity and coverage and mapped governance, reporting and information flows to show accountability relationships.
- We reviewed papers submitted to the Department's main boards and its executive and commercial and investment subcommittees; the High Speed Rail programme board; and the HS2 Limited board.
- We interviewed key staff at the Department, including the senior responsible owner for High Speed 2, and the chief executive of HS2 Limited, as well as the Major Projects Authority.
- We drew on our past work, for example our report on *Lessons from cancelling the InterCity West Coast franchise competition*.[29]

29 Comptroller and Auditor General, *Lessons from cancelling the InterCity West Coast franchise competition*, Session 2012-13, HC 796, National Audit Office, December 2012.

# Appendix Three

## The timetable for High Speed 2 phase one

**Phase one high-level programme plan milestones**

| Milestone | Date | |
|---|---|---|
| Initial baseline | March 2012 | |
| Specification and baseline documents issued | April 2012 | |
| All design contracts let | May 2012 | |
| Safeguarding plans published | September 2012 | |
| Compensation scheme published | September 2012 | |
| Environmental consultation | April 2013 | |
| Introduce hybrid bill | December 2013 | |
| Complete preliminary design | September 2014 | |
| Commence reference design | October 2014 | |
| Powers granted (royal assent of the hybrid bill) | May 2015 | |
| | | If powers are granted on time: |
| Procurement strategy agreed | + 0 months | May 2015 |
| Commence land acquisition | + 1 month | June 2015 |
| Full funds in place | + 4 months | September 2015 |
| Delivery partner (for construction) in place | + 8 months | January 2016 |
| Detailed design and other time critical contracts awarded | + 8 months | January 2016 |
| Main construction contracts awarded | + 13 months | June 2016 |
| Start of main construction | + 20 months | January 2017 |
| End of main construction | + 10 years 10 months | March 2026 |
| Train service operations (phase one) | + 11 years 7 months | December 2026 |

**NOTE**

1 'Safeguarding' is the process whereby arrangements are introduced to protect land along the route from developments that are likely to interfere with the programme.

*Source: Department for Transport*

# Appendix Four

## Reconciliation of cost estimates for phase one

**This figure shows how the £13.8 billion cost estimate used in the economic case, which we refer to in Part Two of the report, relates to the January 2012 £16.3 billion undiscounted construction cost estimate reported in Part Three.**

| | Undiscounted (£bn) | Present value (£bn) |
|---|---|---|
| Capital costs | | |
| Construction | **16.3** | 14.7 |
| Track renewal and new trains | 10.4 | 4.1 |
| Subtotal | 26.7 | 18.8 |
| Operating costs | 17.8 | 8.2 |
| Revenues | Not given | (13.2) |
| Net cost | Not given | **13.8** |

**NOTES**

1 It is standard for costs and benefits in an economic appraisal to be discounted to a 'present value' so that those which occur later are given a lower present value. For High Speed 2 the present value is over a 60-year period to 2086 for phase one and 2092 for phase two.

2 Present values include VAT while undiscounted figures do not.

*Source: National Audit Office analysis of HS2 Limited data*

Report by the Comptroller and Auditor General

# High Speed 2: A review of early programme preparation

HC 124 Session 2013-14

ISBN 978-0-10-298142-1

Ordered by the House of Commons to be printed on 14 May 2013

## CORRECTION

Paragraph 2.10 (page 23) of the report was produced in error.

The report incorrectly states that High Speed 2 is expected to carry 148,000 passengers between London and the West Midlands a day in 2026. The correct date is 2037.

**Please see the corrected paragraph below:**

**2.10** Quantified benefits are largely expected to be for travellers, particularly through faster, more reliable and less crowded journeys. Within net transport benefits of £18.8 billion (**Figure 6**), benefits for business travellers, whose time is given a higher value than other travellers, are estimated at £12.6 billion. The value of benefits depends on the number of forecast passengers. High Speed 2 is expected to carry 148,000 passengers between London and the West Midlands a day in 2037 and trains will be, on average, between 50 and 60 per cent full. If the forecasts prove inaccurate the expected level of transport user benefits from High Speed 2 could be higher or lower. In our previous reports on High Speed 1, we drew attention to the impact of over-optimistic passenger demand forecasts on the programme's economic case.

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