



Department  
for Transport

# HS2 Phase 2a Strategic Outline Business Case

## Strategic Case

November 2015

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# Section 1: Executive Summary

- 1.1 HS2 has the potential to change the economic landscape of the country; it will transform our cities, communities and the way that people travel and live. It will bypass our existing congested railways and deliver extra capacity and improved connectivity that will help unlock growth and regeneration for cities throughout the country.
- 1.2 The sooner we build HS2, the sooner we will deliver these benefits. That is why we intend to build the section from Fradley (in the West Midlands) to Crewe more quickly, to be delivered in 2027, six years earlier than planned.
- 1.3 Accelerating delivery of this section of HS2 (the “Phase 2a” scheme) will deliver faster journeys from London to Crewe, Manchester, Liverpool, Preston, Warrington, Wigan and Glasgow more quickly. Building faster to Crewe means that the North West and Scotland will see more of the benefits of HS2 more quickly, and this will bring economic benefits sooner.
- 1.4 HS2 Phase 2a has the potential to deliver an increase in capacity on our congested rail network. It bypasses bottlenecks at Colwich Junction and around Stafford, potentially improving the reliability and performance of the West Coast Main Line (WCML).
- 1.5 Crewe is already a major hub on the WCML. It has excellent regional and long distance connectivity. Building HS2 to Crewe also improves journey times for connecting passengers travelling to or from the wider North West, including Chester, North Wales, Stoke-on-Trent and Shrewsbury. Cheshire East Council, Stafford and Stoke-on-Trent City Council have all set out their vision for economic growth in the region as part of the Northern Gateway Partnership. Cheshire East Council have also made the case that more trains stopping at Crewe would bring even more benefits to the region. Our analysis shows more benefits could be achieved by stopping more trains at Crewe and we are developing options for Crewe Station that could achieve that. We are also continuing to work on optimising the service pattern for Crewe and the wider North West.
- 1.6 The Phase 2a section of route is relatively easy to build. It does not require new stations or additional rolling stock to operate. As the Economic Case demonstrates, the acceleration is financially positive. As a standalone scheme, it provides value for money. By building straight on from Phase One, there are potential efficiency savings to be made, from integrating construction and procurement between the two projects.

- 1.7 In order to ensure our case for Phase 2a is robust we have considered alternatives to the Phase 2a scheme presented. We have found no alternative that could deliver the journey time benefits of Phase 2a or which would provide a better step towards completing the full “Y” network (which is the route from London, via Birmingham, to Leeds and Manchester).
- 1.8 The accelerated delivery of Phase 2a reinforces the Government’s commitment to the full “Y” network. Work on the rest of Phase Two is being progressed with urgency. The full network will be delivered by 2033 (subject to Parliamentary approval), bringing high speed services to Leeds, Sheffield and the East Midlands, and further improving services to Manchester and Scotland.
- 1.9 We will continue to look at what else we can achieve. We are committed to ensuring that as much of the North as possible benefits from HS2 as soon as possible. We will continue to work with the cities in the surrounding area such as Stoke-on-Trent and with the Northern Gateway Partnership to explore ways to increase the positive impact of HS2 for their area, and with Transport for the North on the Northern Powerhouse Rail (NPR) programme. Together HS2 and NPR will help to rebalance the economy by transforming rail travel to, from, and within the North. We are also continuing to work with the Scottish Government to examine and develop options for further improving journey times to Scotland and maximising the benefits HS2 could bring.
- 1.10 There is much to do, but we are determined to move quickly and ensure the country gains the benefits of HS2 as soon as possible.

## Section 2: The Scope of Phase 2a

- 2.1 HS2 is a new high speed rail network for the UK, connecting London with major cities in the Midlands and the North of England. It is a Y-shaped network that will be delivered in several stages. Trains will also run beyond the “Y” network to serve places such as Liverpool, Warrington, Newcastle and on to Scotland.
- 2.2 Phase One of HS2 will see a new high speed line constructed from Euston to north of Birmingham, where it will re-join the existing West Coast Main Line (WCML), allowing fast, direct services to destinations including Crewe, Manchester, Liverpool, Preston and Glasgow. New high speed trains will serve Birmingham city centre and an interchange station designed to serve the wider West Midlands. At Old Oak Common in West London, a new interchange will be built connecting HS2 with Crossrail and the Great Western Main Line. Phase One will be built and operational by 2026 (subject to Parliamentary approval of the Phase One hybrid Bill).
- 2.3 The proposals for Phase Two extend the line to the north-west and north-east, to Manchester with connections to the WCML at Crewe and Golborne, and to Leeds with a connection to the East Coast Main Line approaching York. There will be new stations in Manchester and Leeds, with intermediate stations to serve the East Midlands and South Yorkshire. Phase Two will be completed seven years after Phase One, in 2033.
- 2.4 This document sets out the Strategic Case for the Phase 2a route between Fradley (at the point at which Phase One joins the WCML) and Crewe, and for accelerating delivery of this section of HS2 Phase Two.
- 2.5 Phase 2a is a 37 mile railway starting at Fradley at its southern end. At the northern end it connects with the WCML south of Crewe to allow HS2 services to join the WCML and call at Crewe Station. North of this junction with the WCML, Phase 2a continues to a tunnel portal south of Crewe, thereby providing passive provision for completing Phase Two, as set out in the 2013 Line of Route Consultation<sup>1</sup> (in other words, trains would only start travelling up to the tunnel portal once the next part of the Phase Two route was built).

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1 <https://www.gov.uk/government/consultations/hs2-phase-two-proposed-line-of-route-from-west-midlands-to-manchester-and-leeds>

- 2.6 Phase 2a also includes an Infrastructure Maintenance Depot located in the Basford area south of Crewe, as consulted in 2013. The alignment is as consulted in 2013, with some route refinements made in response to consultation.
- 2.7 The 2013 Strategic Case<sup>2</sup> set out a proposed train service pattern that would run once Phase One opens in 2026. This assumes that six trains per hour run through Crewe (with two services stopping there) and one train per hour runs through Stoke-on-Trent (without stopping). For the purposes of modelling, we have assumed that this service pattern continues to run once Phase 2a opens in 2027. When the rest of Phase Two opens in 2033, we have assumed that the Phase Two train service pattern will run across the network, as set out in the 2013 Strategic Case.
- 2.8 We are continuing to work on developing the best service pattern for Crewe and the wider North West. We have modelled a number of alternative service patterns as part of the economic analysis (set out in more detail in section 5, which covers value for money). In addition, both Line of Route Consultation responses and Sir David Higgins have recommended that HS2 serve a new high speed hub station at Crewe. The Government supports the vision for a Crewe Hub, and intends to make further announcements on the way forward in 2016. We are working with Network Rail and local stakeholders to understand how best to develop options which are affordable and deliver value for money.
- 2.9 This document is one of the five Cases making up the Government's Strategic Outline Business Case (SOBC) for Phase 2a. The five cases are:
- a. Strategic Case
  - b. Economic Case
  - c. Financial Case
  - d. Commercial Case
  - e. Management Case
- 2.10 The SOBC stage of developing a major project outlines the high level outcomes which the project intends to deliver. It sets out the need for intervention and how this will further ministers' aims and objectives. It provides suggested or preferred ways forward and presents the evidence for decision, including the costs and benefits.
- 2.11 The scope, costs and schedule are refined as the project moves to an Outline Business Case, which is then further refined to give greater confidence in delivery by the time a final investment decision is taken at the Full Business Case stage. As a result, the Train Service Specification (TSS) and designs set out in this Strategic Case are intended to give Government confidence in the intentions and outputs of the project, but will continue to be refined and may change as the project develops.

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<sup>2</sup> <https://www.gov.uk/government/publications/hs2-strategic-case>

## The rest of Phase Two

- 2.12 This Strategic Case for Phase 2a sets out our initial proposal to accelerate the delivery of the route between Fradley and Crewe. The rest of Phase Two, from Crewe to Manchester and Glasgow, and Birmingham to the East Midlands, Sheffield and Leeds is referred to as the rest of Phase Two.
- 2.13 The accelerated delivery of Phase 2a reinforces the Government's commitment to the full HS2 "Y" network. We are making good progress on Phase One, where construction will commence in 2017 (subject to Parliamentary approval) with services due to commence in 2026. Work on the rest of Phase Two is being progressed with urgency. The Secretary of State expects to announce a decision on the route for the rest of Phase Two in late 2016. The intention is for the full "Y" network to be delivered by 2033, bringing high speed services to Leeds, Sheffield and the East Midlands, and improving still further services to Manchester and Scotland.

## Section 3: The Rationale for Acceleration: delivering benefits of HS2 Phase Two sooner

- 3.1 The 2013 HS2 Strategic Case established the case for HS2. It set out how both phases of HS2 will help achieve the Government's objectives to build a stronger, more balanced economy capable of delivering lasting growth and widely shared prosperity. It also showed how the "Y" network will provide sufficient capacity to meet long term demand, improve resilience and reliability across the network, and improve connectivity by delivering better journey times and making travel easier.
- 3.2 Since the Strategic Case for HS2 was published in 2013 we have continued to work to develop and refine the evidence base for HS2. A report "Supplement to the October 2013 Strategic Case for HS2" updating this work is published alongside this document and can be viewed at: <https://www.gov.uk/government/collections/hs2-phase-two-from-the-west-midlands-to-leeds-and-manchester>.

### HS2 and the North

- 3.3 The economy in the North West has many strengths. In the decade to 2012, the fastest growing local economies in the North of England were Cumbria, Cheshire and Warrington, followed by the city-region of Greater Manchester. In 2013 the North West had one of the largest percentage increases in Gross Value Added (GVA) per head at 3.4 per cent. Greater Manchester generates £48 billion GVA, a 4 per cent share of the national economy, and is one of the UK's main centre of financial and professional services outside of London. Of the three areas of the North which have a Gross Disposable Household Income per head above the English average, two are in Cheshire.
- 3.4 Despite these strengths, there are areas of the North West economy that underperform in relation to the rest of England. The Manchester Independent Economic Review highlighted that lower skill levels often lead to lower levels of economic output. The Cheshire and Warrington region performs strongly in terms of GVA per head compared with the national level. However productivity in this area has not kept pace with national increases in performance. Productivity is also lower than average in a number of important, largely service-based sectors such as professional services, banking and finance, and insurance. Cheshire and Warrington also face demographic challenges, with a smaller, and in relative terms declining, proportion of the population of working age.

- 3.5 The Government is committed to transforming northern growth, creating a Northern Powerhouse of jobs, investment and prosperity, and rebalancing the national economy. Good transport has an important role to play in transforming the Northern economy, as set out in the Government's Northern Transport Strategy (2015). Faster, more reliable transport improves connectivity, and brings cities closer together – opening up new markets, new job opportunities, and new opportunities for growth.
- 3.6 HS2 will form a key part of the Government's strategy to improve transport in the North of England. The step change in capacity and connectivity that HS2 will bring will play an important role in rebalancing the economy and stimulating economic growth in the North.

### We have the opportunity to accelerate the delivery of the section of Phase Two between Fradley (in the West Midlands) and Crewe

- 3.7 The section of Phase Two between Fradley and Crewe is an excellent candidate for acceleration. It is a relatively straightforward section of line from an engineering point of view. It does not pass through any major urban areas, nor require the delivery of new stations, meaning that it can be developed and built relatively quickly. Nor does it require additional rolling stock, as the Phase One service specification will be maintained. All of these factors mean that this section of HS2 Phase Two can feasibly be delivered earlier than other sections of the route.

### Other sections of Phase Two

- 3.8 We have considered whether there are alternative sections of Phase Two that could be accelerated by 2027 (subject to decisions on the rest of the Phase Two route). These include the section between Sheffield and Leeds, the Western Leg all the way to Manchester, or the section of route between Birmingham and the East Midlands. The following criteria are relevant when considering sections of the route that could be accelerated:
- connectivity to Phase One
  - delivery of clear connectivity and journey time benefits
  - readiness of the design
  - ability to accelerate delivery to complete by 2027
- 3.9 Phase 2a has a number of advantages over other sections of Phase Two as a standalone scheme. It connects directly with Phase One, meaning that high speed trains could continue to run on to Crewe from London on a dedicated high speed network as soon as the line is built, and that additional rolling stock (over and above that used for Phase One) is not required. It improves journey times between London and the key markets of Manchester and the North West, which show strong demand for long distance travel. It also has the potential to relieve some of the pressure on a

particularly constrained section of the West Coast Main Line (WCML), and to deliver additional capacity, reliability and performance benefits to the railway over and above the benefits from faster journey times. By connecting to the WCML at Crewe, Phase 2a is also able to take advantage of the existing rail connectivity at Crewe. We have looked at the possible benefits of maximising this connectivity by stopping more trains at Crewe, and this set out in more detail in Section 5.

- 3.10 One option considered was to accelerate the section of route between Sheffield and Leeds (subject to a decision on the route). A substantial programme of work is underway to understand how to achieve the optimum solution for passengers at Leeds Station, and how to connect Sheffield and Leeds with plans for enhanced rail infrastructure in the North as part of ambitions for the Northern Powerhouse and Northern Powerhouse Rail (NPR). This is important work and we need to get it right. The need to deliver this work to the required standard means that we are not confident that this section of route could be delivered as quickly as the route to Crewe. In contrast, Phase 2a does not require any new stations to be built, and therefore the design is possible to finalise swiftly.
- 3.11 Another option (subject to a decision on the route) would be to build all the way to Manchester and the WCML link at Golborne as part of Phase 2a. Manchester is an important market for HS2, and building all the way to Manchester by 2027 would be likely to deliver good capacity and connectivity benefits. However, the section of route north of Crewe to Manchester is more complex than the section to the south. It travels through an area of more complex geology, and potentially includes new stations and junctions. In addition, developing the best solution for passengers at Manchester, including how best to link with NPR and to complement the growth and development plans of Manchester, will require more time. Sir David Higgins in his 2014 report “Rebalancing Britain”<sup>3</sup> also highlighted the need to carry out more work on the Golborne link to the WCML and the proposed depot at Golborne. As a result, we do not believe that these route sections could be designed and built in time to open by 2027.
- 3.12 Another option considered was to accelerate the section of route between Birmingham and the East Midlands (subject to a decision on the route). As with Phase 2a, this section of route would have the advantage of connecting directly with Phase One. There would also be some journey time benefits to communities on the Eastern Leg, particularly Derby and Nottingham. However, construction of the route between Birmingham and the East Midlands is not as straightforward as the route to Crewe. The location and design of the route and a hub station have also been subject to a considerable amount of work in order to ensure that HS2 delivers the greatest benefits possible to the East Midlands. This included exploring alternative sites for an East Midlands hub station, as recommended by Sir David Higgins in his report “Rebalancing Britain” (2014). Although all this work has now concluded, it has meant that options

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3 <https://www.gov.uk/government/publications/rebalancing-britain-from-hs2-towards-a-national-transport-strategy>

which may have enabled delivery of the route by 2027 could not have been developed in the time available.

- 3.13 As part of the Strategic Case, we have considered the costs and benefits of Phase 2a as a standalone scheme, independent of the rest of Phase Two. This is a hypothetical scenario, as Government remains committed to the rest of the “Y” network. There are a number of reasons why we believe that accelerating the route to Crewe would present a better case as a stand-alone scheme than accelerating to the East Midlands. For example, it would be easier to achieve good connectivity at Crewe than it would be at an East Midlands hub, as Crewe is already well connected to the classic rail network. Accelerating to Crewe does not require additional rolling stock as it can be run using the Phase One Train Service Specification (TSS), whereas accelerating delivery of the section of route to the East Midlands would require both additional rolling stock and more trains to run out of Euston – something which we believe could be hard to achieve in 2027 with the proposed phased development of Euston Station (which would deliver six platforms for use by high speed trains in 2026, with the remaining five following by 2033). These factors all mean that, at this stage, we do not believe that accelerating to the East Midlands would deliver as much value for money as the route to Crewe, as a standalone case.
- 3.14 For the reasons set out above, we have concluded that at this stage none of these sections should be accelerated as an alternative to Phase 2a. That said if, in the future, we identify ways that we can sensibly bring forward construction of sections of the route, we will explore these further.

## Strategic Objectives

- 3.15 This document, the Strategic Case for Phase 2a, sets out the case for accelerating the delivery of a particular section of Phase Two between Fradley and Crewe for delivery by 2027, six years earlier than the rest of Phase Two.
- 3.16 The Government’s role is to build a stronger, more balanced economy capable of delivering lasting growth and widely shared prosperity, and transport plays a key role in this. In this context, the over-arching strategic objectives for Phase 2a are the same as those for the whole scheme. These were set out in the 2013 Strategic Case for HS2, and are to:
- provide sufficient capacity to meet long term demand, and to improve resilience and reliability across the network
  - improve connectivity by delivering better journey times and making travel easier

Any solution must also:

- minimise disruption to the existing network
- use proven technology that we know can deliver the desired results

- be affordable and represent good value to the taxpayer
- minimise impacts on local communities and the environment

3.17 Whichever option is chosen also needs to support the delivery of the rest of Phase Two. As a result, the preferred option will also need to meet the following specific objectives of:

- improving connectivity and journey times for cities north of Birmingham
- delivering benefits to Northern cities sooner than previously envisaged for Phase Two
- enabling the efficient delivery of the rest of Phase Two

## Section 4: The Case for West Midlands to Crewe

### Accelerating to Crewe means that people will benefit from improvements to journeys north of Birmingham much earlier than originally planned

- 4.1 HS2 Phase One will deliver journeys faster than comparable existing rail services. On top of the journey time savings that will already have been delivered by Phase One, Phase 2a will deliver further journey time savings of up to 13 minutes.
- 4.2 Phase 2a will therefore deliver faster journeys from London to Manchester, Crewe, Liverpool, Preston, Warrington, Wigan and Glasgow as long distance trains will run on dedicated high speed track as far as Crewe before re-joining the classic network. By building Phase 2a six years earlier than planned, these cities in the North of England and Scotland will see more of the benefits of HS2 more quickly.
- 4.3 Improvements in connectivity from HS2 have the potential to unlock significant productivity benefits for the economy. The journey time savings delivered by Phase One will be important and noticeable, but accelerating the delivery of a section of Phase Two means that people will benefit from faster journey times and enhanced connectivity much sooner than the opening of the full Phase Two in 2033.
- 4.4 The connectivity improvements created by HS2 will also result in wider economic impacts of £366 million as a standalone scheme, while the full “Y” network generates wider economic impacts of £14 billion.

### Phase 2a could provide additional capacity and performance benefits between Birmingham and Crewe

- 4.5 Demand for passenger and freight services is growing. Passenger rail journeys have more than doubled since privatisation 20 years ago, and journeys between London, Birmingham and Manchester have trebled in the same period. Total rail freight volumes have risen by 70 per cent since privatisation in the mid-1990s. The West Coast Main Line (WCML) is now operated at a higher intensity than other major European fast lines, and despite an extensive £9 billion upgrade programme completed in 2008, 60 per cent of the additional peak intercity capacity created was used up by 2014. In 1994, there were 17 trains a day operating between Manchester and London.

This new investment allowed 47 trains to operate each day. Over the same period, Birmingham to London trains increased from 31 per day to 49 in 2013. But by 2033 further capacity will be required to accommodate demand.

- 4.6 The WCML is now very heavily utilised, particularly in the morning and evening peaks – carrying 15-16 trains per hour in the peaks. Such an intensive level of operation impacts reliability and performance because there is little time and space to recover from incidents. There are also missed opportunities to offer new services to passengers, even when the demand is there.
- 4.7 Despite the significant WCML upgrade work that was completed in 2009 there are a number of infrastructure constraints between the West Midlands and Crewe that currently impact on the capacity and performance of the WCML. Improving these existing bottlenecks has been the focus of a number of Network Rail projects. This includes major works currently being undertaken around the Norton Bridge Junction and improvements around Stafford on the WCML. These improvements will create extra capacity, providing the capability to deliver more trains on the route and shortening journey times, and will also reduce congestion and delays in the Stafford area.
- 4.8 Despite these major investments, a number of infrastructure constraints still remain. These restrictions limit the timetable that can be run and the number of train paths available. They also impact on the resilience and performance of the WCML.

## Performance and reliability

- 4.9 One of the potential benefits from delivering Phase 2a early is that it effectively acts as a bypass around these constraints, reducing the number of trains per hour that pass through Colwich Junction as fast long distance services transfer onto the HS2 network.
- 4.10 This could help to improve the reliability and performance of this section of the WCML – as more resilience is created in the timetable, improving performance and reliability.

## Released capacity

- 4.11 Accelerating the delivery of the section of Phase Two between the West Midlands and Crewe could provide benefits in terms of released capacity on the rail network.
- 4.12 After the Phase 2a section of route is opened in 2027, long distance services will run on high speed lines from London until just south of Crewe, leaving more space for additional services on the WCML. Upon completion of Phase 2a, trains will re-join the WCML just south of Crewe and run on the classic network up to Manchester, Liverpool and other cities in the North West. This means that extra capacity could be released on the WCML and stations between Handsacre and Crewe – such as Rugeley, Trent Valley and Stafford, where there could be potential for new local stopping services to be introduced (subject to future decisions on capacity allocation).

- 4.13 At this stage, no decisions have been taken on the introduction of any new services, but the Government will consider the possible options. Well established statutory, regulatory and administrative processes will be used to build an open and shared evidence base, consult passengers, communities and freight users, establish options and take decisions ahead of introduction of a new timetable in 2026.
- 4.14 Any released capacity delivered by Phase 2a may also be beneficial for freight. Rail freight currently delivers £1.5 billion p.a. of economic benefits. The WCML is particularly important for freight. In 2011, around 42 freight trains per day used the WCML with 43 per cent of all freight journeys using it at some point. Network Rail's forecasts suggest that demand could nearly double by 2033 from 42 to 80 freight trains per day, with the majority of the growth being in intermodal freight. The planned expansion of the Port of Liverpool is predicted to further increase traffic, and may impose a capacity challenge on northern section of WCML.
- 4.15 Although this projected increase in rail freight traffic is good news for the UK economy, it is likely to pose a challenge for the current rail network. Network Rail estimate that the typical utilisation of intermodal freight paths today is around 85 per cent, which effectively means running at or near capacity<sup>4</sup> and so future growth would be restricted. Government is investing in the railway to help meet this demand for freight traffic. However, significant capacity constraints for freight still exist.
- 4.16 Phase One provides some extra capacity for freight. The Train Services Specification (TSS) presented to the hybrid Bill committee in January 2015 suggests that at least one extra freight train per hour in each direction could operate post Phase One between London and Handsacre and that a second might be possible as well. However, most of the benefits for freight traffic travelling north of Birmingham are to be delivered once the whole of Phase Two has been built in 2033.
- 4.17 Delivering Phase 2a by 2027 could unlock some of these freight benefits earlier, contributing sooner to economic growth. Phase 2a is expected to release capacity on the WCML slow lines between Birmingham and Basford yard, a major freight interchange immediately south of Crewe. This released capacity could mean that there is the potential to run additional freight services along this section of the WCML, and so unlock some of the freight benefits from HS2 earlier, contributing to economic growth.

## Accelerating to Crewe connects HS2 with the wider North West

- 4.18 Crewe is already well connected to the local and national UK rail network. It is a significant rail hub where the main trunk of the WCML and four regional rail lines converge, acting as a gateway to the North West, and giving Crewe 360 degree rail connectivity to major destinations including Liverpool and Scotland; Manchester;

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4 Freight typically requires more flexibility in the timetable in order to ensure that services can respond to the changing demand requirements – such as a large container ship docking at a port – that are a feature of the freight market.

Stoke-on-Trent; Birmingham and London; Shrewsbury and South Wales; and Chester and North Wales. This makes Crewe a strategically important location on the rail network, for both passenger services and freight.

- 4.19 In a typical off-peak hour there are 20 departures from Crewe to destinations elsewhere in the North West, Scotland, and North and South Wales. Crewe Station draws its demand from a wide catchment, including other local stations such as Chester and Stoke-on-Trent. Over the past decade, the number of passengers using Crewe Station has grown, with 3.7 million passengers using the station in 2013/2014 compared to 2.7 million in 2004/05. In addition, in 2013/14 a third of passengers were interchanging between rail services at Crewe. When interchange is ranked as a percentage of overall station usage, Crewe is amongst the top ten UK stations for the proportion of station users who are inter-changing between trains. Passenger numbers at Crewe are forecast to continue to grow, and HS2 Limited forecast that with Phase Two of HS2 as consulted, 6.3 million passengers could be using Crewe Station in 2036.
- 4.20 By building HS2 to Crewe by 2027, people travelling to and from the North West, from places including Chester, North Wales, Stoke-on-Trent and Shrewsbury will also have the option to join faster services to London, and those travelling further afield who currently pass through or change trains at Crewe on their way to or from London will have the option of using high speed services for part of their journey. As a result, accelerating the part of Phase Two to Crewe means that there is the potential for people to benefit from greater improvements to journey times much earlier than originally planned.

## Stopping more trains at Crewe

- 4.21 The 'reference case' in our economic analysis assumes the Phase One service pattern, where two trains per hour stop at Crewe and go on to serve destinations across the wider North West including Liverpool. An additional three high speed trains per hour travel through Crewe on the way to Manchester or Scotland, and a single classic compatible service travels via Crewe on the WCML from Handsacre to Liverpool. However none of these services are assumed to stop at Crewe. Advice from Sir David Higgins, and responses to the consultation, suggested that there was the potential for more benefits to be delivered from stopping more trains at Crewe to further improve connectivity across the North West.
- 4.22 We have explored the benefits of stopping four trains per hour at Crewe rather than two as in the Phase One service specification. Our modelling showed that stopping these extra trains could deliver an additional £302 million in benefits and £251 million in revenue. This is set out in more detail in Section 5.

4.23 While further work, including on costs and funding, must be completed before decisions can be taken on whether to proceed, the Government supports the vision for a Crewe Hub. The Government intends to make further announcements on the scheme in 2016, and any Crewe Hub scheme will be subject to public consultation. Such a proposal will need to be affordable, offer value for money, and bring benefits to Crewe town and the entire region including Cheshire, Warrington, Stoke-on-Trent and Staffordshire.

### Regeneration of the Crewe and the region

4.24 HS2 will drive growth by acting as a catalyst for major regeneration and development schemes, delivering better connectivity and providing opportunities for the UK's businesses and workforce. It will generate economic opportunities and development beyond the direct impacts of building a new railway.

4.25 The recently formed Northern Gateway Partnership, a collaboration of seven local authorities across Cheshire and Staffordshire, and the Cheshire and Warrington and Stoke-on-Trent and Staffordshire Local Enterprise Partnerships, has set out their aspirations for economic growth in the region, to capitalise on the opportunities and investment that they believe will be generated by HS2. Cheshire East Council have also set out their vision for regenerating the sub-region in response to consultation, which they believe is exceptionally well placed to deliver a boost to economic connectivity, enable high value development and regeneration and provide employment, skills and business opportunities directly linked to HS2 investment. Their long term vision is for a town and a region which is a nationally significant economic centre; one of the leading advanced engineering and manufacturing centres in England; and a sought-after place not only in Cheshire but the UK as a whole.

## Section 5: The Economic Benefits of Phase 2a

- 5.1 As part of the Strategic Outline Business Case (SOBC), HS2 Limited have carried out an economic appraisal of Phase 2a. This sets out the expected costs, benefits and revenues for the scheme, both as an increment to Phase One, and as part of a full Phase Two. This chapter outlines the main findings of this work – a more detailed set of results and an explanation of the assumptions and modelling is included in the Economic Case.

### Phase 2a offers value for money on its own and as part of the full “Y” network

- 5.2 The Economic Case shows that accelerating the delivery of Phase 2a has a positive financial impact, meaning that on a Net Present Value (NPV) basis costs are less than the income generated. As set out in the Economic Case, delivering Phase 2a in 2027 would generate additional revenues of £346 million compared to a relatively modest increase in cost due to acceleration (around £25 million NPV).
- 5.3 Viewed as a “stand-alone” scheme (incremental addition to Phase One assuming a purely hypothetical scenario where the rest of Phase Two is not built by 2033), Phase 2a demonstrates value for money and generates over £2 billion in benefits. The Phase 2a Economic Case “Reference Case” which follows the same methodology as the HS2 2013 Economic Case shows Phase 2a has a Benefit-Cost Ratio (BCR) of 1.6 (including Wider Economic Impacts). However, construction inflation since 2011 has been higher than background inflation and may continue. This was recognised in the Spending Review and slightly reduces the BCR to 1.3, as discussed in paragraph 5.14. The BCR will be updated to take account of this and other changes to methodology in the Outline Business Case for Phase 2a in 2017.
- 5.4 Our economic appraisal was based around the working assumption that Phase 2a will operate the same Train Service Specification (TSS) as Phase One, as previously set out in the 2013 HS2 consultation.

### Phase 2a maintains high value for money for the full “Y” network

- 5.5 Since the last Economic Case we have undertaken a number of updates in the modelling, a combination of updates to our demand forecasts and updates reflecting the changes in the rail network. We have also updated the costs. The central case BCR for the full “Y” network has been recalculated as part of our consideration of Phase 2a.

On a comparable basis to the 2013 Economic Case the BCR would have increased. However, construction inflation since 2011 has been higher than background inflation and may continue. This was recognised in the Spending Review and will have a slight negative impact on the BCR, bringing it back to a BCR of 2.2, compared to the 2013 BCR of 2.3. The BCR will be updated to take account of this and other changes in methodology in the Strategic Outline Business Case for the rest of Phase Two next year.

## Phase 2a: how it meets our objectives

- 5.6 Phase 2a meets the strategic objectives we set for the scheme. The preferred option improves journey times and connectivity north of Birmingham. Accelerating the delivery of the section of Phase Two between Fradley and Crewe delivers journey time savings of 13 minutes in addition to journey time savings already delivered by Phase One.
- 5.7 Once Phase 2a opens, people will be able to travel to Crewe from London in 55 minutes. Liverpool, Preston and Warrington will all benefit from 13 minutes of journey time savings, while journeys from London to Manchester would also be faster than under Phase One.
- 5.8 By building this section of Phase Two earlier than planned, the preferred option delivers benefits to Northern cities sooner than previously envisaged for Phase Two. Although not one of our objectives, acceleration also delivers revenues earlier than envisaged for Phase Two.

## Wider economic impacts

- 5.9 Delivering the HS2 route between the West Midlands and Crewe delivers wider economic impacts of £366 million while the full “Y” network generates wider economic impacts of £14.2 billion. Some of these wider economic impacts will come from businesses being more accessible to one another leading to greater interaction between them (agglomeration benefits) as well as offering improved accessibility to labour markets, and affecting the overall level of labour supply.
- 5.10 Improving connectivity through faster, more frequent and more reliable train services could help support knowledge intensive sectors, which particularly benefit from improved connectivity. And it would also enable businesses to reduce costs by moving people and goods more quickly, easily and reliably. These could all help to improve productivity and help stimulate the economy in the North West.

## What could change the Benefit Cost Ratio for HS2: sensitivity tests

- 5.11 To better understand the robustness of the economic case, we have assessed it using a range of different scenarios, and found that the economic case remains strong. These scenarios included a range of different assumptions about economic growth, growth in demand for rail travel, and the valuation of time savings. A summary of their

effect on the 2013 compatible BCR is outlined below, and more detail is provided in the Economic Case.

### **Long term demand**

- 5.12 Our approach to forecasting demand remains as set out in the 2013 Economic Case. Our reference case assumes that demand is capped in 2037, preventing benefits and revenue from increasing as a result of additional passenger demand after this point. However, if the predicted level of demand was increased and capped in 2044 (11 years after the full Phase Two opening), the standalone BCR for Phase 2a rises by around 0.2, while the BCR for the full “Y” network rises by around 1.3 (both compared to the reference case).

### **Values of time**

- 5.13 To ensure that the values we use continue to reflect the most up-to-date evidence, we have recently published the outputs from a major research project into how people value a range of benefits, such as quicker journey times, improved reliability and reduced crowding. While further work and consultation needs to be done before fully implementing the findings into our economic analysis, our initial estimates suggest that adopting the key recommendations of the study would increase the BCR of the full “Y” network rising by 0.1 (compared to the reference case).

### **Construction inflation**

- 5.14 The reference case in the Economic Case assumes construction costs increase over time in line with general price inflation (i.e. the “GDP deflator”). This is in line with the work that was carried out in the 2013 Economic Case. However, we recognise that since 2011 construction inflation (and growth in other project-specific costs) has been higher than background inflation, and that this may continue over the next five years. As a result, we have included a sensitivity test in which construction cost inflation reflects more recent historic trends, and applied this to the years up to 2020/21. This is consistent with the approach which was taken in the 2015 Spending Review, and has the effect of decreasing the BCR for Phase 2a by 0.3 and the full “Y” BCR by 0.3.

### **Optimism bias**

- 5.15 The reference case in the Economic Case assumes an optimism bias (OB) factor of 40 per cent. This approach is consistent with Green Book Supplementary Guidance on OB and reflects a detailed, bottom-up attribution of different assets to different risk categories.
- 5.16 Department of Transport’s appraisal guidance (WebTAG) provides its own advice on OB for conventional rail schemes which requires an OB of between 66 per cent and 40 per cent to be applied to costs, depending on the project stage. The “greenfield” nature of a large share of HS2 Phase 2 construction makes it rather different from investments on the existing rail network. This, together with the fact that HS2 costs are estimated on a different basis from Network Rail projects, means that it is appropriate for HS2 to

follow the Green Book Supplementary guidance. However, in order to assess the impact of a higher OB, we have also included a sensitivity which assumes that OB is 50 per cent. In this scenario, the full “Y” BCR would decrease by 0.1 and the Phase 2a incremental BCR would also decrease by 0.1 (compared to the reference case).

### **Other factors**

- 5.17 In addition to these sensitivity tests, there are a number of reasons to believe that our assessment is conservative. For example, we do not assume any land use change resulting from the improvements in connectivity of Phase 2a or from the full “Y” network, which may make businesses alter their location decisions and could lead to further benefits from regeneration and people moving to more productive jobs. Potential opportunities also exist to improve the train service specification operating on the HS2 route to Crewe (set out below), and these could improve the BCR for the incremental Phase 2a case.

## **Optimising the Phase 2a train service pattern could deliver further benefits**

- 5.18 When carrying out economic modelling, it is necessary to make a number of assumptions, particularly about the train service pattern that will run in the future. We believe that the assumptions used in our reference case have resulted in a conservative estimate of the benefits delivered by Phase 2a. As a result we have also modelled a number of alternative scenarios.

### **Reference case**

- 5.19 Our reference case assumes the same service pattern and routing as Phase One runs for six years until the rest of Phase Two is operational. Then it assumes that the Phase Two TSS is operated – as set out in the 2013 SOBC. This reference case assumes that two out of three London to Manchester services are routed via Crewe (but do not stop at Crewe) and use the additional HS2 infrastructure delivered by Phase 2a. The third Manchester service is routed through Stoke-on-Trent (but does not call there) and so does not get any journey time reduction compared to Phase One.

### **Alternative scenarios**

- 5.20 We have also looked at two alternatives to the reference case. In both scenarios, we have assumed that the rest of Phase Two is not built after 2033. These show that there is the potential for further benefits to be delivered from the Phase 2a scheme over the main ones presented in this Economic Case.
- 5.21 The first alternative looks at the benefits of routing all three London to Manchester services via Crewe, so that they all take advantage of the journey time improvements offered by Phase 2a. When this third service is re-routed via Crewe, a pathing “penalty” is included to take account of possible congestion on the line between Crewe and Manchester. As a result we assume that all three services save nine minutes of journey

time to Manchester over Phase One (rather than the 13 minutes assumed in the reference case). This analysis also allowed for additional infrastructure costs of up to £200 million to facilitate this routing. This routing approach adds £148 million net transport benefits and £114 million revenue to the Phase 2a benefits. Running three services through Manchester could also help to relieve a possible platforming constraint at Euston that might arise if one service continues to run via Stoke-on-Trent (but does not stop).

- 5.22 The second alternative looks at the benefits of stopping more trains at Crewe station. In the reference case, two trains an hour are assumed to stop at Crewe, and then carry on to Liverpool, Wigan, Warrington and Preston. In consultation, some stakeholders have made the case for more services to call at Crewe to deliver even more benefits to the region. To investigate this, the economic appraisal includes a sensitivity test of stopping four trains per hour at Crewe rather than two trains per hour. Over the appraisal period, this alternative delivers net transport benefits of £278 million and a further £251 million in revenues. At this stage of analysis infrastructure costs to allow those stops has not been estimated, so a BCR has not been calculated.

## Interactions with Euston Station

- 5.23 As discussed above, the differential in journey times between trains that travel via Crewe to Manchester and those that travel via Stoke-on-Trent may create a platforming issue at Euston. To mitigate any platforming issue and to maximise the journey time benefits of the route between Fradley and Crewe, HS2 Limited has considered two different ways of mitigating the risk to performance on the National Rail and HS2 networks. There are two families of solution: “with infrastructure” and “without infrastructure”.
- 5.24 HS2 Limited has previously explored with DfT’s Rail Executive and Network Rail how the performance risks could be mitigated through train service planning – the “without infrastructure” solution. There are a number of choices that could be made about services that serve Crewe and this will be the subject of detailed work to inform an Outline Business Case for Phase 2A. This work will be overseen by a Project Development Group that has already been created and contains representatives from HS2 Limited, DfT Rail Executive, DfT Passenger Services, DfT High Speed Rail Group and Network Rail.
- 5.25 HS2 Limited has also explored mitigating the pressure at Euston between 2027 and 2033 by routing all three Manchester services via Crewe. This was modelled as one of the alternatives in the Phase 2a Economic Case (see above). However running an additional service through Crewe for the intervening six years may create capacity constraints in the Crewe area, which may require additional infrastructure to alleviate. HS2 Limited carried out some high level work with its consultants and Network Rail to identify whether there were small scale interventions that could be made to the Network Rail network to mitigate any such congestion impacts at Crewe. Following this work, HS2 Limited has identified an infrastructure pot of £200 million that it believes it is

prudent to make provision for at this time until the more detailed work can be carried out. This £200 million includes £150 million for works in the Crewe area and a further £50 million for the route north of Crewe. Although the preference is to find a solution which does not require further infrastructure, at this time the company believes that it is prudent to include this £200 million in the Phase 2a estimate.

## Interface and opportunities with development at Crewe Station

- 5.26 As noted above, Crewe is already a major hub connecting to destinations including Chester, North Wales, Stoke-on-Trent and Shrewsbury. The potential advantages of creating a new high speed hub at Crewe were recognised by David Higgins in his 2014 report, where he recommended that the line should be extended to a new transport hub at Crewe, and that this should be delivered by 2027.
- 5.27 The proposal put forward in this strategic case does not include an assessment of the benefits and costs of a new Crewe Hub. We are working with Network Rail, HS2 Limited and local stakeholders to consider the costs of different options at Crewe, which would give the flexibility to stop significantly more HS2 services. We are working towards a preferred approach in 2016, and any station development will need to be affordable and offer value for money. While no decisions on Crewe Hub have been taken we have designed Phase 2a in a way which seeks to be flexible with potential options for a Crewe Hub. Phase 2a will work with a Crewe Hub station at any of what look to be the front-runner sites, although the location of a Crewe Hub and the associated HS2 alignment in the Crewe area to serve this may require some refinements to be made to the technical design of the northern end of Phase 2a.

## Interface and opportunities with Phase One

- 5.28 There are potential benefits and efficiency savings to be made from building straight on from Phase One, through integrating construction and procurement.
- 5.29 For example, we are pursuing the potential efficiency savings from integrated construction, and the forthcoming Pre-Qualification Questionnaires (PQQs) for Phase One Civils are designed to facilitate this. The Major Civils Works Contracts PQQ includes an option which would allow successful firms to bid for a further £1.8 billion – £3.3 billion (2015 prices) of work to build a section of Phase Two north of Birmingham. The provisions would support the delivery of Phase 2a by providing the option to award one or more further packages for civils works through a mini-competition among the successful bidders, providing they are performing well under their existing package contracts. HS2 Limited would not be obliged to exercise this option and could elect to procure works separately if that were judged to be more efficient.

## Next steps

5.30 The analysis presented in this section will continue to be refined as the project moves through the business case development stage. We are aware of a number of areas where more work will be required, and our focus for the next stage of analytical work will be:

- a fuller analysis of the impact of stopping more trains at Crewe including information on the costs and impacts
- further refine our understanding of the impacts of running all three Manchester HS2 services via Crewe as part of Phase 2a, include the impact on congestion on the line between Crewe and Manchester
- further optimising the service pattern for Crewe and the wider North West, including exploring how Stoke-on-Trent might be served (see section 6)
- continuing to fully explore options for a Crewe Hub, and how best to maximise connectivity and regeneration potential at Crewe
- continuing to look at how to maximise efficiencies with the rest of the “Y” network, and to learn the lessons from international best practice and apply them to Phase 2a

## Section 6: Alternatives to Phase 2a

6.1 Consideration of alternative investments is normal practice. It is mandated in HM Treasury business case guidance for public sector organisations, which requires a minimum of four short-listed options be examined at Strategic Outline Business Case (SOBC) stage, including a do-minimum and preferred option. We have previously considered alternatives to Phase One, Phase Two and the full “Y” network, and have published extensive analysis of alternative investments. In keeping with this we have also assessed a number of alternatives to Phase 2a, which are outlined below.

### Do nothing

6.2 One option would be to do nothing. We could continue along the current programme, delivering Phase One in 2027, and then Phase Two in 2033. Continuing with this programme would still help Government build a stronger, more balanced economy capable of delivering lasting growth and widely shared prosperity. Phase One is an important infrastructure project in its own right, and will do much to improve capacity south of Birmingham.

6.3 However, many more benefits would be delivered once the second phase of HS2 is built – connecting northern cities, and speeding up journeys. Doing nothing would mean we miss the opportunity of realising some of these benefits six years earlier than the opening of the full Phase Two route in 2033. Doing nothing would mean that we did not accelerate delivery of this section of Phase Two, even though it is well developed, could be delivered early, and the costs of acceleration are outweighed by savings and additional revenue. Government believes that if there is a financially positive and affordable option to bring forward a tranche of benefits by six years, that would help rebalance the economy and unlock the growth and regeneration the country badly needs, then it would be perverse not to take it.

### Alternatives – objectives

6.4 Alternatives to Phase 2a still need to meet the HS2 programme objectives, supporting Government’s aim of building a stronger, more balanced economy capable of delivering lasting growth and widely shared prosperity. In this context, alternatives need to:

- enable the construction of the rest of Phase Two, delivering the long-term benefits of HS2
- provide sufficient capacity to meet long term demand, and to improve resilience and reliability across the rail network

- improve connectivity by delivering better journey times and making travel easier
- minimise disruption to the existing network
- use proven technology that we know can deliver the desired results
- be affordable and represent good value to the taxpayer
- minimise impacts on local communities and the environment

6.5 Alternatives also need to meet the Phase 2a objectives of:

- improving connectivity and journey times for cities north of Birmingham
- delivering benefits to Northern cities sooner than previously envisaged for Phase Two
- enable the efficient delivery of the rest of Phase Two

## Alternatives – aviation, roads and demand

6.6 Previous work carried out by the Government and HS2 Limited showed that a dedicated high speed “Y” network is the best way to meet the HS2 programme objectives. The 2013 Strategic Case for HS2 considered a number of alternatives to the “Y” network. These were assessed for how well they would deliver the benefits of improved capacity, connectivity and economic growth provided by HS2.

6.7 Domestic aviation was ruled out, as it is most economically viable for journeys over 400 miles, which is about the distance from London to Glasgow or Edinburgh. Check-in times mean that for many shorter intercity journeys, road or rail will almost always be a better option than domestic aviation.

6.8 The 2013 Strategic Case for HS2 also looked at whether significantly increasing road capacity would meet the objectives of HS2. The Government is already carrying out the biggest ever upgrade of our strategic road network, and by 2021 spending on road enhancements will have tripled. This will counter the effects of past under-investment, maintain the network and add some extra capacity where it is needed to ease congestion on existing motorways. However, the 2013 Strategic Case found that these enhancements do not provide the additional capacity needed to allow roads alone to cater for the predicted increase in passenger demand. Roads are also not well suited to improving connectivity between city centres, because traffic speeds are limited, or for providing additional commuter capacity into major cities, because of the traffic constraints that exist there.

6.9 The 2013 Strategic Case for HS2 also assessed whether fares could be used to address capacity problems. This was ruled out, as in order to be effective, the approach would need to involve very significant and highly undesirable price rises. It would also not meet the objective of improving connectivity between cities, and would also have serious consequences for economic productivity and growth.

The report concluded that a new rail line would be the best way to meet the objectives of the Strategic Case.

- 6.10 The 2013 Strategic Case concluded that new transport provision was required to meet the objectives of HS2, and that rail (rather than roads or aviation) was best suited to addressing the challenges identified.

### Alternative accelerations

- 6.11 One option would have been to assess different sections of the Phase Two route which might be accelerated. However, as set out in section 3, we do not currently believe other sections of Phase Two could be delivered by 2027. They therefore would not be a feasible way to meet the objective of being able to bring benefits sooner than the rest of Phase Two.
- 6.12 We also decided not to shortlist alternatives which looked at accelerating the route to deliver in other years, such as 2030 instead of 2027. This was because it was felt that these options were not sufficiently different to the reference case to be real strategic alternatives. In addition, any changes in benefits and costs that would come from a different delivery year would be likely to be too small to be assessed properly as part of our economic modelling. As we believe that we can deliver Phase 2a by 2027, deliberately lengthening the time taken to delivery would not be a credible alternative.

### Alternatives to a route to Crewe

- 6.13 As part of their route development, HS2 Limited have assessed a number of different route options for this section of line. This work was used to support a route decision on the section of line between Birmingham and Crewe.
- 6.14 Early route development work (between 2010 and 2012) considered a wide range of possible route options between the West Midlands and Manchester. The findings of this work are detailed in the report “Options for Phase Two of the high speed rail network”<sup>5</sup> which was delivered to Government in March 2012.
- 6.15 For each of the elements of the proposed Phase Two scheme, options for the route, stations and infrastructure were developed around four main criteria:
- engineering and construction feasibility
  - sustainability
  - demand considerations, including journey times
  - cost

HS2 Limited also sought to follow existing transport corridors, and to avoid inhabited areas and environmentally sensitive sites as far as possible.

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5 <https://www.gov.uk/government/publications/options-for-phase-two-of-the-high-speed-rail-network>

- 6.16 Route options were sifted against these criteria, using progressively more detailed analysis and specialist knowledge within each category as the options were narrowed down. External stakeholders and advisors were involved where appropriate, and local stakeholders were also regularly involved in the development and assessment of station options.
- 6.17 To choose the best option, short sections of potential routes were then compared, considering their cost, journey time and environmental impact. From that process, a final shortlist was developed. Out of this, a preferred route was developed, and went out to consultation on 17 July 2013 with a closing date for responses of 31 January 2014. More detail on this process is available in the 2013 consultation document.
- 6.18 Government's response to the relevant section of the consultation is published in the command paper. An independent report of the consultation process and a summary of issues raised have also been published alongside the decision document.
- 6.19 Consultation responses proposed alternative alignments for the proposed route and a number of refinements that could be made. Suggested major changes to the proposed route focussed on the high speed line connecting to Stoke-on-Trent, and a new HS2 hub station being built at Crewe. The government asked HS2 Limited to provide further advice on these issues. More information and our response to these points is included in the Command Paper.
- 6.20 Stoke-on-Trent City Council proposed an alternative to the route via Crewe that was included in the Phase Two route consultation. This would connect HS2 to existing classic routes, to enable classic compatible services to serve Stoke-on-Trent and Manchester from 2026. The scheme proposed by Stoke-on-Trent City Council would reconnect to the consultation route north of Crewe, when the rest of Phase Two is completed in 2033, to provide a faster route to Manchester. This would not deliver the same level of journey time savings and benefits as the consultation route via Crewe, and further assessment highlighted significant concerns over the operational feasibility of running new services on mixed traffic lines, with a potential impact on the reliability of HS2.
- 6.21 In order to ensure that the Government gave full consideration to Stoke-on-Trent City Council's proposal, HS2 Limited also reviewed additional evidence provided by the Council for a continuous high speed alignment through Stoke-on-Trent. Following the approach to route optioneering that has been used throughout the route development process, HS2 Limited developed this into a route that accorded with its technical requirements and could be compared against the consultation alignment through Crewe using its sifting methodology. This is referred to below as the 'Stoke Route'.
- 6.22 The Phase Two consultation route via Crewe includes a connection to the West Coast Main Line (WCML) south of Crewe, and assumes that services joining the WCML will run through the existing Crewe station. The Stoke Route follows the Phase Two

consultation route through Staffordshire until north of the A34, near Stone. At this point it bears east towards Stoke-on-Trent, following the existing railway corridor through Stoke-on-Trent, before re-joining the consultation route north of Crewe, and connecting to the WCML in order to serve Liverpool. The Stoke Route includes a new station in Stoke-on-Trent, for both high speed and classic services.

- 6.23 Based on these route options, HS2 Limited modelled a number of scenarios for services via Crewe or Stoke-on-Trent to compare their performance. This modelling shows a significant reduction in the benefits and revenues generated by the Stoke Route in comparison with the consultation route via Crewe. This is driven by a number of factors, including longer journey times to the key markets of Manchester and the North, and loss of the wider regional connectivity delivered by the proposed connection at Crewe.
- 6.24 The wider results of HS2 Limited's work indicate that the Stoke Route also performs less well in sustainability terms than the consultation route via Crewe, as well as entailing some significant engineering challenges. The Government therefore concluded that this route is less effective than the consultation route via Crewe route in delivering the desired benefits, and should not be taken forward.
- 6.25 We do however recognise the important role Stoke-on-Trent plays in the wider economic sub-region and welcome the way Stoke-on-Trent City Council, Cheshire East Council and other partners are working together to ensure that the benefits of HS2 are maximised. We want to see whether Stoke-on-Trent and Macclesfield could receive HS2 services as part of Phase Two and therefore, the Secretary of State has asked HS2 Limited to explore how we best serve Stoke-on-Trent and Macclesfield, including through classic-compatible trains via the Handsacre Junction. Initial modelling suggests this could give journey times to London of a little over an hour – a significant improvement on the current 84 minutes journey time. Any HS2 services would also likely be supplemented by continued classic rail services.

## Rail alternatives to Phase 2a

- 6.26 We have previously undertaken extensive work on strategic alternatives for Phase One, Phase Two and the full "Y" network. This work was published in a series of reports, the conclusions of which are summarised in the 2013 Strategic Case. This work concluded that that the full HS2 "Y" network was the only way to meet all the objectives of capacity connectivity and economic growth.
- 6.27 Comparison with the Phase One alternative showed that the strategic alternatives provided considerably less capacity and connectivity than HS2, while resulting in an unacceptably high level of performance risk due to ongoing disruption caused during construction, and that this was likely to be an ongoing risk because of the proposed very high intensity use of existing infrastructure. With regard to the full "Y" network alternatives, the work showed that very extensive infrastructure works would be required in pursuit of the aim to provide a step change in service provision. These

would lead to a scale of works on the existing network with consequential disruption to services over a lengthy period, which could be untenable in practice. The full “Y” network alternatives would also not deliver the scale of connectivity and capacity benefits that HS2 brings.

- 6.28 There are no strategic alternatives to Phase 2a. This is because Phase 2a is a scheme to accelerate Phase Two of the HS2 programme. The scheme is about delivering the benefits of Phase Two earlier and so must provide a high speed service between Phase One and the rest of Phase Two. The alternatives we have evaluated are therefore (a) an option to accelerate a shorter section of the Phase Two programme, and (b) options to tackle congestion on the WCML through a combination of classic rail upgrades and new alignment.
- 6.29 We have carried out an economic assessment of Phase 2a to demonstrate its value for money in delivering Phase Two benefits, and also as a standalone scheme for the hypothetical scenario that no more of HS2 is built. We have carried out both assessments for each of the alternative options. But the critical objective is that the options must enable and deliver the benefits of Phase Two.
- 6.30 We commissioned Atkins to assess the alternatives to accelerating the delivery of a new high speed line between West Midlands and Crewe. A separate report by Atkins is published alongside this Strategic Case, which sets out the process and results in more detail. A summary of the results and our conclusions are set out below.

## Option development

- 6.31 Atkins developed a number of potential alternatives to Phase 2a. These options were then sifted down to three options which were taken forward for detailed analysis. The criteria used for this sift was that the options needed to:
- enable delivery of the Phase 2a train service
  - deliver a similar level of capacity as Phase 2a
  - and deliver an environmental impact that is no worse than Phase 2a
- 6.32 Options taken forward were then assessed against the Phase 2a objectives. Two of these options (the low and medium cost options) focus on enhancing the classic rail network to improve connectivity and capacity by bypassing some of the current capacity constraints on the WCML, and so delivering some improvements to journey time and performance. These two options are:
- Low cost option – Colwich cut-off and Stafford bypass: this involves 4.2 miles (6.8km) of new 140mph (225km/h) alignment which joins onto the Stone line via a grade separated junction. This section of the Stone line would be upgraded to allow 140mph (225km/h) running. This would connect onto 6.7 miles (10.8km) of new 140mph (225km/h) alignment which would finally connect into the WCML north of

Norton Bridge. This option has three flat junctions and one grade separated junction with the WCML

- Medium cost option: this involves using 9.5 miles (15.2km) of the Phase 2a alignment from Streethay Junction to Great Haywood, a 3 miles (4.8km) high speed spur to Stone Line, upgrade of 4 miles (6.5km) of Stone Line to 140mph (225km/h), and 6.7 miles (10.8km) of new 140mph (225km/h) alignment to WCML near Norton Bridge. It involves building one flat junction with the WCML and two flat junctions on to the Stoke-on-Trent branch.

6.33 The third option, looked at a different way of delivering Phase 2a so that it connects with the WCML further south of Crewe at Baldwin’s Gate:

- High cost option: this involves using 26.4 miles (42.5km) of the Phase 2a alignment from Streethay Junction joining the WCML 11.4 miles (18.3km) south of Crewe at a flat junction onto the WCML where high speed trains would run along these fast lines for 11.4 miles (18.3km) to Crewe.

6.34 As with Phase 2a, Atkins assessed the levels of benefits, revenues and costs for the alternatives, as part of the full “Y” network and as an incremental over Phase One. They were also assessed against a number of strategic objectives around journey time, capacity, reliability and construction.

### None of the options deliver the same journey time improvements as Phase 2a.

6.35 The options were all assessed against the journey time improvements delivered by Phase 2a. The analysis showed that all three of the alternatives delivered much lower journey time improvements than Phase 2a, and therefore bring fewer benefits to the North West.

	Journey time reduction
Phase 2A	13 mins
High cost option	10.5 mins
Medium cost option	7.5 mins
Low cost option	5.5 mins

Table 6.1: Journey time reductions relative to Phase One

## Value for money assessment

6.36 As with the Phase 2a case, Atkins assessed the value for money of the three alternatives in two ways: as an incremental case and as part of the full “Y” network. The incremental case examines the impact of the alternatives compared to a baseline where Phase One exists but the rest of Phase Two is not built. Considered in isolation, the three alternatives deliver better value for money than Phase 2a. This is because although the benefits, revenues and costs are all lower for the alternatives they also cost less – and the reduction in costs is proportionately larger than the reduction in benefits. The BCRs have been calculated on the basis of the Reference Case in the Phase 2a Economic Case, which is consistent with the methodology used in the 2013 HS2 Economic Case.

£2011, 2011 PV	Incremental Phase 2A	Incremental high cost option	Incremental medium cost option	Incremental low cost option
Transport User Benefits (Business)	£1.5bn	£1.2bn	£0.9bn	£0.6bn
Transport User Benefits (Other)	£0.4bn	£0.3bn	£0.3bn	£0.2bn
Other quantifiable benefits	£0.0bn	£0.0bn	£0.0bn	£0.0bn
Loss to Government of Indirect Taxes	-£0.1bn	-£0.1bn	-£0.1bn	£0.0bn
<b>Net Transport Benefits (PVB)</b>	<b>£1.9bn</b>	<b>£1.5bn</b>	<b>£1.1bn</b>	<b>£0.7bn</b>
Wider Economic Impacts (WEIs)	£0.4bn	£0.3bn	£0.2bn	£0.1bn
<b>Net Benefits including WEIs</b>	<b>£2.2bn</b>	<b>£1.7bn</b>	<b>£1.3bn</b>	<b>£0.9bn</b>
Capital Costs	£2.7bn	£1.7bn	£1.4bn	£1.1bn
Operating Costs	£0.1bn	£0.1bn	£0.0bn	£0.0bn
Total Costs	£2.8bn	£1.8bn	£1.5bn	£1.1bn
Revenues	£1.4bn	£1.1bn	£0.9bn	£0.6bn
<b>Net Costs to Government (PVC)</b>	<b>£1.4bn</b>	<b>£0.7bn</b>	<b>£0.6bn</b>	<b>£0.5bn</b>
<b>BCR without WEIs (ratio)</b>	<b>1.3</b>	<b>2.2</b>	<b>1.8</b>	<b>1.5</b>
<b>BCR with WEIs (ratio)</b>	<b>1.6</b>	<b>2.6</b>	<b>2.2</b>	<b>1.8</b>
<b>NPV without WEIs</b>	<b>£0.4bn</b>	<b>£0.8bn</b>	<b>£0.5bn</b>	<b>£0.2bn</b>
<b>NPV with WEIs</b>	<b>£0.8bn</b>	<b>£1.1bn</b>	<b>£0.7bn</b>	<b>£0.4bn</b>

Table 6-1: Economic appraisal of the alternatives as an increment to Phase One

6.37 If our objective was to deliver benefits between Birmingham and Crewe, and never build the rest of Phase Two, then these could be considered as alternatives to Phase 2a. However, Phase 2a is an accelerated part of Phase Two, which Government is committed to, so should be considered in that context.

6.38 When assessed as part of the full “Y” network (assumed completed by 2033), the analysis shows that Phase 2a and the alternatives deliver very similar Benefit-Cost ratios (BCRs).

<b>£2011, 2011 PV</b>	<b>Full Y incorporating Phase 2A</b>	<b>Full Y incorporating the high cost option</b>	<b>Full Y incorporating the medium cost option</b>	<b>Full Y incorporating the low cost option</b>
Transport User Benefits (Business)	£43.2bn	£42.3bn	£41.7bn	£41.0bn
Transport User Benefits (Other)	£18.2bn	£17.9bn	£17.8bn	£17.6bn
Other quantifiable benefits	£0.2bn	£0.2bn	£0.2bn	£0.2bn
Loss to Government of Indirect Taxes	-£3.0bn	-£3.0bn	-£2.9bn	-£2.9bn
<b>Net Transport Benefits (PVB)</b>	<b>£58.6bn</b>	<b>£57.3bn</b>	<b>£56.7bn</b>	<b>£55.9bn</b>
Wider Economic Impacts	£14.2bn	£14.0bn	£13.8bn	£13.7bn
<b>Net Benefits including WEIs</b>	<b>£72.8bn</b>	<b>£71.3bn</b>	<b>£70.5bn</b>	<b>£69.5bn</b>
Capital Costs	£39.0bn	£38.1bn	£37.8bn	£37.5bn
Operating Costs	£22.9bn	£22.8bn	£22.8bn	£22.8bn
<b>Total Costs</b>	<b>£61.9bn</b>	<b>£60.9bn</b>	<b>£60.6bn</b>	<b>£60.2bn</b>
Revenues	£33.1bn	£32.3bn	£31.8bn	£31.3bn
<b>Net Costs to Government (PVC)</b>	<b>£28.8bn</b>	<b>£28.6bn</b>	<b>£28.8bn</b>	<b>£28.9bn</b>
<b>BCR without WEIs (ratio)</b>	<b>2.0</b>	<b>2.0</b>	<b>2.0</b>	<b>1.9</b>
<b>BCR with WEIs (ratio)</b>	<b>2.5</b>	<b>2.5</b>	<b>2.4</b>	<b>2.4</b>
<b>NPV without WEIs</b>	<b>£29.7bn</b>	<b>£28.7bn</b>	<b>£27.9bn</b>	<b>£26.9bn</b>
<b>NPV with WEIs</b>	<b>£44.0bn</b>	<b>£42.7bn</b>	<b>£41.7bn</b>	<b>£40.6bn</b>

Table 6-2: Economic Appraisal of the Full “Y” incorporating Phase 2a and the alternative options

6.39 The alternatives all show a relatively large reduction in the magnitude of benefits and revenue for the full “Y” network compared with Phase 2a (when the alternatives are viewed as a permanent substitution for Phase 2a). The reason for this is that in comparison with the preferred option, all passengers who travel on the western leg of Phase Two suffer from longer and less reliable journeys. This leads to reduction in benefits, as well as a fall in revenues. The cost saving in the context of the full “Y” network is relatively small, meaning that the BCR’s are lower than full “Y” network for the low and medium cost options. The high cost option has a similar BCR in comparison to Phase 2a, because the reduction in benefits is matched but the reduction in costs.

6.40 The above analysis has been undertaken assuming that classic compatible trains travel at the existing line speed for non-tilt rolling stock on the WCML. If allowed to use the higher “tilt speed” on straighter sections of track (which HS2 Limited believe should be possible), the journey times for the alternative options would reduce by between 45

seconds and 1 minute, and benefits would increase accordingly. However, this does not change the overall conclusion that the alternative options have broadly similar BCR's to Phase 2a as part of the full "Y" network and offer higher BCR's than Phase 2a when considered as a standalone investment. Similarly, we do not expect that changes to the assumptions around construction cost inflation would significantly impact our overall conclusions.

## Strategic assessment

6.41 Atkins have also assessed how well the alternatives meet our strategic objectives around capacity, journey time, reliability and performance. This assessment shows that the alternatives do not meet our strategic objectives as well as Phase 2a.

## Capacity

6.42 The alternatives all deliver some additional capacity on the WCML between Birmingham and Crewe because new infrastructure is being built. Atkins advise the infrastructure is capable of running the full "Y" TSS that is set out in the 2013 Strategic Case, and as a result the alternatives deliver the same number of additional seats as Phase 2a.

6.43 One of the advantages of HS2 is that it releases capacity on the classic network as fast services 'transfer' to the high speed network, creating space on the existing network for additional passenger and freight train services. Atkins have therefore assessed the extent to which the alternatives deliver residual capacity after Phase Two opens in 2033. The alternatives would result in sections of the classic network being used at relatively high intensity, and so are less future proof than Phase 2a.

6.44 As a result, the alternatives offer less flexibility than Phase 2a to run further additional services beyond those included in the TSS. This could constrain the ability to run a more ambitious train service in the future than the one set out in the 2013 Strategic Case for HS2. This may be particularly important if a decision is taken to introduce a hub station at Crewe, which would provide an opportunity to further optimise the Phase Two train service. There is also less scope for residual capacity to be used by freight (particularly at peak hours), which could constraint the ability of the WCML to cope with future demands from the rail industry relative to Phase 2a.

## Alternatives are expected to offer lower reliability than a dedicated high speed track

6.45 Phase 2a is expected to be highly reliable. The sponsor's requirements for HS2 specify that HS2 trains must run with no more than an average thirty second delay. Reliability and performance contribute towards better journeys and connectivity, and so we have also carried out a strategic assessment of how well the alternatives perform on these measures relative to Phase 2a.

- 6.46 However, overall the alternatives are all expected to offer lower reliability than Phase 2a. The alternatives are predicated on exclusive use of the WCML fast lines during normal operations. In reality, all four lines of the WCML are needed by classic services as an infrastructure failure or incident could result in the closure of two of the four sets of lines.
- 6.47 The WCML currently suffers from problems with levels of performance and reliability. All of the alternatives make greater use of this existing infrastructure which means that there is a risk of some performance dis-benefits. In addition, the low, medium and high cost options would be running at higher intensity than Phase 2a for most of the day between Baldwin's Gate and Crewe after 2033. This means that the impact of any disruption on the WCML will have a large effect on the performance and reliability of the services, as there is less space in the timetable to cope with service perturbations. The high cost option would be more reliable than the low and medium cost options as it includes 26.4 miles (42.5km) of new alignment, and so trains spend less time on the existing WCML. However, it is expected to offer less reliability than Phase 2a as it would still require running on a longer section of classic network.

## Construction

- 6.48 Atkins also assessed the extent to which the construction of the alternatives would impact on the classic network relative to Phase 2a.
- 6.49 The low cost option would be the most disruptive, as it would require a grade separated junction to be built at Rugeley, new flat junctions to be built along the WCML, and a lightly used section of the classic network to be upgraded. The medium cost option also requires a section of the classic network to be upgraded, and three new junctions to be built between Birmingham and Crewe. Atkins do not believe that these need to be grade separated, and as such, the options would probably be less disruptive than the low cost option. Atkins' assessment suggests that the high cost option would be expected to have a lower level of disruption to the WCML than Phase 2a, on the basis that a simpler junction is built as part of this option.

## The alternatives do not deliver the same level of connectivity as Phase 2a

- 6.50 The Atkins options trade off connectivity with costs for Phase 2a. But by building a shorter section of track, reductions in journey times are not as great. Set against this, HS2 Limited has already found cost savings for the preferred route's connection with the WCML. As well as saving costs, the new design has a reduced impact on the environment. Both these benefits are delivered without compromising on journey times.

## Conclusion

6.51 As part of this Strategic Case for Phase 2a we have not reassessed those broad alternatives which were rejected in 2013, of providing road or aviation capacity or demand management instead of HS2. We have considered alternative high speed alignments to Phase 2a, both in the development of HS2, and in response to points raised from the 2013 Line of Route Consultation. For the reasons set out above, we do not believe there is a better high speed alignment. We have considered whether any other section of the HS2 route should be accelerated, and concluded they should not. We therefore assessed three rail alternatives to Phase 2a. The above analysis of value for money and strategic objectives shows that the alternative options:

- do not provide the same level of connectivity benefits for the major cities of the Midlands and the North due to lower journey time improvements
- do not provide as much additional capacity to meet the long term needs for the north-south railway as Phase 2a
- do not provide as much additional released capacity for commuters and freight on the WCML as Phase 2a, limiting the potential of the WCML to cope with increases in demand
- offer a less robust solution to the problem of resilience and performance, particularly on the WCML which suffers from relatively high levels of unreliability
- could have a greater impact on services on existing lines as construction work is carried out (the low and medium cost options only)
- might be worth considering if the objective was only to improve journey times to Crewe, but do not provide as a good a step towards the full HS2 network

6.52 As a result we have concluded that proceeding with the acceleration of Phase 2a is the option which best meets our objectives.

## Section 7: Conclusions

- 7.1 This Strategic Case sets out the case for Phase 2a. It supports a route decision on the section of HS2 between Fradley and Crewe, and makes the case for delivering this section of the route earlier than planned, in 2027.
- 7.2 This is a challenging project, but it is necessary to be ambitious to meet our objectives and support Governments strategy of rebalancing the economy and stimulating economic growth in the North.
- 7.3 What is presented here is just one step on the path towards building HS2. The Government is making good progress in delivering High Speed Two by 2033. For Phase One, the Government has confirmed the route and safeguarded it from further development. We have begun to acquire land where the track will be laid. We have introduced the HS2 Phase One hybrid Bill into Parliament where it is currently being scrutinised by the House of Commons High Speed Rail (London- West Midlands) Bill Select Committee. By taking these steps, the Government remains on course for construction of Phase One commencing in 2017.
- 7.4 The Government is also making good progress on Phase Two. The command paper, “High Speed Two: East and West The next steps to Crewe and beyond” published alongside this Strategic Case, sets out further details on our plans for a Crewe Hub and the rest of the “Y” network, as well as explaining how we will ensure that HS2 is “future proofed” for high speed rail services in the North of England.
- 7.5 The next steps are to conduct the environmental impact assessment for the route between West Midlands and Crewe, and to further develop our plans for the rest of the “Y” network north of Crewe; and deposit a hybrid bill for Phase 2a in Parliament in 2017.
- 7.6 There is much to do but the Government is determined to move quickly so that we can ensure the country realises the benefits of HS2 as soon possible. By taking action now, we can ensure that we create a long-lasting, secure and efficient rail legacy for future generations.